

### Getting started with the X-NUCLEO-IHM12A1 low voltage dual brush DC motor driver expansion based on STSPIN240 for STM32 Nucleo

## Introduction

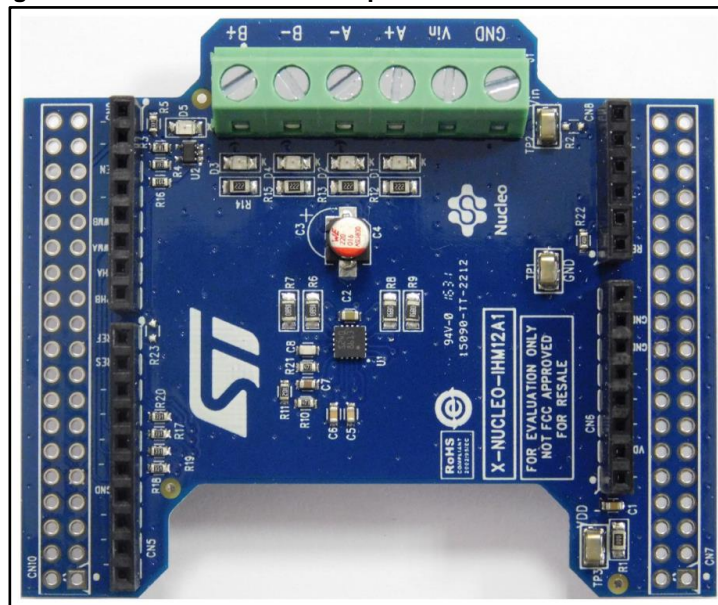
The X-NUCLEO-IHM12A1 is a low voltage dual brush DC motor driver expansion board based on the STSPIN240 for STM32 Nucleo.

It provides an affordable and easy-to-use solution for the implementation of portable motor driving applications such as thermal printers, robotics and toys.

Thanks to its programmable current limiter and complete set of protection features, it offers high levels of performance and robustness.

The X-NUCLEO-IHM12A1 is compatible with the Arduino UNO R3 connector and most STM32 Nucleo boards.

Figure 1: X-NUCLEO-IHM12A1 expansion board for STM32 Nucleo



---

## Contents

<b>1</b>	<b>Hardware and software requirements.....</b>	<b>5</b>
<b>2</b>	<b>Getting started.....</b>	<b>6</b>
<b>3</b>	<b>Hardware description and configuration.....</b>	<b>7</b>
	3.1    Selecting the STM32 Nucleo board.....	8
	3.2    Selecting reference voltage.....	8
<b>4</b>	<b>Bill of materials.....</b>	<b>10</b>
<b>5</b>	<b>Schematic diagram.....</b>	<b>12</b>
<b>6</b>	<b>Revision history .....</b>	<b>13</b>

## List of tables

Table 1: Arduino UNO R3 connector table .....	7
Table 2: ST morpho connector table .....	8
Table 3: J1 connector, switches and test points .....	8
Table 4: Reference voltage selection .....	9
Table 5: Document revision history .....	13

---

## List of figures

Figure 1: X-NUCLEO-IHM12A1 expansion board for STM32 Nucleo.....	1
Figure 2: X-NUCLEO-IHM02A1 switch and connectors positions.....	7
Figure 3: X-NUCLEO-IHM12A1 circuit schematic.....	12

# 1 Hardware and software requirements

The main features of the X-NUCLEO-IHM12A1 expansion board are:

- Low voltage range from 1.8 V to 10 V
- Current up to 1.3 A r.m.s
- Current control with adjustable off-time
- Full protection overcurrent and short-circuit protection
- Low  $R_{DS(ON)}$  power stage (HS + LS = 0.4  $\Omega$  typ.)
- Thermal shutdown
- Compatible with Arduino UNO R3 connector
- Compatible with STM32 Nucleo boards
- Connection for two independent DC motors
- RoHS compliant

To use the STM32 Nucleo development boards with the X-NUCLEO-IHM12A1 expansion board, the following software and hardware specifications are required:

- an STM32 Nucleo development board (NUCLEO-F401RE, NUCLEO-F334R8, NUCLEO-F030R8 or NUCLEO-L053R8)
- an X-NUCLEO-IHM12A1 expansion board
- the X-CUBE-SPN12 software package (available on [www.st.com](http://www.st.com))
- a PC/Laptop with Microsoft Windows (7 and above) to install the software package (X-CUBE-SPN12)
- a type A USB to mini-B USB cable to connect the STM32 Nucleo board to the PC/Laptop
- an IDE chosen from among IAR Embedded Workbench for ARM (EWARM), Keil microcontroller development kit (MDK-ARM) and system workbench for STM32 Nucleo project
- up to two dual brush DC motors with compatible voltage and current ratings for the STSPIN240 driver
- an external power supply or external battery able to provide the right voltage for the DC motor used.

## 2 Getting started

The X-NUCLEO-IHM12A1 expansion board is a low voltage dual brush DC motor driver covering a wide range of applications.

The maximum ratings of the expansion board are:

- Power stage supply voltage (VS) from 1.8 V to 10 V
- Motor phase current up to 1.3 A rms.

To start your project with the expansion board:

1. Check the jumper position based on your configuration.
2. Connect the X-NUCLEO-IHM12A1 to the STM32 Nucleo board through Arduino UNO R3 Connectors (CN5, CN6, CN8 and CN9).
3. Supply the board through the input 5 (Vin) and 6 (GND) of the connector J1. The D5 (red) LED will turn on.
4. Develop your application using the examples provided with the firmware library (X-CUBE-SPN12).

Visit [www.st.com](http://www.st.com) for supporting material regarding the STSPIN240 Low voltage dual brush DC motor driver and [www.st.com/stm32nucleo](http://www.st.com/stm32nucleo).

### 3 Hardware description and configuration

Figure 2: X-NUCLEO-IHM02A1 switch and connectors positions

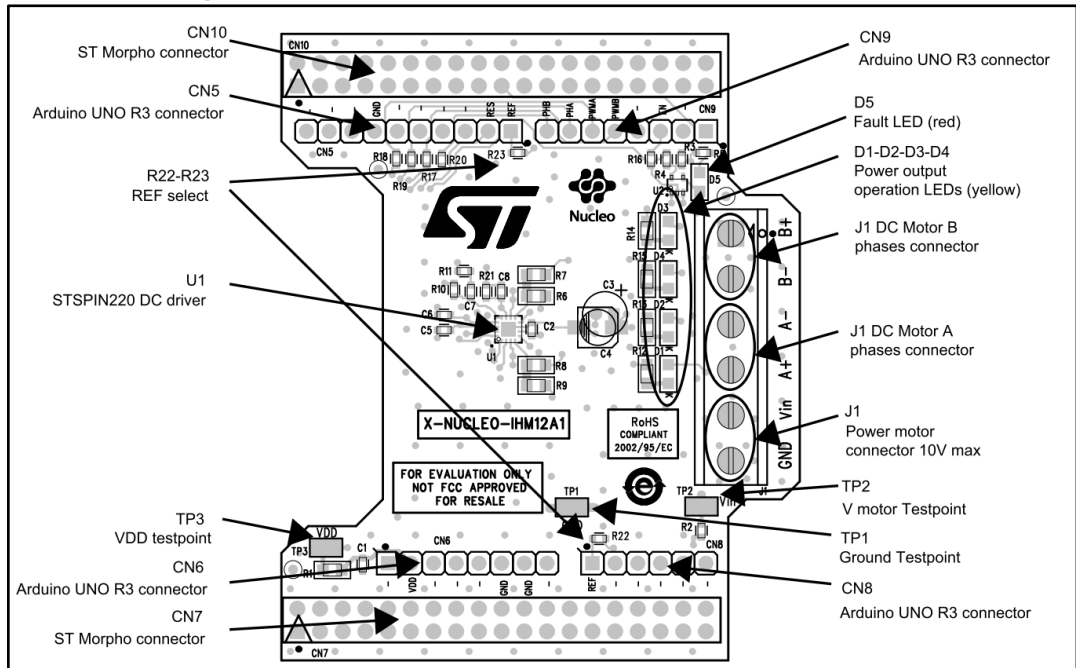


Table 1: Arduino UNO R3 connector table

Connector	Pin <sup>(1)</sup>	Signal	Remarks
CN5	1	REF	See <a href="#">Section 3.2: "Selecting reference voltage"</a>
	2	RESET	
	7	Ground	
CN9	3	ENABLE	
	5	PWMB	
	6	PWMA	
	7	PHA	
CN6	8	PHB	
	2	VDD	
	6	Ground	
CN6	7	Ground	
	7	Ground	
CN5	1	REF	See <a href="#">Section 3.2: "Selecting reference voltage"</a>

**Notes:**

<sup>(1)</sup>All the non-listed pins are not connected

Table 2: ST morpho connector table

Connector	Pin <sup>(1)</sup>	Signal	Remarks
CN10	9	Ground	
	19	RESET	
	21	REF	See <a href="#">Section 3.2: "Selecting reference voltage"</a>
	23	PHB	
	25	PHA	
	27	PWMA	
	29	PWMB	
	33	ENABLE	
CN7	12	VDD	
	20	Ground	
	22	Ground	
	28	REF	See <a href="#">Section 3.2: "Selecting reference voltage"</a>

**Notes:**

<sup>(1)</sup>All the non-listed pins are not connected

Table 3: J1 connector, switches and test points

Name	Pin	Label	Description
J1	5 - 6	Vin - GND	Motor power supply
	1 - 2	B+, B-	Motor B phases connection
	3 - 4	A+, A-	Motor A phases connection
TP1	-	GND	Ground
TP2	-	VIN	Motor power supply
TP3	-	VDD	Digital power supply (by default 3.3 V coming from STM32 Nucleo board)

### 3.1 Selecting the STM32 Nucleo board

The X-NUCLEO-IHM12A1 expansion board offers native support for the following STM32 Nucleo development boards:

- NUCLEO-F401RE
- NUCLEO-F334R8
- NUCLEO-F030R8
- NUCLEO-L053R8

### 3.2 Selecting reference voltage

The reference voltage for the current limiter circuitry of the STSPIN240 can be selected through dedicated resistors shown below.



Table 4: Reference voltage selection

Signal	R22	R23	Connector	Remarks
REF	200 k $\Omega$	Not mounted	CN8 pin1	Default NUCLEO-F401RE or NUCLEO-F334R8 or NUCLEO-L053R8
REF	Not mounted	200 k $\Omega$	CN5 pin1	NUCLEO-F030R8



These signals must be used by all expansion boards stacked on the X-NUCLEO-IHM12A1.

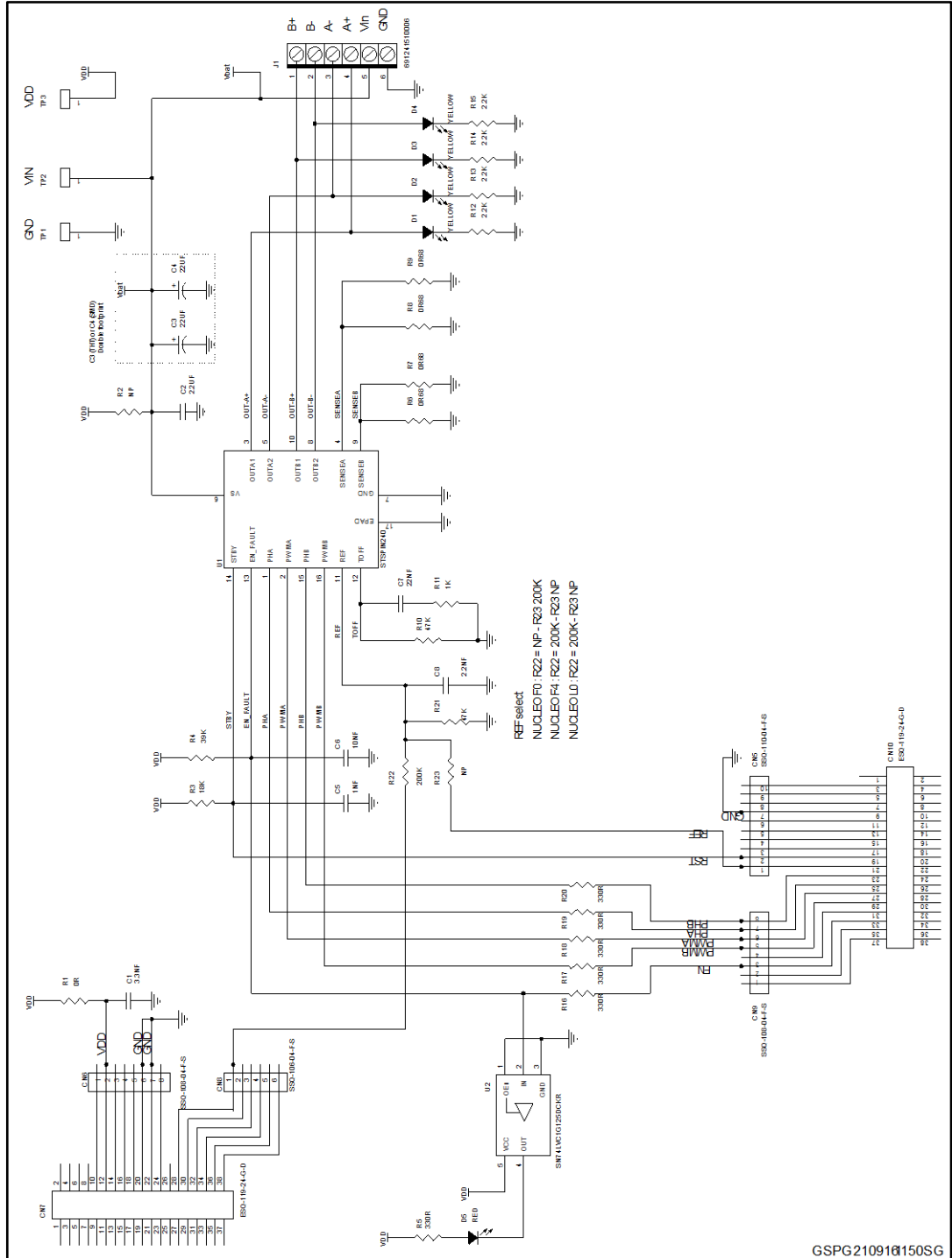
## 4 Bill of materials

Item	Q.ty	Reference	Value	Description	Part number	Manufacturer
1	1	CN5	SSQ-110-04-F-S	HEADER	SSQ-110-04-F-S	SAMTEC
2	2	CN6,CN9	SSQ-108-04-F-S	HEADER	SSQ-108-04-F-S	SAMTEC
3	2	CN7,CN10	NP	HEADER	ESQ-119-24-G-D	SAMTEC
4	1	CN8	SSQ-106-04-F-S	HEADER	SSQ-106-04-F-S	SAMTEC
5	1	C1	3.3nF, 50V, ±15%	CER, 603	3.3NF_50V_X7R_0603	N.A.
6	1	C2	2.2µF, 16V, ±20%	CER, 603	2.2UF_16V_X5R_0603	N.A.
7	1	C3	NP, 16V, ±20%	ALU, D5_H11_P2	860010372002	WURTH ELECTRONIK
8	1	C4	22µF, 16V, ±20%	ALU, L4.5_W4.5	865080340003	WURTH ELECTRONIK
9	1	C5	1nF, 50V, ±15%	CER, 603	1NF_50V_X5R_0603	N.A.
10	1	C6	10nF, 50V, ±15%	CER, 603	10NF_50V_X7R_0603	N.A.
11	1	C7	22nF, 50V, ±5%	CER, 603	22NF_50V_X7R_0603	N.A.
12	1	C8	2.2nF, 50V, ±15%	CER, 603	2.2NF_50V_X7R_0603	N.A.
13	4	D1,D2,D3,D4	YELLOW	LED, 805	150080YS75000	WURTH ELEKTRONIK
14	1	D5	RED	LED, 805	150080RS75000	WURTH ELEKTRONIK
15	1	J1	691241510006	SCREW	691241510006	WURTH ELEKTRONIK
16	3	M1,M2,M3	OPTICAL_TARGET	OPTICAL_TARGET	OPTICAL_TARGET	N.A.
17	1	R1	0R, 1/8W, ±5%	RES, 805	0R_5%_0805	N.A.
18	2	R2,R23	NP	RES, 603	R_NP_0603	N.A.
19	1	R3	18kΩ, 1/10W, ±5%	RES, 603	18K_5%_0603	N.A.
20	1	R4	39kΩ, 1/10W, ±5%	RES, 603	39K_5%_0603	N.A.
21	6	R5,R16,R17,R18,R19,R20	330Ω, 1/10W, ±5%	RES, 603	330R_5%_0603	N.A.
22	4	R6,R7,R8,R9	0R68, 1/3W, ±1%	RES, 805	0R68_1%_0805_0.33W	N.A.

Item	Q.ty	Reference	Value	Description	Part number	Manufacturer
23	2	R10,R21	47k $\Omega$ , 1/10W, $\pm$ 5%	RES, 603	47K_5%_0603	N.A.
24	1	R11	1k $\Omega$ , 1/10W, $\pm$ 5%	RES, 603	1K_5%_0603	N.A.
25	4	R12,R13,R14,R15	2.2k $\Omega$ , 1/8W, $\pm$ 5%	RES, 805	2.2K_5%_0805	N.A.
26	1	R22	200k $\Omega$ , 1/10W, $\pm$ 1%	RES, 603	200K_1%_0603	N.A.
27	3	TP1,TP2,TP3	S1751-46R	TEST POINT	S1751-46R	HARWIN
28	1	U1	STSPIN240	DRIVER, QFN16	STSPIN240	ST
29	1	U2	SN74LVC1G1 25DCKR	LOGIC, SOT353	SN74LVC1G125DCKR	TI

# 5 Schematic diagram

Figure 3: X-NUCLEO-IHM12A1 circuit schematic



## 6 Revision history

Table 5: Document revision history

Date	Version	Changes
04-Oct-2016	1	Initial release.

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2016 STMicroelectronics – All rights reserved