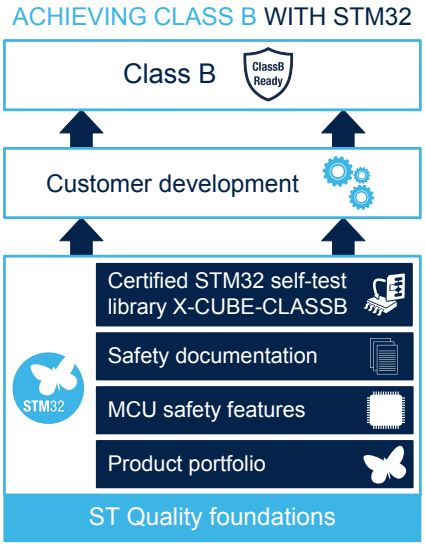
X-CUBE-CLASSB

Data brief

Class B 60730-1 and 60335-1 functional safety package with software expansion for STM32Cube



Product status link
X-CUBE-CLASSB

Features

Available versions

- X-CUBE-CLASSB version 2.2.x supports the STM32L0, STM32L1, STM32L4, STM32L4+, STM32F0, STM32F1, STM32F2, STM32F3, STM32F4, and STM32F7 series
- X-CUBE-CLASSB version 2.3.x supports the STM32G0, STM32G4, STM32WB (Cortex®-M4 core only), and STM32H7 series (Cortex®-M7 core only)
- X-CUBE-CLASSB version 2.4.x supports the STM32L5 series
- X-CUBE-CLASSB version 3.x.x extends the package for dual-core microcontrollers:
  - Operates when both cores contribute to the overall safety task
  - Includes safety status exchange between cores
  - Handles internal resources overlay
  - Certified upon STM32H7x7 dual-core microcontrollers
- X-CUBE-CLASSB version 4.0.0 supports the STM32C0, STM32F7, STM32G0, STM32G4, STM32H5, STM32H7 (Cortex®-M7 core only), STM32L4, STM32L4+, STM32U5, STM32WL, and STM32MP1 series with a specific user guide for each series and a specific UL common certificate

Differences between versions

- For versions 2.x.x and 3.x.x, the Expansion Packages:
  - are delivered as full code source and based on STM32Cube HAL
  - relate to a common user guide (AN4435) as well as to a common UL certificate
- For version 4.0.0, the Expansion Package:
  - features a different structure adopted from the similar safety firmware in X-CUBE-STL (STMicroelectronics industrial safety library)
  - is delivered in a precompiled, and therefore fixed, object code format (except configuration and integration procedures), which makes it independent of tools, compilers, and any other STMicroelectronics firmware
  - relates to a specific dedicated user manual for each supported series and to a specific UL common certificate
  - is supported by STM32CubeProgrammer (STM32CubeProg) command-line interface

Common version features

- Optimized portability among different microcontrollers through STM32Cube
- Partially optimized code written in assembler code for time-critical tests
- Support for compilers associated with IAR Systems® IAR Embedded Workbench®, Keil® MDK-ARM, and GCC compiler-based integrated development environments such as STMicroelectronics STM32CubeIDE or SW4STM32
- Certified by UL®
- Coverage of worldwide standards (IEC, UL, CSA)

1 Description

The IEC 60730-1 and IEC 60335-1 safety standards define the test and the diagnostic methods, effective to detect random hardware failures, that ensure the safe operation of hardware and software embedded in household appliances under the control of electronic programmable devices.

With its X-CUBE-CLASSB functional safety package based on robust built-in STM32 safety features, STMicroelectronics provides a comprehensive set of certified software self-test libraries and documentation for manufacturers to reduce significantly the development efforts, time, and cost to achieve the UL/CSA/IEC 60335-1 and the 60730-1 worldwide safety certifications for their STM32-based applications up to Class B level.

A set of test APIs focused on generic safety-critical core components (CPU, SRAM, flash memory, and clock system) is provided exclusively in the firmware package. The associated examples suggest a possible integration of this set in a final application where simple code demonstrates sequential polling of the APIs and checking results of the performed partial tests.

Only the testing methods applied are the subject of the certification. The API integration provided, the extensions to the test of other application-specific core components, and the necessary configuration of all associated hardware through HAL drivers (if applied) are inspected but not certified for safety. This is supposed to be subject to further modification, extension, and verification entirely under the end-user's responsibility (such as the replacement of HAL drivers with sequences calling LL drivers directly).

The parts of the library and examples of its integration, which are delivered as full source code, can lead to dependence on the compilers and HAL driver versions available at the time of the certification process. Users must consider this point when combining the certified API sources with their latest versions as described in the associated user manual.

The X-CUBE-CLASSB functional safety package consists of a set of expansion software for STM32Cube (self-test libraries and their integration examples) and a dedicated user guide. The user guide is either the application note *Guidelines for obtaining UL/CSA/IEC 60730-1/60335-1 Class B certification in any STM32 application* (AN4435), or one of the dedicated IEC 60730-1 self-test library user guides for each series supported by the version 4.0.0 of the library. The Ordering information of the X-CUBE-CLASSB data brief provides a summary of the versions available.

Common safety principles described in the microcontroller series safety manuals, available with the X-CUBE-STL industrial safety package, are mostly applicable as well, despite the fact that these manuals target different industry-oriented standards. This is due to the significant overlay between these safety standards.

2 General information

The X-CUBE-CLASSB functional safety package runs on STM32 microcontrollers based on Arm® cores.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2.1 Ordering information

X-CUBE-CLASSB is available for free download from the *www.st.com* website with the versions described in Table 1.

Table 1. X-CUBE-CLASSB versions summary

Version	Supported products	User guide	Certificate	Format
2.2.x	STM32L0, STM32L1, STM32L4, STM32L4+, STM32F0, STM32F1, STM32F2, STM32F3, STM32F4, and STM32F7 microcontrollers	AN4435	UL common certificate(1)	HAL-based open source
2.3.x	STM32G0, STM32G4, STM32WB(2), and STM32H7(3) microcontrollers			
2.4.x	STM32L5 microcontrollers			
3.x.x	STM32H7(4) microcontrollers			
4.0.0	STM32C0 microcontrollers (X-CUBE-CLASSB-C0) STM32F7 microcontrollers (X-CUBE-CLASSB-F7) STM32G0 microcontrollers (X-CUBE-CLASSB-G0) STM32G4 microcontrollers (X-CUBE-CLASSB-G4) STM32H5 microcontrollers (X-CUBE-CLASSB-H5) STM32H7 microcontrollers(3) (X-CUBE-CLASSB-H7) STM32L4 and STM32L4+ microcontrollers (X-CUBE-CLASSB-L4) STM32U5 microcontrollers (X-CUBE-CLASSB-U5) STM32WL microcontrollers (X-CUBE-CLASSB-WL) STM32MP1 microprocessors(2) (X-CUBE-CLASSB-MP1)	UM3119 UM3251 UM3083 UM3167 UM3267 UM3252 UM3166 UM2986 UM3191 UM3190	Specific UL common certificate(1)	Precompiled object code independent of any other STMicroelectronics firmware

1. *Refer to the "Product Certifications" section in the "Documentation" tab of the X-CUBE-CLASSB product web page.*
2. *Cortex®-M4 core only.*
3. *Cortex®-M7 core only.*
4. *Dual-core products. The patch 3.0.1 is available. It corrects a typo in the linker scatter file of the "CM4" core in the "ARM-KEIL" project example.*

2.2 What is STM32Cube?

STM32Cube is an STMicroelectronics original initiative to improve designer productivity significantly by reducing development effort, time, and cost. STM32Cube covers the whole STM32 portfolio.

STM32Cube includes:

- A set of user-friendly software development tools to cover project development from conception to realization, among which are:
  - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
  - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
  - STM32CubeCLT, an all-in-one command-line development toolset with code compilation, board programming, and debug features
  - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
  - STM32CubeMonitor (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD), powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real time
- STM32Cube MCU and MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeH5 for the STM32H5 series), which include:
  - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over hardware
  - A consistent set of middleware components such as ThreadX, FileX / LevelX, NetX Duo, USBX, USB-PD, mbed-crypto, secure manager API, MCUboot, and OpenBL
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU and MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

3 License

3.1 License for versions 2.2.x, 2.3.x, 2.4.x, and 3.x.x

X-CUBE-CLASSB versions 2.2.x, 2.3.x, 2.4.x, and 3.x.x are delivered under the *Mix Ultimate Liberty+OSS+3rd-party V1* software license agreement (SLA0048).

The software components provided in these versions come with different license schemes as shown in Table 2.

Table 2. Software component license agreements

Software component	Copyright	License
Class B library	STMicroelectronics	Proprietary
Cortex®-M CMSIS	Arm Limited	Apache License 2.0
HAL STM32	STMicroelectronics	BSD-3-Clause
Board support package (BSP)	STMicroelectronics	BSD-3-Clause
Project examples	STMicroelectronics	Proprietary

3.2 License for version 4.0.0

X-CUBE-CLASSB version 4.0.0 is delivered under the SLA0048 software license agreement and its Additional License Terms.

Revision history

Table 3. **Document revision history**

Date	Revision	Changes
02-Feb-2016	1	Initial release.
24-Oct-2017	2	Updated *Features*: • Added compatibility with STM32L4, STM32F1, and STM32F7 series • Added support of GCC-based AC6 compiler Added *Ordering information*.
15-Nov-2019	3	Updated *Features*: • Added the support of the STM32L4+, STM32G0, STM32G4, STM32WB, and STM32H7 series • Discriminated between version 2.2.0 and version 2.3.0 Added *License*.
20-Apr-2021	4	Updated *Features*: • Support for the STM32L5 series with version 2.4.0 • Support for dual-core microcontrollers with version 3.0.0 Updated *Description*: • APIs for safety-critical core components and associated examples • Certification subject • Certification dependence on open source • Commonality with X-CUBE-STL
01-Sep-2022	5	Updated *Features* and *Description*: • Support for the STM32U5 series with version 4.0.0 • Specific user guide and UL certificate for version 4.0.0 Updated *Ordering information* and *License*.
12-Jan-2023	6	Updated *Features*, *Description*, and *Ordering information* for the version 4.0.0: • Support for the STM32C0 series and STM32G0 series • Specific user guide for each supported series and specific UL common certificate
04-Aug-2023	7	Updated *Features* and *Ordering information* for the version 4.0.0: • Added the support for the STM32G4 series, STM32L4 series, STM32L4+ series, STM32WL series, and STM32MP1 series • Added the specific user guide for each new supported series
09-Jan-2024	8	Updated Features and Ordering information for the version 4.0.0: • Added the support for the STM32F7 series, STM32H5 series, and STM32H7 series • Added the specific user guide for each new supported series • Added the support of the STM32CubeProgrammer (STM32CubeProg) command-line interface

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