



## 1. Description

### 1.1. Project

|                 |                   |
|-----------------|-------------------|
| Project Name    | HT01_V1A2F001     |
| Board Name      | custom            |
| Generated with: | STM32CubeMX 6.6.1 |
| Date            | 09/23/2022        |

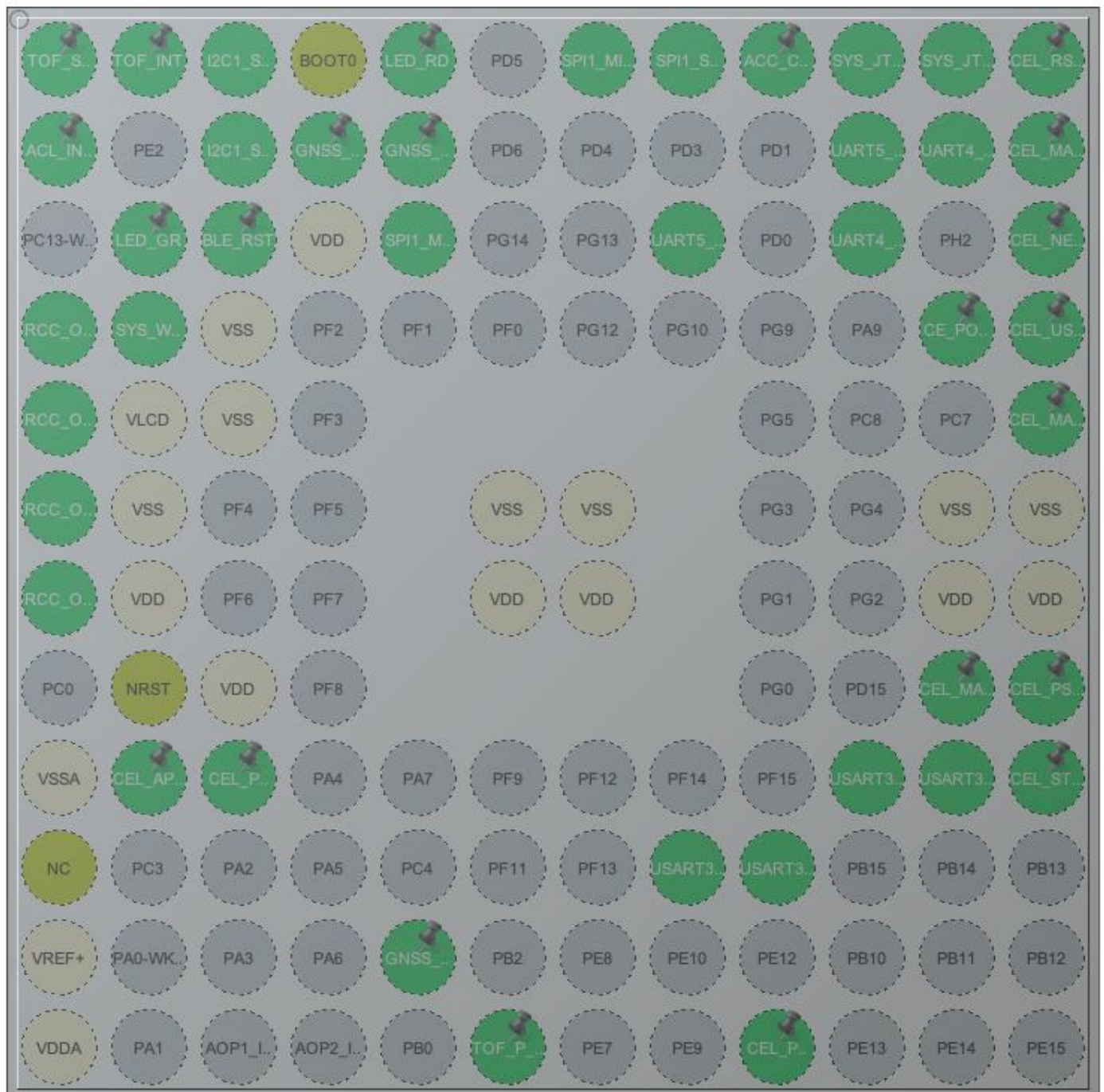
### 1.2. MCU

|                |               |
|----------------|---------------|
| MCU Series     | STM32L1       |
| MCU Line       | STM32L151/152 |
| MCU name       | STM32L151QEHx |
| MCU Package    | UFBGA132      |
| MCU Pin number | 132           |

### 1.3. Core(s) information

|         |               |
|---------|---------------|
| Core(s) | Arm Cortex-M3 |
|---------|---------------|

## 2. Pinout Configuration



UFBGA132 (Top view)

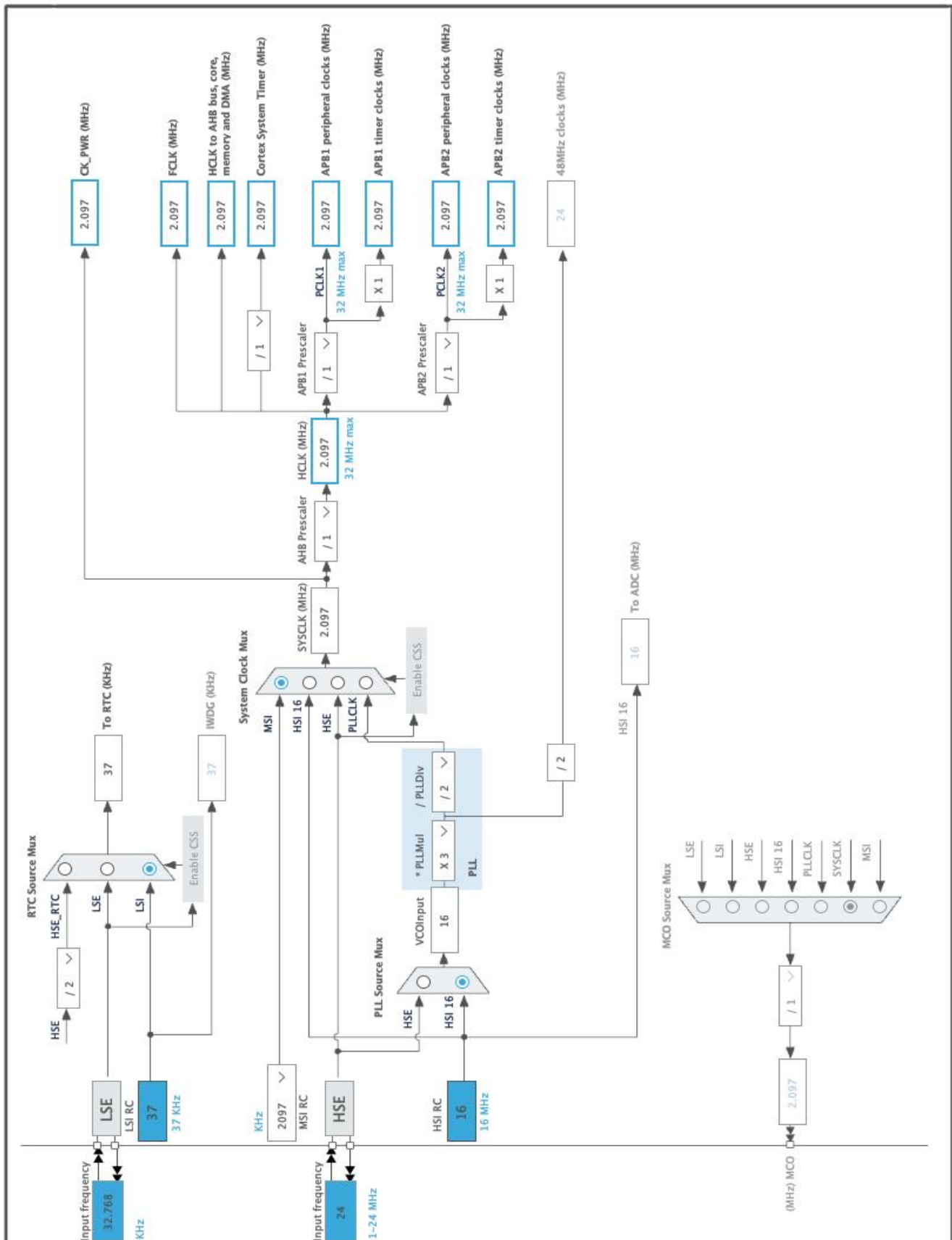
### 3. Pins Configuration

| Pin Number<br>UFBGA132 | Pin Name<br>(function after<br>reset) | Pin Type | Alternate<br>Function(s) | Label          |
|------------------------|---------------------------------------|----------|--------------------------|----------------|
| A1                     | PE3 *                                 | I/O      | GPIO_Output              | TOF_SHUT_N     |
| A2                     | PE1 *                                 | I/O      | GPIO_Input               | TOF_INT        |
| A3                     | PB8                                   | I/O      | I2C1_SCL                 |                |
| A4                     | BOOT0                                 | Boot     |                          |                |
| A5                     | PD7 *                                 | I/O      | GPIO_Output              | LED_RD         |
| A7                     | PB4                                   | I/O      | SPI1_MISO                |                |
| A8                     | PB3                                   | I/O      | SPI1_SCK                 |                |
| A9                     | PA15 *                                | I/O      | GPIO_Output              | ACC_CS_N       |
| A10                    | PA14                                  | I/O      | SYS_JTCK-SWCLK           |                |
| A11                    | PA13                                  | I/O      | SYS_JTMS-SWDIO           |                |
| A12                    | PA12 *                                | I/O      | GPIO_Output              | CEL_RST_N      |
| B1                     | PE4 *                                 | I/O      | GPIO_Input               | ACL_INT2       |
| B3                     | PB9                                   | I/O      | I2C1_SDA                 |                |
| B4                     | PB7 *                                 | I/O      | GPIO_Output              | GNSS_RX        |
| B5                     | PB6 *                                 | I/O      | GPIO_Output              | GNSS_TX        |
| B10                    | PC12                                  | I/O      | UART5_TX                 |                |
| B11                    | PC10                                  | I/O      | UART4_TX                 |                |
| B12                    | PA11 *                                | I/O      | GPIO_Input               | CEL_MAIN-DTR   |
| C2                     | PE5 *                                 | I/O      | GPIO_Output              | LED_GR         |
| C3                     | PE0 *                                 | I/O      | GPIO_Output              | BLE_RST        |
| C4                     | VDD                                   | Power    |                          |                |
| C5                     | PB5                                   | I/O      | SPI1_MOSI                |                |
| C8                     | PD2                                   | I/O      | UART5_RX                 |                |
| C10                    | PC11                                  | I/O      | UART4_RX                 |                |
| C12                    | PA10 *                                | I/O      | GPIO_Input               | CEL_NET_STATUS |
| D1                     | PC14-OSC32_IN                         | I/O      | RCC_OSC32_IN             |                |
| D2                     | PE6-WKUP3                             | I/O      | SYS_WKUP3                |                |
| D3                     | VSS                                   | Power    |                          |                |
| D11                    | PA8 *                                 | I/O      | GPIO_Input               | CE_PON_TRG     |
| D12                    | PC9 *                                 | I/O      | GPIO_Output              | CEL_USB_BOOT   |
| E1                     | PC15-OSC32_OUT                        | I/O      | RCC_OSC32_OUT            |                |
| E2                     | VLCD                                  | Power    |                          |                |
| E3                     | VSS                                   | Power    |                          |                |
| E12                    | PC6 *                                 | I/O      | GPIO_Input               | CEL_MAIN_RI    |
| F1                     | PH0-OSC_IN                            | I/O      | RCC_OSC_IN               |                |
| F2                     | VSS                                   | Power    |                          |                |

| Pin Number<br>UFBGA132 | Pin Name<br>(function after<br>reset) | Pin Type | Alternate<br>Function(s) | Label        |
|------------------------|---------------------------------------|----------|--------------------------|--------------|
| F6                     | VSS                                   | Power    |                          |              |
| F7                     | VSS                                   | Power    |                          |              |
| F11                    | VSS                                   | Power    |                          |              |
| F12                    | VSS                                   | Power    |                          |              |
| G1                     | PH1-OSC_OUT                           | I/O      | RCC_OSC_OUT              |              |
| G2                     | VDD                                   | Power    |                          |              |
| G6                     | VDD                                   | Power    |                          |              |
| G7                     | VDD                                   | Power    |                          |              |
| G11                    | VDD                                   | Power    |                          |              |
| G12                    | VDD                                   | Power    |                          |              |
| H2                     | NRST                                  | Reset    |                          |              |
| H3                     | VDD                                   | Power    |                          |              |
| H11                    | PD14 *                                | I/O      | GPIO_Input               | CEL_MAIN_DCD |
| H12                    | PD13 *                                | I/O      | GPIO_Input               | CEL_PSM      |
| J1                     | VSSA                                  | Power    |                          |              |
| J2                     | PC1 *                                 | I/O      | GPIO_Input               | CEL_AP_RDY   |
| J3                     | PC2 *                                 | I/O      | GPIO_Output              | CEL_PWR_KEY  |
| J10                    | PD12                                  | I/O      | USART3_RTS               |              |
| J11                    | PD11                                  | I/O      | USART3_CTS               |              |
| J12                    | PD10 *                                | I/O      | GPIO_Input               | CEL_STATUS   |
| K1                     | NC                                    | NC       |                          |              |
| K8                     | PD9                                   | I/O      | USART3_RX                |              |
| K9                     | PD8                                   | I/O      | USART3_TX                |              |
| L1                     | VREF+                                 | Power    |                          |              |
| L5                     | PC5 *                                 | I/O      | GPIO_Output              | GNSS_PWR_EN  |
| M1                     | VDDA                                  | Power    |                          |              |
| M6                     | PB1 *                                 | I/O      | GPIO_Output              | TOF_P_EN     |
| M9                     | PE11 *                                | I/O      | GPIO_Output              | CEL_PWR_EN   |

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

## 4. Clock Tree Configuration



## 5. Software Project

### 5.1. Project Settings

| Name                              | Value  |
|-----------------------------------|--|
| Project Name                      | HT01_V1A2F001  |
| Project Folder                    | /Users/gazirahman/STM32CubeIDE/workspace_1.9.0/HT01_V1A2F001 |
| Toolchain / IDE                   | STM32CubeIDE   |
| Firmware Package Name and Version | STM32Cube FW_L1 V1.10.3                                      |
| 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   | Yes                                   |
| Backup previously generated files when re-generating            | Yes                                   |
| 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) | Yes                                   |
| Enable Full Assert  | No                                    |

### 5.3. Advanced Settings - Generated Function Calls

| Rank | Function Name       | Peripheral Instance Name |
|------|---------------------|--------------------------|
| 1    | SystemClock_Config  | RCC                      |
| 2    | MX_GPIO_Init        | GPIO                     |
| 3    | MX_I2C1_Init        | I2C1                     |
| 4    | MX_SPI1_Init        | SPI1                     |
| 5    | MX_UART4_Init       | UART4                    |
| 6    | MX_UART5_Init       | UART5                    |
| 7    | MX_USART3_UART_Init | USART3                   |
| 8    | MX_RTC_Init         | RTC                      |

## 6. Power Consumption Calculator report

### 6.1. Microcontroller Selection

|           |               |
|-----------|---------------|
| Series    | STM32L1       |
| Line      | STM32L151/152 |
| MCU       | STM32L151QEHx |
| Datasheet | DS10002_Rev8  |

### 6.2. Parameter Selection

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

### 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               |



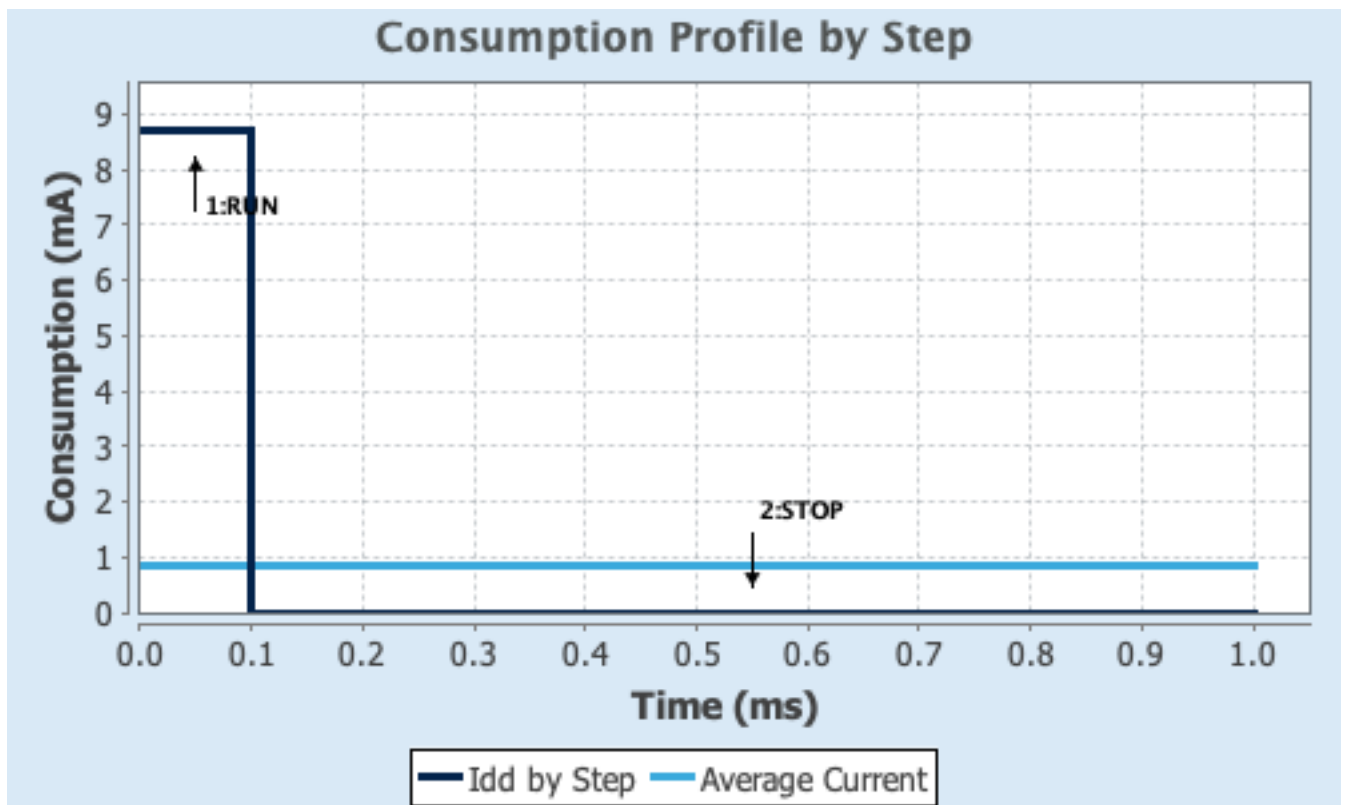
#### 6.4. Sequence

|                               |             |                |
|-------------------------------|-------------|----------------|
| <b>Step</b>                   | Step1       | Step2          |
| <b>Mode</b>                   | RUN         | STOP           |
| <b>Vdd</b>                    | 3.0         | 3.0            |
| <b>Voltage Source</b>         | Battery     | Battery        |
| <b>Range</b>                  | Range1-High | NoRange        |
| <b>Fetch Type</b>             | FLASH       | n/a            |
| <b>CPU Frequency</b>          | 32 MHz      | 0 Hz           |
| <b>Clock Configuration</b>    | HSI PLL     | ALL CLOCKS OFF |
| <b>Clock Source Frequency</b> | 16 MHz      | 0 Hz           |
| <b>Peripherals</b>            |             |                |
| <b>Additional Cons.</b>       | 0 mA        | 0 mA           |
| <b>Average Current</b>        | 8.7 mA      | 560 nA         |
| <b>Duration</b>               | 0.1 ms      | 0.9 ms         |
| <b>DMIPS</b>                  | 33.0        | 0.0            |
| <b>Ta Max</b>                 | 103.43      | 105            |
| <b>Category</b>               | In DS Table | In DS Table    |

#### 6.5. Results

|               |                               |                 |               |
|---------------|-------------------------------|-----------------|---------------|
| Sequence Time | 1 ms                          | Average Current | 870.5 $\mu$ A |
| Battery Life  | 5 months, 9 days,<br>22 hours | Average DMIPS   | 33.0 DMIPS    |

#### 6.6. Chart



## 7. Peripherals and Middlewares Configuration

### 7.1. I2C1

#### I2C: I2C

##### 7.1.1. 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 |

### 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   | Disabled           |
| Data Cache        | Enabled            |
| Flash Latency(WS) | 0 WS (1 CPU cycle) |

###### RCC Parameters:

|                                |      |
|--------------------------------|------|
| HSI Calibration Value          | 16   |
| MSI Calibration Value          | 0    |
| HSE Startup Timeout Value (ms) | 100  |
| LSE Startup Timeout Value (ms) | 5000 |

###### Power Parameters:

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

### 7.3. RTC

**mode: Activate Clock Source**

**mode: Activate Calendar**

**WakeUp: Internal WakeUp**

**7.3.1. Parameter Settings:**

**General:**

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

**Calendar Time:**

|  |                      |
|--|----------------------|
| Data Format                                | BCD data format      |
| Hours                                      | 0                    |
| Minutes                                    | 0                    |
| Seconds                                    | 0                    |
| Day Light Saving: value of hour adjustment | Daylightsaving None  |
| Store Operation                            | Storeoperation Reset |

**Calendar Date:**

|          |         |
|----------|---------|
| Week Day | Monday  |
| Month    | January |
| Date     | 1       |
| Year     | 0       |

**Wake UP:**

|                 |             |
|-----------------|-------------|
| Wake Up Clock   | RTCCLK / 16 |
| Wake Up Counter | 0           |

**7.4. SPI1**

**Mode: Full-Duplex Master**

**7.4.1. Parameter Settings:**

**Basic Parameters:**

|              |           |
|--------------|-----------|
| Frame Format | Motorola  |
| Data Size    | 8 Bits    |
| First Bit    | MSB First |

**Clock Parameters:**

|                           |                         |
|---------------------------|-------------------------|
| Prescaler (for Baud Rate) | 2                       |
| Baud Rate                 | <b>1.0485 MBits/s *</b> |
| Clock Polarity (CPOL)     | Low                     |
| Clock Phase (CPHA)        | 1 Edge                  |

**Advanced Parameters:**

|                 |          |
|-----------------|----------|
| CRC Calculation | Disabled |
| NSS Signal Type | Software |

## 7.5. SYS

**Debug: Serial Wire**

**mode: System Wake-Up 3**

**Timebase Source: SysTick**

## 7.6. UART4

**Mode: Asynchronous**

### 7.6.1. 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           |

## 7.7. UART5

**Mode: Asynchronous**

### 7.7.1. 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           |

## 7.8. USART3

**Mode: Asynchronous**

**Hardware Flow Control (RS232): CTS/RTS**

### 7.8.1. 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           |

**\* User modified value**

## 8. System Configuration

### 8.1. GPIO configuration

| IP     | Pin            | Signal         | GPIO mode                     | GPIO pull/up pull down      | Max Speed     | User Label |
|--------|----------------|----------------|-------------------------------|-----------------------------|---------------|------------|
| I2C1   | PB8            | I2C1_SCL       | Alternate Function Open Drain | No pull-up and no pull-down | <b>High *</b> |            |
|        | PB9            | I2C1_SDA       | Alternate Function Open Drain | No pull-up and no pull-down | <b>High *</b> |            |
| RCC    | PC14-OSC32_IN  | RCC_OSC32_IN   | n/a                           | n/a                         | n/a           |            |
|        | PC15-OSC32_OUT | RCC_OSC32_OUT  | n/a                           | n/a                         | n/a           |            |
|        | PH0-OSC_IN     | RCC_OSC_IN     | n/a                           | n/a                         | n/a           |            |
|        | PH1-OSC_OUT    | RCC_OSC_OUT    | n/a                           | n/a                         | n/a           |            |
| SPI1   | PB4            | SPI1_MISO      | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
|        | PB3            | SPI1_SCK       | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
|        | PB5            | SPI1_MOSI      | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
| SYS    | PA14           | SYS_JTCK-SWCLK | n/a                           | n/a                         | n/a           |            |
|        | PA13           | SYS_JTMS-SWDIO | n/a                           | n/a                         | n/a           |            |
|        | PE6-WKUP3      | SYS_WKUP3      | n/a                           | n/a                         | n/a           |            |
| UART4  | PC10           | UART4_TX       | Alternate Function Push Pull  | Pull-up                     | <b>High *</b> |            |
|        | PC11           | UART4_RX       | Alternate Function Push Pull  | Pull-up                     | <b>High *</b> |            |
| UART5  | PC12           | UART5_TX       | Alternate Function Push Pull  | Pull-up                     | <b>High *</b> |            |
|        | PD2            | UART5_RX       | Alternate Function Push Pull  | Pull-up                     | <b>High *</b> |            |
| USART3 | PD12           | USART3_RTS     | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
|        | PD11           | USART3_CTS     | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
|        | PD9            | USART3_RX      | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
|        | PD8            | USART3_TX      | Alternate Function Push Pull  | No pull-up and no pull-down | <b>High *</b> |            |
| GPIO   | PE3            | GPIO_Output    | Output Push Pull              | <b>Pull-up *</b>            | Very Low      | TOF_SHUT_N |
|        | PE1            | GPIO_Input     | Input mode                    | No pull-up and no pull-down | n/a           | TOF_INT    |
|        | PD7            | GPIO_Output    | Output Push Pull              | No pull-up and no pull-down | Very Low      | LED_RD     |
|        | PA15           | GPIO_Output    | Output Push Pull              | No pull-up and no pull-down | Very Low      | ACC_CS_N   |
|        | PA12           | GPIO_Output    | Output Push Pull              | <b>Pull-up *</b>            | Very Low      | CEL_RST_N  |
|        | PE4            | GPIO_Input     | Input mode                    | <b>Pull-up *</b>            | n/a           | ACL_INT2   |

| IP | Pin  | Signal      | GPIO mode        | GPIO pull/up pull down      | Max Speed | User Label     |
|----|------|-------------|------------------|-----------------------------|-----------|----------------|
|    | PB7  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | GNSS_RX        |
|    | PB6  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | GNSS_TX        |
|    | PA11 | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_MAIN-DTR   |
|    | PE5  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | LED_GR         |
|    | PE0  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | BLE_RST        |
|    | PA10 | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_NET_STATUS |
|    | PA8  | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CE_PON_TRG     |
|    | PC9  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | CEL_USB_BOOT   |
|    | PC6  | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_MAIN_RI    |
|    | PD14 | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_MAIN_DCD   |
|    | PD13 | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_PSM        |
|    | PC1  | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_AP_RDY     |
|    | PC2  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | CEL_PWR_KEY    |
|    | PD10 | GPIO_Input  | Input mode       | No pull-up and no pull-down | n/a       | CEL_STATUS     |
|    | PC5  | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | GNSS_PWR_EN    |
|    | PB1  | GPIO_Output | Output Push Pull | <b>Pull-up *</b>            | Very Low  | TOF_P_EN       |
|    | PE11 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Very Low  | CEL_PWR_EN     |

## 8.2. DMA configuration

nothing configured in DMA service



### 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   | 0                    | 0           |
| System tick timer                          | true   | 15                   | 0           |
| RTC wake-up interrupt through EXTI line 20 | unused |                      |             |
| Flash global interrupt                     | unused |                      |             |
| RCC global interrupt                       | unused |                      |             |
| I2C1 event interrupt                       | unused |                      |             |
| I2C1 error interrupt                       | unused |                      |             |
| SPI1 global interrupt                      | unused |                      |             |
| USART3 global interrupt                    | unused |                      |             |
| UART4 global interrupt                     | unused |                      |             |
| UART5 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                             | true                 | false            |
| Debug monitor                           | false                             | true                 | false            |
| Pendable request for system service     | false                             | true                 | false            |
| System tick timer                       | false                             | true                 | true             |

\* User modified value

## 9. System Views

### 9.1. Category view

#### 9.1.1. Current

#### Middleware

#### System Core

#### Analog

#### Timers

#### Connectivity

#### Multimedia

#### Computing

DMA

RTC 

I2C1 

GPIO 

SPI1 

NVIC 

UART4 

RCC 

UART5 

SYS 

USART3 

## 10. Docs & Resources

| Type              | Link  |
|-------------------|---|
| Presentations     | <a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf</a>   |
| Presentations     | <a href="https://www.st.com/resource/en/product_presentation/stm32_eval-tools_portfolio.pdf">https://www.st.com/resource/en/product_presentation/stm32_eval-tools_portfolio.pdf</a>   |
| Presentations     | <a href="https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf">https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf</a>   |
| Presentations     | <a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf</a>   |
| Training Material | <a href="https://www.st.com/resource/en/sales_guide/sg_sc2157.pdf">https://www.st.com/resource/en/sales_guide/sg_sc2157.pdf</a>   |
| Brochures         | <a href="https://www.st.com/resource/en/brochure/brstm32ulp.pdf">https://www.st.com/resource/en/brochure/brstm32ulp.pdf</a>   |
| Flyers            | <a href="https://www.st.com/resource/en/flyer/flnucleolrwan.pdf">https://www.st.com/resource/en/flyer/flnucleolrwan.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>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an2548-using-the-stm32f0f1f3gxl-series-dma-controller-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2548-using-the-stm32f0f1f3gxl-series-dma-controller-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf</a> |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf</a>   |
| Application Notes | <a href="https://www.st.com/resource/en/application_note/an3126-audio-and-">https://www.st.com/resource/en/application_note/an3126-audio-and-</a>   |

waveform-generation-using-the-dac-in-stm32-products-  
stmicroelectronics.pdf

- Application Notes [https://www.st.com/resource/en/application\\_note/an3155-usart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](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](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/an3193-stm32l1xx-ultralow-power-features-overview-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3193-stm32l1xx-ultralow-power-features-overview-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3216-getting-started-with-stm32l1xxx-hardware-development-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3216-getting-started-with-stm32l1xxx-hardware-development-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3236-increase-the-number-of-touchkeys-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3236-increase-the-number-of-touchkeys-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3248-using-stm32l1-analog-comparators-in-application-cases-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3248-using-stm32l1-analog-comparators-in-application-cases-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf](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](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/an3422-migration-of-microcontroller-applications-from-stm32f1-to-stm32l1-series-stmicroelectronics.pdf](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/an3960-esd-considerations-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3960-esd-considerations-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf](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](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/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-](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/an4299-improve-conducted-noise-robustness-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4299-improve-conducted-noise-robustness-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4310-sampling-capacitor-selection-guide-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4310-sampling-capacitor-selection-guide-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4312-design-with-surface-sensors-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4312-design-with-surface-sensors-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4316-tuning-a-touch-sensing-application-on-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4316-tuning-a-touch-sensing-application-on-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4566-extending-the-dac-performance-of-stm32-microcontrollers-stmicroelectronics.pdf](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/an4612-migrating-from-stm32l1-series-to-stm32l4-series-and-stm32l4-series-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4612-migrating-from-stm32l1-series-to-stm32l4-series-and-stm32l4-series-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4654-migrating-between-stm32l1-and-stm32l0-series-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4654-migrating-between-stm32l1-and-stm32l0-series-microcontrollers-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/an4706-stm32cube-firmware-examples-for-stm32l1-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4706-stm32cube-firmware-examples-for-stm32l1-series-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4718-how-to-design-a-vbat-system-based-on-stm32l0l1-series-with-external-components-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4718-how-to-design-a-vbat-system-based-on-stm32l0l1-series-with-external-components-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/an4759-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4759-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-microcontrollers-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/an4838-managing-memory-protection-unit-in-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4838-managing-memory-protection-unit-in-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4879-usb-hardware-and-pcb-guidelines-using-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4879-usb-hardware-and-pcb-guidelines-using-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4908-stm32-usart-automatic-baud-rate-detection-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4908-stm32-usart-automatic-baud-rate-detection-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-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf](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/an5036-thermal-management-guidelines-for-stm32-applications-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5036-thermal-management-guidelines-for-stm32-applications-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5105-getting-started-with-touch-sensing-control-on-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5105-getting-started-with-touch-sensing-control-on-stm32-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5156-introduction-to-stm32-microcontrollers-security-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5156-introduction-to-stm32-microcontrollers-security-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5225-usb-typec-power-delivery-using-stm32-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5225-usb-typec-power-delivery-using-stm32-mcus-and-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5408-migrating-from-stm32l0-stm32l1-and-stm32l4-series-associated-with-sx12xx-transceivers-to-stm32wl-series-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5408-migrating-from-stm32l0-stm32l1-and-stm32l4-series-associated-with-sx12xx-transceivers-to-stm32wl-series-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5543-enhanced-methods-to-handle-spi-communication-on-stm32-devices-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5543-enhanced-methods-to-handle-spi-communication-on-stm32-devices-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4899-stm32-microcontroller-gpio-hardware-settings-and-lowpower-consumption-stmicroelectronics.pdf](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/an1202\\_freertos\\_guide-](https://www.st.com/resource/en/application_note/an1202_freertos_guide-for_related_Tools_freertos-guide-stmicroelectronics.pdf)  
for related Tools [freertos-guide-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an1202_freertos_guide-for_related_Tools_freertos-guide-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an1602\\_semihosting\\_in](https://www.st.com/resource/en/application_note/an1602_semihosting_in_for_related_Tools_truestudio-how-to-do-semihosting-in-truestudio-stmicroelectronics.pdf)  
for related Tools [\\_truestudio-how-to-do-semihosting-in-truestudio-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an1602_semihosting_in_for_related_Tools_truestudio-how-to-do-semihosting-in-truestudio-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an1801\\_stm32cubeprog](https://www.st.com/resource/en/application_note/an1801_stm32cubeprog_for_related_Tools_rammer_in_truestudio-installing-stm32cubeprogrammer-in-truestudio-)  
for related Tools [rammer\\_in\\_truestudio-installing-stm32cubeprogrammer-in-truestudio-](https://www.st.com/resource/en/application_note/an1801_stm32cubeprog_for_related_Tools_rammer_in_truestudio-installing-stm32cubeprogrammer-in-truestudio-)

& Software [stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an1801_stm32cubeprog_for_related_Tools_rammer_in_truestudio-installing-stm32cubeprogrammer-in-truestudio-)

Application Notes [https://www.st.com/resource/en/application\\_note/atollic\\_editing\\_keyboard](https://www.st.com/resource/en/application_note/atollic_editing_keyboard_for_related_Tools_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf)  
for related Tools [\\_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/atollic_editing_keyboard_for_related_Tools_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/iar\\_to\\_atollic\\_truestudio](https://www.st.com/resource/en/application_note/iar_to_atollic_truestudio_for_related_Tools_migration_guide-truestudio-for-arm-migration-guide-iar-embedded-)  
for related Tools [\\_migration\\_guide-truestudio-for-arm-migration-guide-iar-embedded-](https://www.st.com/resource/en/application_note/iar_to_atollic_truestudio_for_related_Tools_migration_guide-truestudio-for-arm-migration-guide-iar-embedded-)

& Software [workbench-to-truestudio-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/iar_to_atollic_truestudio_for_related_Tools_migration_guide-truestudio-for-arm-migration-guide-iar-embedded-)

Application Notes [https://www.st.com/resource/en/application\\_note/stm32cubemx\\_installatio](https://www.st.com/resource/en/application_note/stm32cubemx_installatio_for_related_Tools_n_in_truestudio-stm32cubemx-installation-in-truestudio-)  
for related Tools [n\\_in\\_truestudio-stm32cubemx-installation-in-truestudio-](https://www.st.com/resource/en/application_note/stm32cubemx_installatio_for_related_Tools_n_in_truestudio-stm32cubemx-installation-in-truestudio-)

& Software [stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/stm32cubemx_installatio_for_related_Tools_n_in_truestudio-stm32cubemx-installation-in-truestudio-)

Application Notes [https://www.st.com/resource/en/application\\_note/an2592-achieving-32bit-](https://www.st.com/resource/en/application_note/an2592-achieving-32bit-for_related_Tools_timer-resolution-with-software-expansion-for-stm32cube-and-standard-)  
for related Tools [timer-resolution-with-software-expansion-for-stm32cube-and-standard-](https://www.st.com/resource/en/application_note/an2592-achieving-32bit-for_related_Tools_timer-resolution-with-software-expansion-for-stm32cube-and-standard-)

& Software [peripheral-library-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2592-achieving-32bit-for_related_Tools_timer-resolution-with-software-expansion-for-stm32cube-and-standard-)

Application Notes [https://www.st.com/resource/en/application\\_note/an2598-smartcard-](https://www.st.com/resource/en/application_note/an2598-smartcard-for_related_Tools_interface-with-stm32f10x-and-stm32l1xx-microcontrollers-)  
for related Tools [interface-with-stm32f10x-and-stm32l1xx-microcontrollers-](https://www.st.com/resource/en/application_note/an2598-smartcard-for_related_Tools_interface-with-stm32f10x-and-stm32l1xx-microcontrollers-)

& Software [stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2598-smartcard-for_related_Tools_interface-with-stm32f10x-and-stm32l1xx-microcontrollers-)

Application Notes [https://www.st.com/resource/en/application\\_note/an2656-stm32f10xxx-](https://www.st.com/resource/en/application_note/an2656-stm32f10xxx-for_related_Tools_lcd-glass-driver-firmware-stmicroelectronics.pdf)  
for related Tools [lcd-glass-driver-firmware-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2656-stm32f10xxx-for_related_Tools_lcd-glass-driver-firmware-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an2668-improving-](https://www.st.com/resource/en/application_note/an2668-improving-for_related_Tools_stm32f1-series-stm32f3-series-and-stm32lx-series-adc-resolution-by-)  
for related Tools [stm32f1-series-stm32f3-series-and-stm32lx-series-adc-resolution-by-](https://www.st.com/resource/en/application_note/an2668-improving-for_related_Tools_stm32f1-series-stm32f3-series-and-stm32lx-series-adc-resolution-by-)

& Software [oversampling-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2668-improving-for_related_Tools_stm32f1-series-stm32f3-series-and-stm32lx-series-adc-resolution-by-)

Application Notes [https://www.st.com/resource/en/application\\_note/an2931-implementing-](https://www.st.com/resource/en/application_note/an2931-implementing-for_related_Tools_the-adpcm-algorithm-in-highdensity-stm32f103xx-microcontrollers-)  
for related Tools [the-adpcm-algorithm-in-highdensity-stm32f103xx-microcontrollers-](https://www.st.com/resource/en/application_note/an2931-implementing-for_related_Tools_the-adpcm-algorithm-in-highdensity-stm32f103xx-microcontrollers-)

& Software [stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2931-implementing-for_related_Tools_the-adpcm-algorithm-in-highdensity-stm32f103xx-microcontrollers-)

Application Notes [https://www.st.com/resource/en/application\\_note/an3078-stm32-](https://www.st.com/resource/en/application_note/an3078-stm32-)

for related Tools    inapplication-programming-over-the-ic-bus-stmicroelectronics.pdf  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an3116-stm32s-adc-](https://www.st.com/resource/en/application_note/an3116-stm32s-adc-modes-and-their-applications-stmicroelectronics.pdf)  
for related Tools    [modes-and-their-applications-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3116-stm32s-adc-modes-and-their-applications-stmicroelectronics.pdf)  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an3174-implementing-](https://www.st.com/resource/en/application_note/an3174-implementing-receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-microcontrollers-stmicroelectronics.pdf)  
for related Tools    [receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-](https://www.st.com/resource/en/application_note/an3174-implementing-receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-microcontrollers-stmicroelectronics.pdf)  
& Software            [microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3174-implementing-receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-microcontrollers-stmicroelectronics.pdf)

Application Notes    [https://www.st.com/resource/en/application\\_note/an3300-how-to-](https://www.st.com/resource/en/application_note/an3300-how-to-calibrate-an-stm32l1xx-internal-rc-oscillator-stmicroelectronics.pdf)  
for related Tools    [calibrate-an-stm32l1xx-internal-rc-oscillator-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3300-how-to-calibrate-an-stm32l1xx-internal-rc-oscillator-stmicroelectronics.pdf)  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an3307-guidelines-for-](https://www.st.com/resource/en/application_note/an3307-guidelines-for-obtaining-iec-60335-class-b-certification-for-any-stm32-application-stmicroelectronics.pdf)  
for related Tools    [obtaining-iec-60335-class-b-certification-for-any-stm32-application-](https://www.st.com/resource/en/application_note/an3307-guidelines-for-obtaining-iec-60335-class-b-certification-for-any-stm32-application-stmicroelectronics.pdf)  
& Software            [stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3307-guidelines-for-obtaining-iec-60335-class-b-certification-for-any-stm32-application-stmicroelectronics.pdf)

Application Notes    [https://www.st.com/resource/en/application\\_note/an3309-clock-](https://www.st.com/resource/en/application_note/an3309-clock-configuration-tool-for-stm32l1xx-microcontrollers-stmicroelectronics.pdf)  
for related Tools    [configuration-tool-for-stm32l1xx-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3309-clock-configuration-tool-for-stm32l1xx-microcontrollers-stmicroelectronics.pdf)  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an3310-updating-](https://www.st.com/resource/en/application_note/an3310-updating-firmware-in-stm32l1xx-microcontrollers-through-inapplication-programming-using-the-usart-stmicroelectronics.pdf)  
for related Tools    [firmware-in-stm32l1xx-microcontrollers-through-inapplication-](https://www.st.com/resource/en/application_note/an3310-updating-firmware-in-stm32l1xx-microcontrollers-through-inapplication-programming-using-the-usart-stmicroelectronics.pdf)  
& Software            [programming-using-the-usart-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3310-updating-firmware-in-stm32l1xx-microcontrollers-through-inapplication-programming-using-the-usart-stmicroelectronics.pdf)

Application Notes    [https://www.st.com/resource/en/application\\_note/an3413-stm32l1x-](https://www.st.com/resource/en/application_note/an3413-stm32l1x-current-consumption-measurement-and-touch-sensing-demonstration-firmware-stmicroelectronics.pdf)  
for related Tools    [current-consumption-measurement-and-touch-sensing-demonstration-](https://www.st.com/resource/en/application_note/an3413-stm32l1x-current-consumption-measurement-and-touch-sensing-demonstration-firmware-stmicroelectronics.pdf)  
& Software            [firmware-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3413-stm32l1x-current-consumption-measurement-and-touch-sensing-demonstration-firmware-stmicroelectronics.pdf)

Application Notes    [https://www.st.com/resource/en/application\\_note/an3964-stm32l1x-](https://www.st.com/resource/en/application_note/an3964-stm32l1x-temperature-sensor-example-stmicroelectronics.pdf)  
for related Tools    [temperature-sensor-example-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3964-stm32l1x-temperature-sensor-example-stmicroelectronics.pdf)  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an4187-using-the-crc-](https://www.st.com/resource/en/application_note/an4187-using-the-crc-peripheral-in-the-stm32-family-stmicroelectronics.pdf)  
for related Tools    [peripheral-in-the-stm32-family-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4187-using-the-crc-peripheral-in-the-stm32-family-stmicroelectronics.pdf)  
& Software

Application Notes    [https://www.st.com/resource/en/application\\_note/an4309-interfacing-an-](https://www.st.com/resource/en/application_note/an4309-interfacing-an-stm32l1xx-microcontroller-with-an-external-i2s-audio-codec-to-play-audio-files-stmicroelectronics.pdf)  
for related Tools    [stm32l1xx-microcontroller-with-an-external-i2s-audio-codec-to-play-audio-](https://www.st.com/resource/en/application_note/an4309-interfacing-an-stm32l1xx-microcontroller-with-an-external-i2s-audio-codec-to-play-audio-files-stmicroelectronics.pdf)  
& Software            [files-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4309-interfacing-an-stm32l1xx-microcontroller-with-an-external-i2s-audio-codec-to-play-audio-files-stmicroelectronics.pdf)

Application Notes    [https://www.st.com/resource/en/application\\_note/an4323-getting-started-](https://www.st.com/resource/en/application_note/an4323-getting-started-with-stemwin-library-stmicroelectronics.pdf)  
for related Tools    [with-stemwin-library-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4323-getting-started-with-stemwin-library-stmicroelectronics.pdf)



& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4435-guidelines-for-obtaining-ulcsaiec-607301603351-class-b-certification-in-any-stm32-application-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4435-guidelines-for-obtaining-ulcsaiec-607301603351-class-b-certification-in-any-stm32-application-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4453-implementing-the-adpcm-algorithm-in-stm32l1xx-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4453-implementing-the-adpcm-algorithm-in-stm32l1xx-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4499-stm32--nrf51822-bluetooth-low-energy-system-solution-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4499-stm32--nrf51822-bluetooth-low-energy-system-solution-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4502-stm32-smbuspmibus-embedded-software-expansion-for-stm32cube-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4502-stm32-smbuspmibus-embedded-software-expansion-for-stm32cube-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4657-stm32-inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4657-stm32-inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4706-stm32cube-firmware-examples-for-stm32l1-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4706-stm32cube-firmware-examples-for-stm32l1-series-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4759-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4759-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4777-stm32-power-mode-examples-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4777-stm32-power-mode-examples-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4808-writing-to-nonvolatile-memory-without-disrupting-code-execution-on-microcontrollers-of-the-stm32l0-and-stm32l1-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4808-writing-to-nonvolatile-memory-without-disrupting-code-execution-on-microcontrollers-of-the-stm32l0-and-stm32l1-series-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4841-digital-signal-processing-for-stm32-microcontrollers-using-cmsis-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4841-digital-signal-processing-for-stm32-microcontrollers-using-cmsis-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an5054-secure-programming-using-stm32cubeprogrammer-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5054-secure-programming-using-stm32cubeprogrammer-stmicroelectronics.pdf)  
for related Tools  
& Software

|  |   |
|--|---|
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5056-integration-guide-for-the-xcubesbsfu-stm32cube-expansion-package-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5056-integration-guide-for-the-xcubesbsfu-stm32cube-expansion-package-stmicroelectronics.pdf</a>   |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5360-getting-started-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5360-getting-started-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf</a>   |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf</a>                               |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5394-getting-started-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5394-getting-started-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf</a>   |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf</a>   |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5426-migrating-graphics-middleware-projects-from-stm32cubemx-540-to-stm32cubemx-550-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5426-migrating-graphics-middleware-projects-from-stm32cubemx-540-to-stm32cubemx-550-stmicroelectronics.pdf</a>   |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5564-getting-started-with-projects-based-on-dualcore-stm32wl-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5564-getting-started-with-projects-based-on-dualcore-stm32wl-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf</a>                               |
| Application Notes for related Tools & Software | <a href="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">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</a> |
| Application Notes for related Tools & Software | <a href="https://www.st.com/resource/en/application_note/an5731-stm32cubemx-and-stm32cubeide-threadsafe-solution-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5731-stm32cubemx-and-stm32cubeide-threadsafe-solution-stmicroelectronics.pdf</a>   |
| Errata Sheets                                  | <a href="https://www.st.com/resource/en/errata_sheet/es0235-stm32l15xxe-and-stm32l15xvdx-ultralowpower-device-limitations-stmicroelectronics.pdf">https://www.st.com/resource/en/errata_sheet/es0235-stm32l15xxe-and-stm32l15xvdx-ultralowpower-device-limitations-stmicroelectronics.pdf</a>   |
| Errata Sheets                                  | <a href="https://www.st.com/resource/en/errata_sheet/es0242-stm32l15xxe-stm32l15xvdx-stm32l162xe-stm32l162xvdx-device-errata-stmicroelectronics.pdf">https://www.st.com/resource/en/errata_sheet/es0242-stm32l15xxe-stm32l15xvdx-stm32l162xe-stm32l162xvdx-device-errata-stmicroelectronics.pdf</a>   |
| Datasheet                                      | <a href="https://www.st.com/resource/en/datasheet/dm00098321.pdf">https://www.st.com/resource/en/datasheet/dm00098321.pdf</a>   |
| Programming                                    | <a href="https://www.st.com/resource/en/programming_manual/pm0056-">https://www.st.com/resource/en/programming_manual/pm0056-</a>   |

|                               |   |
|-------------------------------|---|
| Manuals                       | <a href="#">stm32f10xxx20xxx21xxx1xxxx-cortexm3-programming-manual-stmicroelectronics.pdf</a>   |
| Reference<br>Manuals          | <a href="https://www.st.com/resource/en/reference_manual/rm0038-stm32l100xx-stm32l151xx-stm32l152xx-and-stm32l162xx-advanced-armbased-32bit-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/reference_manual/rm0038-stm32l100xx-stm32l151xx-stm32l152xx-and-stm32l162xx-advanced-armbased-32bit-mcus-stmicroelectronics.pdf</a>                       |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_article/ta0340-stm32l-cortexm3-microcontroller-for-usage-in-lowpower-healthcare-applications-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_article/ta0340-stm32l-cortexm3-microcontroller-for-usage-in-lowpower-healthcare-applications-stmicroelectronics.pdf</a>                           |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_article/ta0342-accurate-power-consumption-estimation-for-stm32l1-series-of-ultralowpower-microcontrollers-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_article/ta0342-accurate-power-consumption-estimation-for-stm32l1-series-of-ultralowpower-microcontrollers-stmicroelectronics.pdf</a> |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1163-description-of-wlcsp-for-microcontrollers-and-recommendations-for-its-use-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1163-description-of-wlcsp-for-microcontrollers-and-recommendations-for-its-use-stmicroelectronics.pdf</a>   |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1178-migrating-from-stm32l156xxd-to-stm32l156xxe-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1178-migrating-from-stm32l156xxd-to-stm32l156xxe-stmicroelectronics.pdf</a>   |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1204-tape-and-reel-shipping-media-for-stm32-microcontrollers-in-bga-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1204-tape-and-reel-shipping-media-for-stm32-microcontrollers-in-bga-packages-stmicroelectronics.pdf</a>   |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1205-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-fpn-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1205-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-fpn-packages-stmicroelectronics.pdf</a>                           |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1206-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-qfp-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1206-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-qfp-packages-stmicroelectronics.pdf</a>                           |
| Technical Notes<br>& Articles | <a href="https://www.st.com/resource/en/technical_note/tn1207-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-so-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1207-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-so-packages-stmicroelectronics.pdf</a>                             |
| Technical Notes<br>& Articles | <a href="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">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</a>     |