

### Getting started with the X-NUCLEO-IHM13A1 low voltage dual brush DC motor driver expansion based on STSPIN250 for STM32 Nucleo

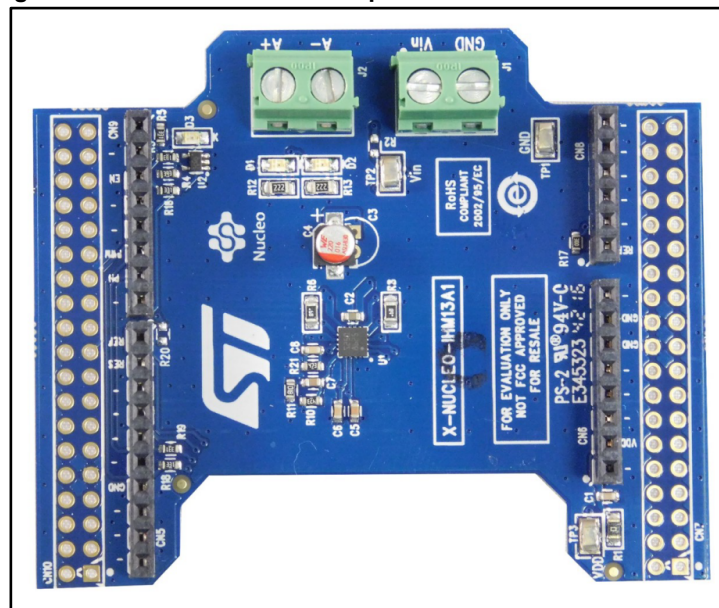
## Introduction

The X-NUCLEO-IHM13A1 is a low voltage brush DC motor driver expansion board based on the STSPIN250 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.

The X-NUCLEO-IHM13A1 is compatible with the Arduino UNO R3 connector and most STM32 Nucleo boards.

Figure 1: X-NUCLEO-IHM13A1 expansion board for STM32 Nucleo



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# 1 Hardware and software requirements

The main features of the X-NUCLEO-IHM13A1 expansion board are:

- Low voltage range from 1.8 V to 10 V
- Current up to 2.6 A r.m.s.
- Current control with adjustable off-time
- Full protection overcurrent and short circuit protection
- Thermal shutdown
- Compatible with Arduino UNO R3 connector
- Compatible with STM32 Nucleo boards
- RoHS compliant

To use the STM32 Nucleo development boards with the X-NUCLEO-IHM13A1 expansion board, the following software and hardware specifications are required:

- a PC/Laptop with Microsoft Windows (7 and above) to install the software package (X-CUBE-SPN13)
- an X-NUCLEO-IHM13A1 expansion board
- an STM32 Nucleo development board (NUCLEO-F401RE, NUCLEO-F334R8, NUCLEO-F030R8 or NUCLEO-L053R8)
- a type A USB to mini-B USB cable to connect the STM32 Nucleo board to the PC/Laptop
- the X-CUBE-SPN13 software package (available on [www.st.com](http://www.st.com))
- an IDE chosen from among IAR Embedded Workbench for ARM (EWARM), Keil microcontroller development kit (MDK-ARM) and system workbench for STM32 Nucleo project
- a DC motor with compatible voltage and current ratings for the STSPIN250 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-IHM13A1 expansion board is a 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 to 10 V
- Motor phase current up to 2.6 A rms.

To start your project with the expansion board:

1. Check the jumper position based on your configuration (see [Section 3.2: "Selecting reference voltage"](#)).
2. Connect the X-NUCLEO-IHM13A1 to the STM32 Nucleo board through Arduino UNO R3 Connectors (CN5, CN6, CN8 and CN9).
3. Supply the board through the input 1 (Vin) and 2 (GND) of the connector J1. The D3 (red) LED will turn on.
4. Develop your application using the examples provided with the firmware library (X-CUBE-SPN13).

Visit [www.st.com](http://www.st.com) for supporting material regarding the STSPIN250 DC motor driver and STM32 Nucleo web pages ([www.st.com/stm32nucleo](http://www.st.com/stm32nucleo)).

### 3 Hardware description and configuration

Figure 2: X-NUCLEO-IHM13A1 switch and connector positions

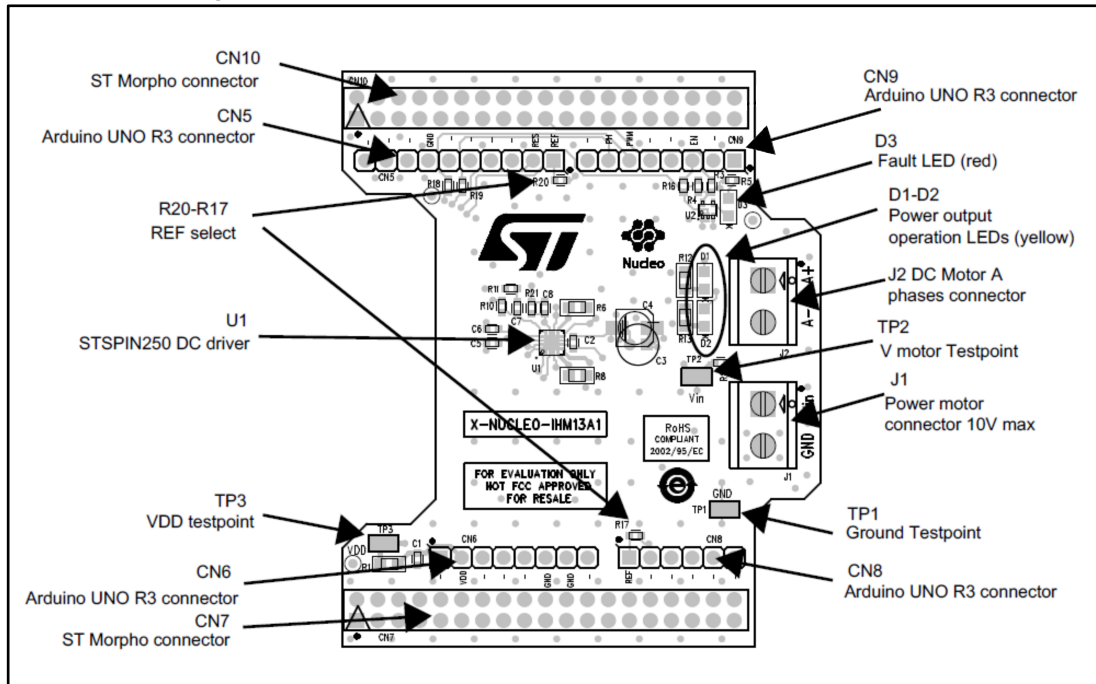


Table 1: Arduino UNO R3 connector table

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	
	6	PWM	
	7	PH	
CN6	2	VDD	
	6	Ground	
	7	Ground	
CN8	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	

Connector	Pin <sup>(1)</sup>	Signal	Remarks
	21	REF	See <a href="#">Section 3.2: "Selecting reference voltage"</a>
	25	PH	
	27	PWM	
	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	1 - 2	Vin - GND	Motor power supply
J2	1 - 2	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-IHM13A1 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 STSPIN250 can be selected through dedicated resistors shown below.

**Table 4: Reference voltage selection**

Signal	R17	R20	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-IHM13A1.

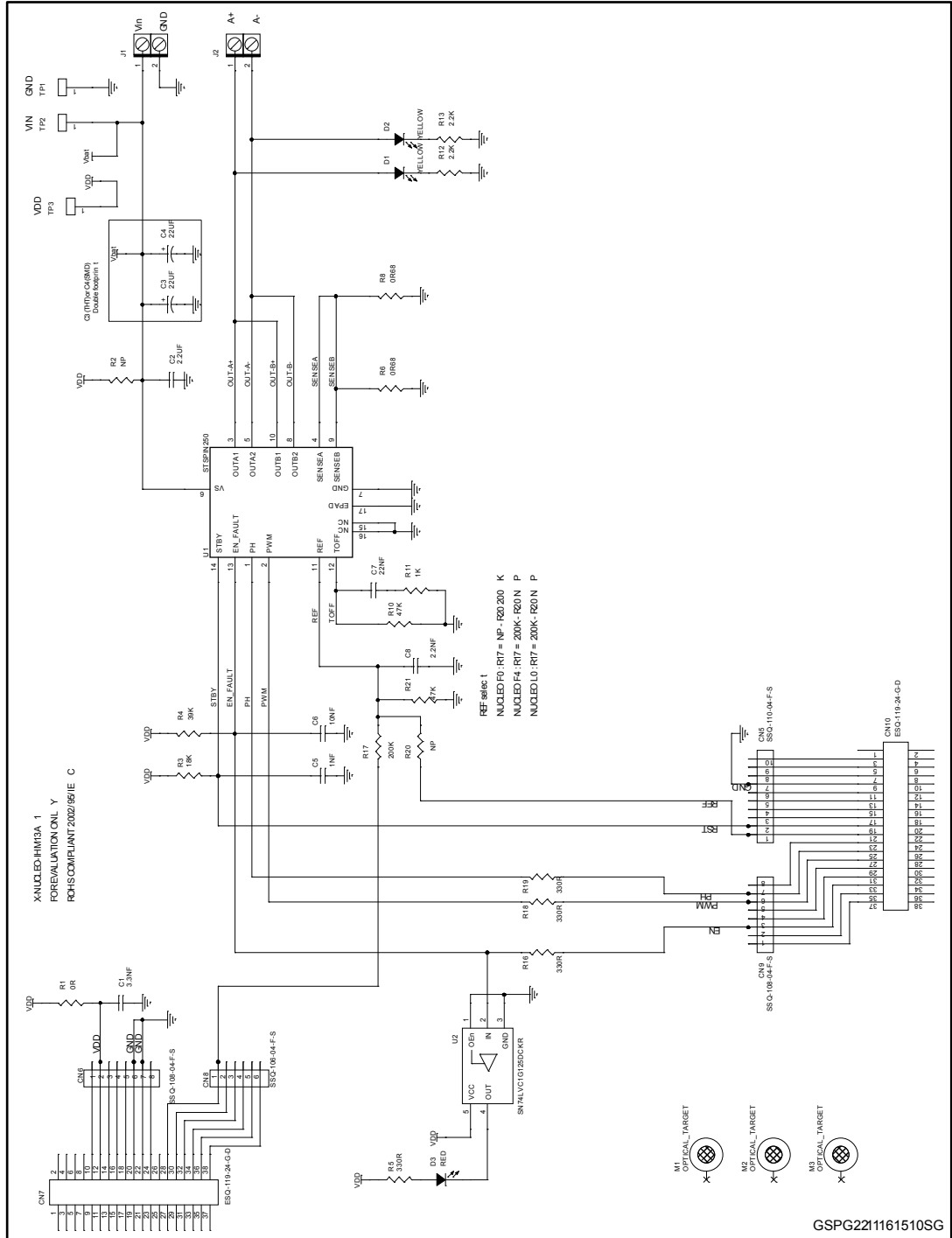
## 4 Bill of materials

Item	Q.ty	Reference	Value	Description	Manufacturer	Part number
1	1	CN5	SSQ-110-04-F-S	HEADER	SAMTEC	SSQ-110-04-F-S
2	2	CN6, CN9	SSQ-108-04-F-S	HEADER	SAMTEC	SSQ-108-04-F-S
3	2	CN7, CN10	NP	HEADER	SAMTEC	ESQ-119-24-G-D
4	1	CN8	SSQ-106-04-F-S	HEADER	SAMTEC	SSQ-106-04-F-S
5	1	C1	3.3 nF, 50 V, $\pm 15\%$	CER, 603	N.A.	3.3NF_50V_X7R_0603
6	1	C2	2.2 $\mu$ F, 16 V, $\pm 20\%$	CER, 603	N.A.	2.2UF_16V_X5R_0603
7	1	C3	NP, 16 V, $\pm 20\%$	ALU, D5_H11_P2	WURTH ELECTRONIK	860010372002
8	1	C4	22 $\mu$ F, 16 V, $\pm 20\%$	ALU, L4.5_W4.5	WURTH ELECTRONIK	865080340003
9	1	C5	1nF, 50 V, $\pm 15\%$	CER, 603	N.A.	1NF_50V_X5R_0603
10	1	C6	10 nF, 50 V, $\pm 15\%$	CER, 603	N.A.	10NF_50V_X7R_0603
11	1	C7	22 nF, 50 V, $\pm 5\%$	CER, 603	N.A.	22NF_50V_X7R_0603
12	1	C8	2.2 nF, 50 V, $\pm 15\%$	CER, 603	N.A.	2.2NF_50V_X7R_0603
13	2	D1, D2	YELLOW	LED, 805	WURTH ELEKTRONIK	150080YS75000
14	1	D3	RED	LED, 805	WURTH ELEKTRONIK	150080RS75000
15	2	J1, J2	6912135100 02	SCREW	WURTH ELEKTRONIK	691213510002
16	3	M1, M2, M3	OPTICAL_ TARGET	OPTICAL_TA RGET	N.A.	OPTICAL_TARGET
17	1	R1	0R, 1/8 W, $\pm 5\%$	RES, 805	N.A.	0R_5%_0805
18	2	R2, R20	NP	RES, 603	N.A.	R_NP_0603
19	1	R3	18 k $\Omega$ , 1/10 W, $\pm 5\%$	RES, 603	N.A.	18K_5%_0603
20	1	R4	39 k $\Omega$ , 1/10 W, $\pm 5\%$	RES, 603	N.A.	39K_5%_0603
21	4	R5, R16, R18, R19	330 R, 1/10W, $\pm 5\%$	RES, 603	N.A.	330R_5%_0603

Item	Q.ty	Reference	Value	Description	Manufacturer	Part number
22	2	R6, R8	0R68, 1/3 W, $\pm 1\%$	RES, 805	N.A.	0R68_1%_0805_0.33W
23	2	R10, R21	47 k $\Omega$ , 1/10 W, $\pm 5\%$	RES, 603	N.A.	47K_5%_0603
24	1	R11	1 k $\Omega$ , 1/10 W, $\pm 5\%$	RES, 603	N.A.	1K_5%_0603
25	4	R12, R13	2.2 k $\Omega$ , 1/8 W, $\pm 5\%$	RES, 805	N.A.	2.2K_5%_0805
26	1	R17	200 k $\Omega$ , 1/10 W, $\pm 1\%$	RES, 603	N.A.	200K_1%_0603
27	3	TP1, TP2, TP3	S1751-46R	TEST POINT	HARWIN	S1751-46R
28	1	U1	STSPIN250	DRIVER, QFN16	STMICROELEC TRONICS	STSPIN250
29	1	U2	SN74LVC1 G125DCKR	LOGIC, SOT353	TEXAS INSTRUMENTS	SN74LVC1G125DCKR

# 5 Schematic diagram

Figure 3: X-NUCLEO-IHM13A1 circuit schematic



## 6 Revision history

Table 5: Document revision history

Date	Version	Changes
01-Dec-2016	1	Initial release.

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