Quick Start Guide

X-NUCLEO-OUT10A1
Industrial digital output expansion board based on IPS161HF for STM32 Nucleo
Quick Start Guide Contents

- X-NUCLEO-OUT10A1: Industrial digital output expansion board
  Hardware and Software overview

- Setup & Demo Examples
- Documents & Related Resources

- STM32 Open Development Environment: Overview
Industrial digital output expansion board
Hardware Overview

X-NUCLEO-OUT10A1 Hardware Description

- The X-NUCLEO-OUT10A1 is an evaluation board based on the IPS161HF 60V/0.5A single channel high side switch with embedded diagnostic (Open Load, Over-Temperature, Over-Load) and protection against overheating and overheating.

- The X-NUCLEO-OUT10A1 interfaces with the microcontroller on the STM32 Nucleo via 3 kV optocouplers driven by GPIO pins and Arduino™ UNO R3.

- The expansion board should be connected to either a NUCLEO-F401RE or NUCLEO-G431RB development board, and can also be stacked with another X-NUCLEO-OUT10A1 or X-NUCLEO-OUT08A1.

- Two X-NUCLEO-OUT10A1 expansion boards allows you to evaluate a dual channel digital output module with 0.5 A capability each, or a 0.5 A single channel safety digital output module. In the second scenario, the first shield output is connected to the supply of the second one. Dedicated on-board hardware can be enabled or disabled to activate fast discharge of high capacitive loads, output voltage sensing and additional surge pulse output line protection.

- The X-NUCLEO-OUT10A1 connected to the X-NUCLEO-OUT08A1 allows you to evaluate a dual channel digital output module with output current capability of 0.5 A and 2 A, respectively.

Features

- Based on the IPS161HF
- Normal operating Voltage range 12 to 33 V
- Extended voltage operating range (J1 open) up to 60 V
- Supply rail reverse polarity protection
- Output load capability up to 0.7A
- Output propagation delay at start-up < 60us.
- Compliance with IEC61000-4-2, IEC61000-4-3, IEC61000-4-5
- Output ON/OFF Status Green LED
- Fault Diagnostic Red LED
- Configurable Cut-off intervention time
- 3 kV galvanic isolation barrier between logic and process sides
- Equipped with Arduino™ UNO R3 connectors
- Wide application development potential in STM32 Nucleo development environment
- Ready for Safety Digital Output Architecture
- CE certified
- RoHS and China RoHS compliant

Key Products on board
IPS161HF:
0.5A Single High Side Smart Power Solid State Relay

Latest info available at www.st.com
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Software Overview

X-CUBE-OUT8 Software Description

• The X-CUBE-OUT8 expansion software package for STM32Cube runs on the STM32 and includes a driver for the IPS161HF.
• The software provides an affordable and easy-to-use solution for the development of single and dual channel digital output modules, letting you easily evaluate the IPS161HF communication and industrial load driving features.
• The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers.
• The software comes with a sample implementation of the driver running on the X-NUCLEO-OUT10A1 expansion board connected to a NUCLEO-F401RE or NUCLEO-G431RB development board.
• You can also perform evaluation of single channel digital output module in P-P by connecting two X-NUCLEO-OUT10A1 with the Output channel of the first connected to the supply rail of the second.

Key features

• Complete software to build applications for the IPS161HF single channel high-side smart power solid state-relay
• GPIOs, PWMs and IRQs configuration
• Fault interrupt handling
• Sample implementation available on the X-NUCLEO-OUT10A1 expansion board when connected to a NUCLEO-F401RE or NUCLEO-G431RB development board
• Easy portability across different MCU families, thanks to STM32Cube
• Free, user-friendly license terms

Overall Software Architecture

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| Hardware | STM32 Nucleo expansion boards
X-NUCLEO-OUT8A1, X-NUCLEO-OUT10A1

STM32 Nucleo development boards
NUCLEO-F401RE/G431RB

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Setup & Demo Examples

HW prerequisites (1/2)

- 1x STM32 Nucleo Industrial digital output expansion board
  (X-NUCLEO-OUT10A1)

- 1x STM32 Nucleo development board
  (NUCLEO-F401RE or NUCLEO-G431RB)

- 1x USB type A to Mini-B cable (for NUCLEO-F401RE) or
  1x USB type A to Micro-B cable (for NUCLEO-FG431RB)

- 1x Laptop/PC running Microsoft Windows™ 7 or above

- 1x external power supply at 24 V
The STM32F401RE can be supplied:

1. (DEFAULT) by USB cable of the STM32 Nucleo development board
   a) CLOSE JP5 to 5V position on the STM32 Nucleo development board
2. By external supply of the X-NUCLEO-OUT10A1
   b) Connect the external supply (from 7 to 12V) to CN2 of X-NUCLEO-OUT10A1
   c) CLOSE JP5 to E5V position on the STM32 Nucleo development board

The STM32G431RBT6U can be supplied:

1. (DEFAULT) by USB cable of the STM32 Nucleo development board
   a) CLOSE JP5 to 5V_STLK position on the STM32 Nucleo development board
2. By external supply of the X-NUCLEO-OUT08A1
   b) Connect the external supply (from 7 to 12V) to CN2 of X-NUCLEO-OUT08A1
   c) CLOSE JP5 to 5V_VIN position on the STM32 Nucleo development board
Execution of the example code

- X-CUBE-OUT8:
  - The package contains the source code example (Keil, IAR, STM32CubeIDE) based on **NUCLEO-F401RE** and **NUCLEO-G431RB**
  - Also, you can find the binary files of the example (one for each of the supported Nucleo boards).

Evaluation by Graphical User Interface

- **STSW-IFAPGUI**
  - Common GUI for IPS products.

- **STSW-OUT8F4**
  - Demonstration binary file for NUCLEO-F401RE enabling the GUI

- **STSW-OUT8G4**
  - Demonstration binary file for NUCLEO-G431RB enabling the GUI
Quick start-up procedure
(see HW and SW prerequisites)

Execution of the example code

• Download the X-CUBE-OUT8 (.zip file) into a folder of your Laptop/PC

• Connect the NUCLEO board and the X-NUCLEO-OUT10A1 by Arduino connectors.

• Connect the USB cable between Laptop/PC and Nucleo board

• Select the example binary file according to your Nucleo board (F401 or G431) and flash it (by your IDE, or by ST-Link Utility or by STM32 Cube Programmer).

• Connect by CN1 the X-NUCLEO-OUT10A1 to a 24V power supply and turn it on.

• Click on the blue button of the Nucleo board to switch between the different pre-loaded driving modes of the output.

Evaluation by Graphical User Interface

• Download and install the latest version of the STSW-IFAPGUI

• Download the STSW-OUT8F4 or STSW-OUT8G4 according to your Nucleo board (F401 or G431).

• Connect the NUCLEO board and the X-NUCLEO-OUT10A1 by Arduino connectors.

• Connect the USB cable between Laptop/PC and Nucleo board

• Flash the demonstration binary file to your Nucleo board (F401 or G431) by your IDE, or by ST-Link Utility or by STM32 Cube Programmer.

• Connect by CN1 the X-NUCLEO-OUT10A1 to a 24V power supply and turn it on.

• Launch the STSW-IFAPGUI. The self recognition phase checks the firmware running on the Nucleo board and then the GUI starts

• Set your preferred duty cycle and PWM for the output driving and check it on the application board.
Start coding in just a few minutes with X-CUBE-OUT8

1. Go to www.st.com/x-nucleo
2. Select X-NUCLEO-OUT10A1
3. Download & unpack X-CUBE-OUT8
4. Download and install (ST-LINK/V2-1 USB driver, STM32 Cube Programmer)
5. Open project example
6. Modify and build application

Generic Nucleo Docs
IPS16xHF drivers
Application example
Documents & Related Resources

All documents are available in the DESIGN tab of the related products webpage

X-NUCLEO-OUT10A1:
- **DB4176**: Industrial digital output expansion board based on IPS161HF for STM32 Nucleo – [Data Brief](#)
- Gerber files, BOM, Schematic

X-CUBE-OUT8:
- **DB4178**: Industrial Digital Output software expansion for STM32Cube – [Data Brief](#)
- **UM2707**: Getting started with the X-CUBE-OUT8 industrial digital output software expansion for STM32Cube – [User Manual](#)
- Software set-up file

STSW-OUT8F4:
- **DB4179**: Demonstration firmware for NUCLEO-F401RE enabling STSW-IFAPGUI on X-NUCLEO-OUT08A1 and X-NUCLEO-OUT10A1 expansion boards– [Data Brief](#)

STSW-OUT8G4:
- **DB4180**: Demonstration firmware for NUCLEO-G431RB enabling STSW-IFAPGUI on X-NUCLEO-OUT08A1 and X-NUCLEO-OUT10A1 expansion boards– [Data Brief](#)

STSW-IFAPGUI:
- **DB3775**: Graphical user interface for the industrial IPS evaluation boards based on STM32 Nucleo – [Data Brief](#)
- **UM2509**: STSW-IFAPGUI, common graphical user interface for the expansion boards of Intelligent Power Switches – [User Manual](#)

Consult www.st.com for the complete list
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The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.