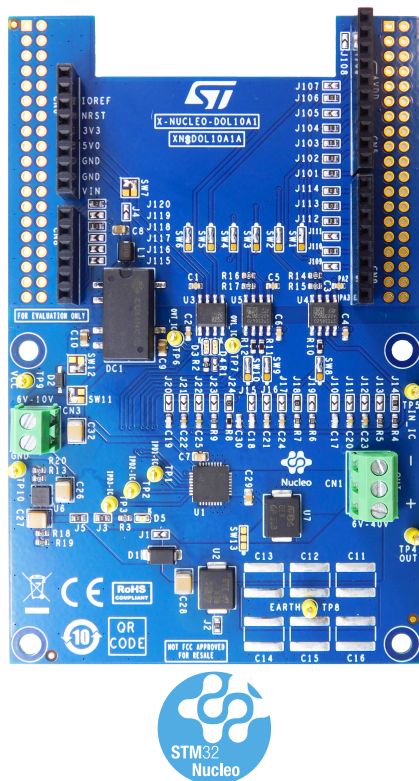


## Industrial digital output expansion board based on IPS1050LQ for STM32 Nucleo



### Features

The **X-NUCLEO-DOL10A1** (with the associated STM32 Nucleo-64 board) is intended to be used in industrial I/O modules and PLC (programmable logic controller) applications, especially in those where industrial safety worths.

- Based on the **IPS1050LQ** single low-side switch, which features:
  - Operating voltage range 5.8 to 10 V
  - Smart overload protection with configurable inrush and limitation levels
  - 3.3 V and 5 V compatible I/O
  - Very low On-state resistance ( $R_{DS(ON)} \leq 50 \text{ m}\Omega$ )
  - Fast demagnetization of inductive loads
  - Junction over-temperature protections
  - Over-temperature diagnostic pin
  - Undervoltage lock-out
  - Loss of supply / loss of ground protection
  - Designed to meet IEC 61000-4-2, IEC61000-4-4, and IEC61000-4-5
  - QFN32L 6x6 mm package
- Galvanic isolation between logic and process sides by **STISO620** digital isolators and isolated DC-DC converter
- Selectable supply of the **IPS1050LQ** from 24 V supply rail, or alternatively from on board isolated dc-dc converter
- Process side supply rail reverse polarity protection by **STPS1H100A**
- On board high efficiency 24 V to 6 V LDO (**LDO40LPURY**)
- Supply rail surge pulse protection by **SM15T39CA**
- Digital signals for smart overload protection configuration
- Configuration for inrush current level setting
- Compatible with STM32 Nucleo development boards
- Equipped with Arduino® UNO R3 connectors
- RoHS and China RoHS compliant
- CE certified

### Product summary

|                                                                                                     |                                       |
|-----------------------------------------------------------------------------------------------------|---------------------------------------|
| Industrial digital output expansion board based on IPS1050LQ for STM32 Nucleo                       | <b>X-NUCLEO-DOL10A1</b>               |
| Single low-side intelligent power switch                                                            | <b>IPS1050LQ</b>                      |
| STM32 Nucleo-64 development board with STM32F401RE MCU, supports Arduino and ST morpho connectivity | <b>NUCLEO-F401RE</b>                  |
| STM32 Nucleo-64 development board with STM32G431RB MCU, supports Arduino and ST morpho connectivity | <b>NUCLEO-G431RB</b>                  |
| Applications                                                                                        | <b>Programmable Logic Controllers</b> |

### Description

The **X-NUCLEO-DOL10A1** industrial digital output expansion board for STM32 Nucleo provides a powerful and flexible environment for the evaluation of the driving and diagnostic capabilities of the **IPS1050LQ** single low-side smart power solid state relay, with configurable smart overload protection.

The **X-NUCLEO-DOL10A1** expansion board interfaces with the microcontroller on the STM32 Nucleo via **STISO620** and Arduino®R3 connectors. The expansion board can be connected to either a **NUCLEO-F401RE** or a **NUCLEO-G431RB** development board.

The digital isolators **STISO620** (featuring 2.8 kV<sub>RMS</sub> galvanic isolation) and the isolated dc-dc DC1 (featuring 3 kVDC isolation) protects the logic side from the typical harsh environment on the process side.

The logic side is the application side where the MCU operates and it is supplied by the VISO\_L rail (3.3 V or 5.0 V, according to setting of SW7). The on-board Arduino® UNO R3 connectors enable the connection to either a **NUCLEO-F401RE** or a **NUCLEO-G431RB** development board.

When the **X-NUCLEO-DOL10A1** is stacked on a **NUCLEO-F401RE**, or on a **NUCLEO-G431RB**, the **VISO\_L** is supplied by the Nucleo board if connected to a PC/Laptop by USB cable. If the **X-NUCLEO-DOL10A1** is used standalone, then **VISO\_L** can be supplied by the **CN6[4]** (**SW7** = close 1-2) or **CN6[5]** (**SW7** = close 2-3).

The process side is the application side beyond the galvanic isolation barrier. On the process side there are three supply rails: the **5V\_P** (5.0 V) and **10V\_P** (10.0 V) both from **DC1**, and the **6V** rail (derived from **V\_FIELD\_RP** line through **LDO40LPUR**).

The **5V\_P** and **10V\_P** rails can be enabled by **JP4** = close. The **6V** rail can be enabled by **JP5** = close.

The **SW11** defines the supply rail of **U1**: by default from **6V** rail (**SW11** = close 2-3), or alternatively from **10V\_P** rail (**SW11** = close 1-2).

The **SW12** defines the pull-up rail of the open drain diagnostic signals: by default from **6V** rail (**SW12** = close 2-3), or alternatively from **5V\_P** rail (**SW12** = close 1-2).

The **V\_FIELD\_RP** rail (from **CN1** connector) is protected both from reverse polarity on **CN1** (by the **STPS1H100A**, provided that **J1** remains open) and against surge pulse (by **SM15T39CA** (**U2**), provided that **J2** is set closed).

The load is connected between the **CN1[2]** connector and the process side supply rail (typically 24 V) on **CN1[1]**.

The reference rail (ground) of the process side power supply rail must be connected to **CN1[3]**.

The **SW13** allows the selection or not of the external TVS that can be used for the demagnetization of the inductive load and for sustaining the surge pulse on the output stage.

The low side power switch integrated in **U1** can be activated/deactivated by the control signals **IN\_L**: by default, this signal is controlled by **CN5[2]** through **SW1[1-2]**.

The on board green LED **D5** can be enabled by closing **J3**: this is driven ON/OFF according to the status (active/inactive) of the low side power switch (**OUT**) integrated in the **U1**.

The diagnostic signal **OVT\_L** (over-temperature) is available on **CN9[6]** (**SW6** = close 1-2) or **CN5[4]** (**SW6** = close 2-3).

Smart overload protection can be configured through the inrush current level setting as follows:

- Configuration for inrush current level setting through **IPD<sub>x</sub>** digital signals (MCU): **SW8** = close 2-3, **SW9** = close 2-3, **SW10** = close 2-3
- Configuration for inrush current level static setting through the digital signal driving the output channel (**IN\_L**): **SW8** = close 1-2 (for H level **J14** = close, for L level **J13** = close), **SW9** = close 1-2 (for H level **J19** = close, for L level **J18** = close), **SW10** = close 1-2 (for H level **J24** = close, for L level **J23** = close)
- Configuration for inrush current level dynamic setting through the digital signal driving the output channel (**IN\_L**): **SW8** = close 1-2, **J14** = close and **J10**, **J11**, **J12** setting for the proper capacitance selection, **SW9** = close 1-2, **J19** = close and **J15**, **J16**, **J17** setting for the proper capacitance selection, **SW10** = close 1-2, **J24** = close and **J20**, **J21**, **J22** setting for the proper capacitance selection

The switches **SW1**, **SW2**, **SW3**, **SW4**, **SW6** offer to the user some flexibility for the remapping of the driving signals **IN\_L**, **IPD1\_L**, **IPD2\_L**, **IPD3\_L** and **OVT\_L** on **CN5**, **CN8** and **CN9** (see [Section 1: Schematic diagrams](#) for further details).

It is also possible to evaluate a system composed of a **X-NUCLEO-DOL10A1** stacked on other expansion boards.



## X-NUCLEO-DOL10A1

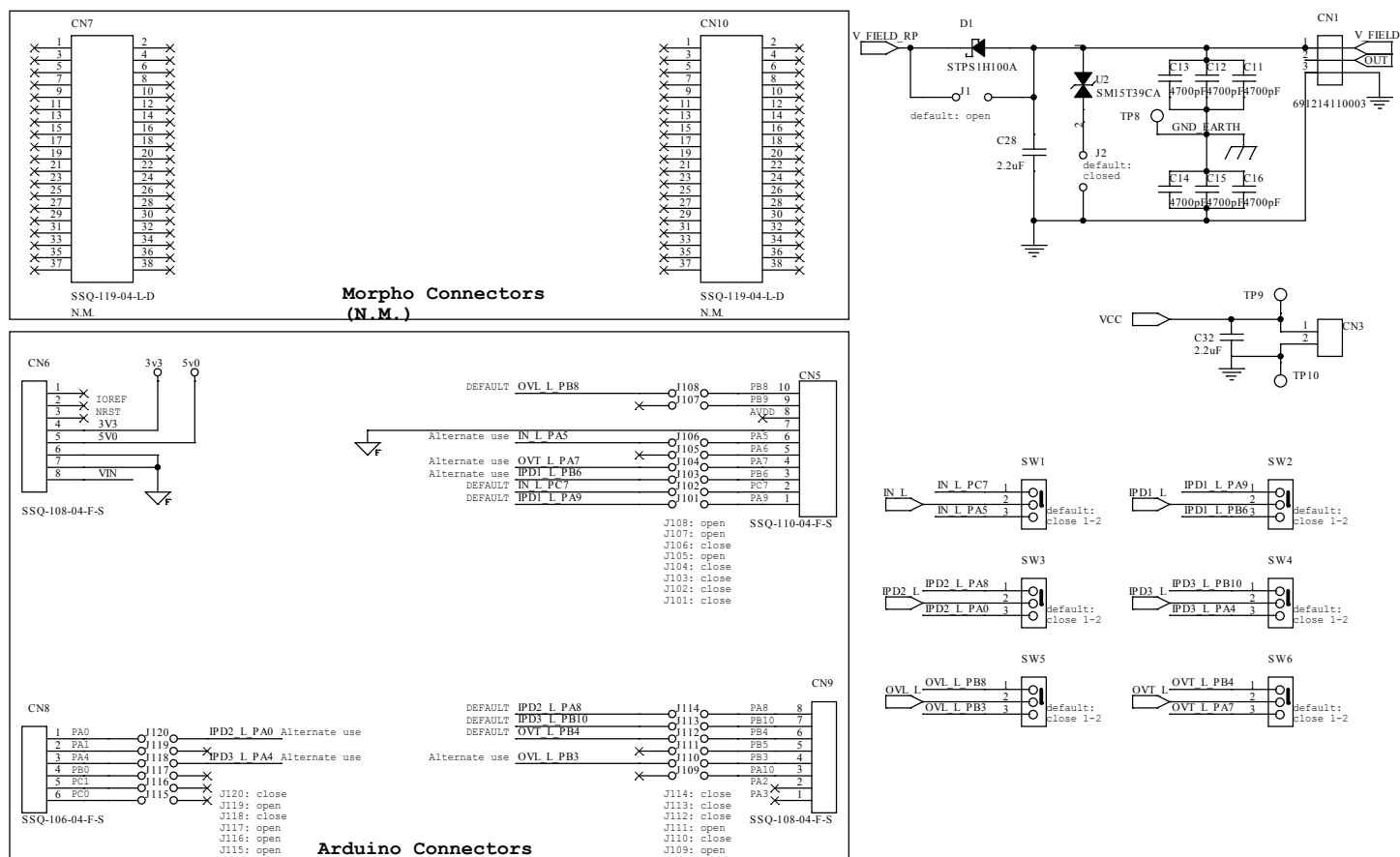
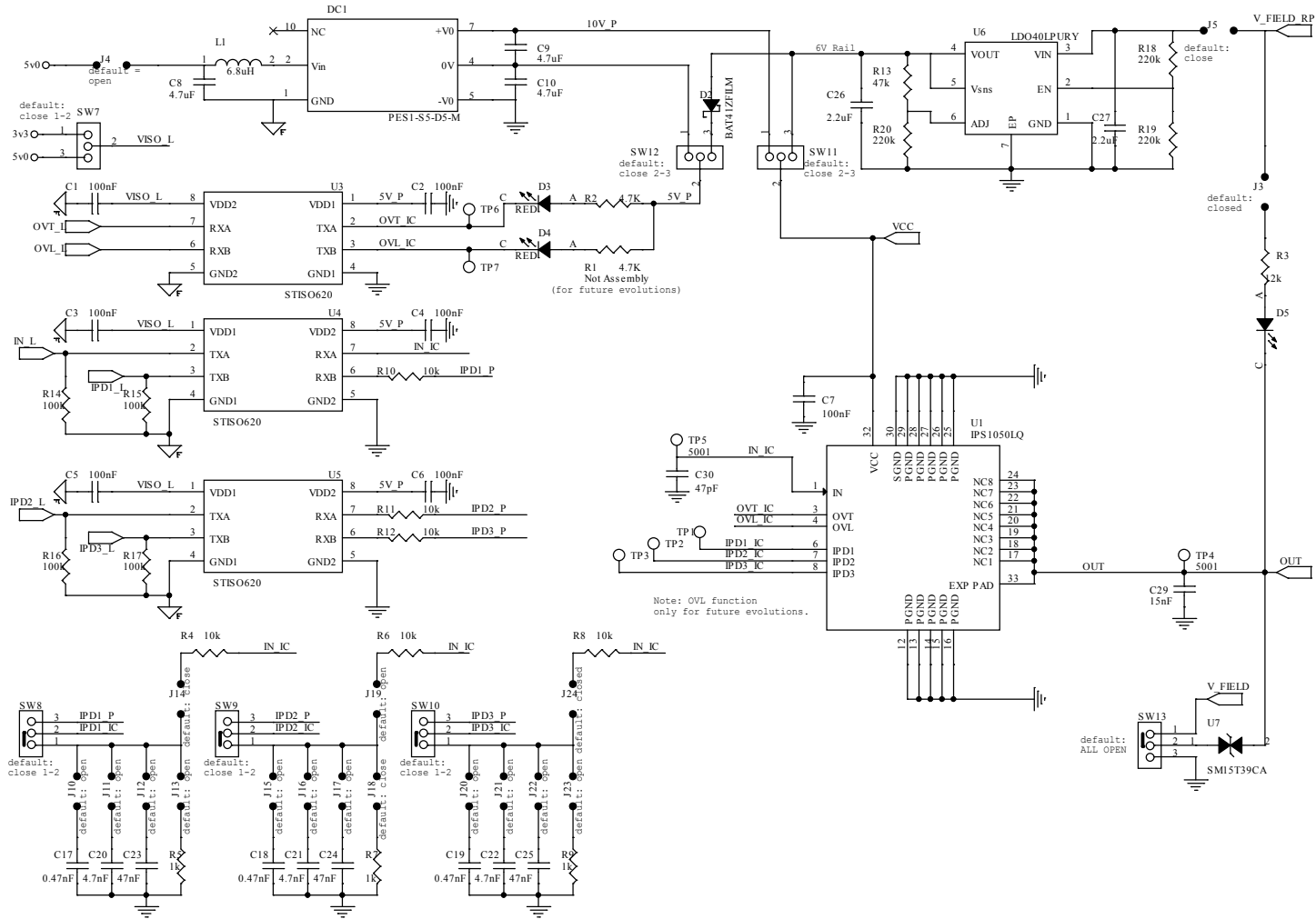


Figure 2. X-NUCLEO-DOL10A1 circuit schematic (2 of 2)



## 2 Board versions

**Table 1. X-NUCLEO-DOL10A1 versions**

| PCB version                 | Schematic diagrams                              | Bill of materials                              |
|-----------------------------|-------------------------------------------------|------------------------------------------------|
| XN\$DOL10A1A <sup>(1)</sup> | <a href="#">XN\$DOL10A1A schematic diagrams</a> | <a href="#">XN\$DOL10A1A bill of materials</a> |

1. This code identifies the X-NUCLEO-DOL10A1 evaluation board first version. It is printed on the board PCB.

## Revision history

Table 2. Document revision history

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 04-Sep-2025 | 1        | Initial release. |

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