

Software expansion for STM32Cube driving industrial digital output based on IPS

Applications & demonstrations	Smart driving example
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)
Hardware	<p>STM32 Nucleo expansion boards</p> <p>X-NUCLEO-OUT19A2, X-NUCLEO-OUT02A1, X-NUCLEO-OUT03A1, X-NUCLEO-OUT04A1, X-NUCLEO-OUT05A1, X-NUCLEO-OUT06A1, X-NUCLEO-OUT07A1, X-NUCLEO-OUT08A1, X-NUCLEO-OUT09A1, X-NUCLEO-OUT10A1, X-NUCLEO-OUT11A1, X-NUCLEO-OUT12A1, X-NUCLEO-OUT13A1, X-NUCLEO-OUT14A1, X-NUCLEO-OUT15A1, X-NUCLEO-OUT16A1, X-NUCLEO-OUT17A1, X-NUCLEO-OUT18A1, X-NUCLEO-OUT19A1, X-NUCLEO-OUT20A1, X-NUCLEO-OUT21A1, X-NUCLEO-OUT22A1, X-NUCLEO-OUT23A1, X-NUCLEO-OUT24A1, X-NUCLEO-OUT25A1, X-NUCLEO-OUT26A1, X-NUCLEO-OUT27A1, X-NUCLEO-OUT28A1, X-NUCLEO-OUT29A1, X-NUCLEO-OUT30A1, X-NUCLEO-OUT31A1, X-NUCLEO-OUT32A1, X-NUCLEO-OUT33A1, X-NUCLEO-OUT34A1, X-NUCLEO-OUT35A1, X-NUCLEO-OUT36A1, X-NUCLEO-OUT37A1, X-NUCLEO-OUT38A1, X-NUCLEO-OUT39A1, X-NUCLEO-OUT40A1, X-NUCLEO-OUT41A1, X-NUCLEO-OUT42A1, X-NUCLEO-OUT43A1, X-NUCLEO-OUT44A1, X-NUCLEO-OUT45A1, X-NUCLEO-OUT46A1, X-NUCLEO-OUT47A1, X-NUCLEO-OUT48A1, X-NUCLEO-OUT49A1, X-NUCLEO-OUT50A1, X-NUCLEO-OUT51A1, X-NUCLEO-OUT52A1, X-NUCLEO-OUT53A1, X-NUCLEO-OUT54A1, X-NUCLEO-OUT55A1, X-NUCLEO-OUT56A1, X-NUCLEO-OUT57A1, X-NUCLEO-OUT58A1, X-NUCLEO-OUT59A1, X-NUCLEO-OUT60A1, X-NUCLEO-OUT61A1, X-NUCLEO-OUT62A1, X-NUCLEO-OUT63A1, X-NUCLEO-OUT64A1, X-NUCLEO-OUT65A1, X-NUCLEO-OUT66A1, X-NUCLEO-OUT67A1, X-NUCLEO-OUT68A1, X-NUCLEO-OUT69A1, X-NUCLEO-OUT70A1, X-NUCLEO-OUT71A1, X-NUCLEO-OUT72A1, X-NUCLEO-OUT73A1, X-NUCLEO-OUT74A1, X-NUCLEO-OUT75A1, X-NUCLEO-OUT76A1, X-NUCLEO-OUT77A1, X-NUCLEO-OUT78A1, X-NUCLEO-OUT79A1, X-NUCLEO-OUT80A1, X-NUCLEO-OUT81A1, X-NUCLEO-OUT82A1, X-NUCLEO-OUT83A1, X-NUCLEO-OUT84A1, X-NUCLEO-OUT85A1, X-NUCLEO-OUT86A1, X-NUCLEO-OUT87A1, X-NUCLEO-OUT88A1, X-NUCLEO-OUT89A1, X-NUCLEO-OUT90A1, X-NUCLEO-OUT91A1, X-NUCLEO-OUT92A1, X-NUCLEO-OUT93A1, X-NUCLEO-OUT94A1, X-NUCLEO-OUT95A1, X-NUCLEO-OUT96A1, X-NUCLEO-OUT97A1, X-NUCLEO-OUT98A1, X-NUCLEO-OUT99A1, X-NUCLEO-OUT100A1</p> <p>STM32 Nucleo development board NUCLEO-64</p>



Features

- Software package to build applications using the expansion boards that mount the industrial intelligent power switches (IPS)
- Includes ready-to-use firmware to evaluate easily the driving and diagnostic capabilities of the IPS products for industrial loads
- Support for NUCLEO-F401RE and NUCLEO-G431RB development boards
- GPIOs, PWMs, and IRQs
- Fault/diagnostics interrupt handling
- Compatible with STM32CubeMX, can be downloaded from st.com and installed directly into STM32CubeMX
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Description

The X-CUBE-IPS expansion software package for STM32Cube runs on the STM32 and includes drivers that control the industrial intelligent power switches (IPS) mounted on several expansion boards.

This software allows controlling the output channels of the expansion boards when connected to a NUCLEO-F401RE or NUCLEO-G431RB development board.

It is possible to build systems with multiple boards stacked to evaluate multichannel digital output modules, even with different output current capabilities.

Each output channel can be switched into the steady-state mode or PWM mode.

In the PWM mode, the software allows you to program the expansion boards to be switched on and off using a specific frequency and duty cycle.

The software included in the package can be used in three integrated development environments (IDEs): IAR, Keil®, and STM32CubeIDE.

The expansion boards supported are the following:

Product summary	
Software expansion for STM32Cube driving industrial digital output based on IPS	X-CUBE-IPS
Single channel high-side switches	IPS1025H/ IPS1025H-32/ IPS1025HF/ IPS160HF/ IPS161HF
Dual channel high-side switches	IPS2050H/ IPS2050H-32
Quad low-side intelligent power switch	IPS4260L
Quad high-side intelligent power switches	IPS4140HQ/ IPS4140HQ-1
Octal channel galvanic isolated high-side switches	ISO808/ISO808-1/ ISO808A/ ISO808A-1/ ISO8200BQ/ ISO8200AQ
Octal channel high side switches	IPS8160HQ/ IPS8160HQ-1/ IPS8200HQ/ IPS8200HQ-1
Microcontrollers	STM32F401RE/ STM32G431RB
Applications	Programmable Logic Controllers

- X-NUCLEO-OUT01A2, 8-ch galvanic isolated high-side digital output based on ISO8200BQ
- X-NUCLEO-OUT02A1, 8-ch galvanic isolated high-side digital output with SPI interface based on ISO8200AQ
- X-NUCLEO-OUT03A1, 2-ch high-side digital output based on IPS2050H
- X-NUCLEO-OUT04A1, 2-ch high-side digital output based on IPS2050H-32
- X-NUCLEO-OUT05A1, 1-ch high-side digital output based on IPS1025H
- X-NUCLEO-OUT06A1, 1-ch high-side digital output based on IPS1025H-32
- X-NUCLEO-OUT07A1, 4-ch low-side digital output based on IPS4260L
- X-NUCLEO-OUT08A1, 1-ch high-side digital output based on IPS160HF
- X-NUCLEO-OUT09A1, 8-ch high-side digital output based on IPS8160HQ
- X-NUCLEO-OUT10A1, 1-ch high-side digital output based on IPS161HF
- X-NUCLEO-OUT11A1, 8-ch galvanic isolated high-side digital output based on ISO808
- X-NUCLEO-OUT12A1, 8-ch galvanic isolated high-side digital output with SPI interface based on ISO808A
- X-NUCLEO-OUT13A1, 8-ch galvanic isolated high-side digital output based on ISO808-1
- X-NUCLEO-OUT14A1, 8-ch galvanic isolated high-side digital output with SPI interface based on ISO808A-1
- X-NUCLEO-OUT15A1, 1-ch high-side digital output based on IPS1025HF
- X-NUCLEO-OUT16A1, 8-ch high-side digital output with parallel and SPI (8/16-bit) interface based on IPS8200HQ
- X-NUCLEO-OUT17A1, 8-ch high-side digital output with parallel and SPI (8/16-bit) interface based on IPS8200HQ-1
- X-NUCLEO-OUT19A1, 8-ch high-side digital output based on IPS8160HQ-1
- X-NUCLEO-DO40A1, 4-ch high-side digital output based on IPS4140HQ
- X-NUCLEO-DO41A1, 4-ch high-side digital output based on IPS4140HQ-1

1 Detailed description

1.1 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- **STM32CubeMX** configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- **STM32CubeIDE** integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- **STM32CubeProgrammer** programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- **STM32CubeMonitor** family of tools (**STM32CubeMonRF**, **STM32CubeMonUCPD**, **STM32CubeMonPwr**) to help developers customize their applications in real-time
- **STM32Cube MCU and MPU packages** specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- **STM32Cube expansion packages** for application-oriented solutions.

1.2 How does this software complement STM32Cube?

This software supports single and multichannel digital output applications.

The package is based on the **STM32CubeHAL**, which is the hardware abstraction layer for the STM32 microcontroller.

The package extends **STM32Cube** by providing a board support package (BSP) for the **STM32 Nucleo** expansion board based on the industrial IPS.

The drivers abstract low-level details of the hardware to access the IPS device data in a hardware-independent manner.

The software package includes a set of examples that the developer can use to start experimenting with the code.

The IPS output channels are controlled via the GPIO peripheral. The application debugging is supported on the respective expansion boards through LEDs, GPIO, and interrupt signals for activity and diagnostics.

Revision history

Table 1. Document revision history

Date	Revision	Changes
09-Jun-2022	1	Initial release.
21-Dec-2022	2	Added references to X-NUCLEO-OUT08A1, X-NUCLEO-OUT09A1, X-NUCLEO-OUT10A1, X-NUCLEO-OUT11A1, X-NUCLEO-OUT12A1, X-NUCLEO-OUT13A1, X-NUCLEO-OUT14A1, X-NUCLEO-OUT19A1, IPS160HF, IPS161HF, ISO808, ISO808-1, IPS8160HQ, IPS8160HQ-1, ISO808A and ISO808A-1.
11-Jul-2023	3	Updated cover image. Added references to X-NUCLEO-OUT01A2 and ISO8200BQ.
06-Oct-2023	4	Updated cover image. Added references to X-NUCLEO-OUT16A1, X-NUCLEO-OUT17A1, IPS8200HQ and IPS8200HQ-1.
20-Dec-2023	5	Updated cover image. Added references to X-NUCLEO-OUT07A1 and IPS4260L.
24-Jul-2024	6	Added reference to STM32CubeMX.
03-Dec-2024	7	Added references to X-NUCLEO-DO40A1, X-NUCLEO-DO41A1, X-NUCLEO-OUT02A1, IPS4140HQ, IPS4140HQ-1 and ISO8200AQ.

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