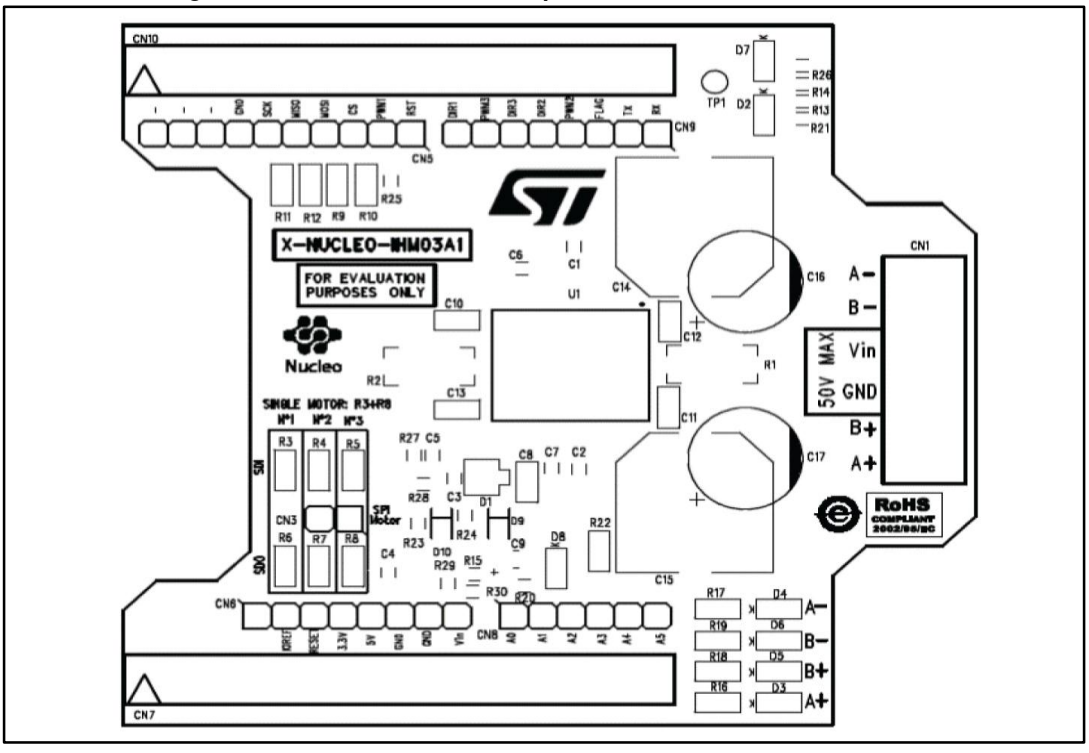
UM1910
User manual

Getting started with the high power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo

Introduction

The X-NUCLEO-IHM03A1 is a high power stepper motor driver expansion board based on the powerSTEP01. It provides an affordable and easy-to-use solution for driving high power bipolar stepper motors in your STM32 Nucleo project. The fully digital motion control through speed profile generation, dynamic positioning feedback and a complete suite of protection features offer high levels of performance and robustness The X-NUCLEO-IHM03A1 is compatible with the Arduino UNO R3 connector and supports the addition of other boards which can be stacked to drive up to three stepper motors with a single STM32 Nucleo board.

Figure 1: X-NUCLEO-IHM03A1 expansion board for STM32 Nucleo



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1 Getting started

The X-NUCLEO-IHM03A1 expansion board is a high power stepper motor driver covering a wide range of applications. In particular, the maximum ratings of the board are the following.

- Power stage supply voltage (VS) from 10.5 V to 50 V
- Motor phase current up to 10 A r.m.s.

Follow this sequence to start your project with the board:

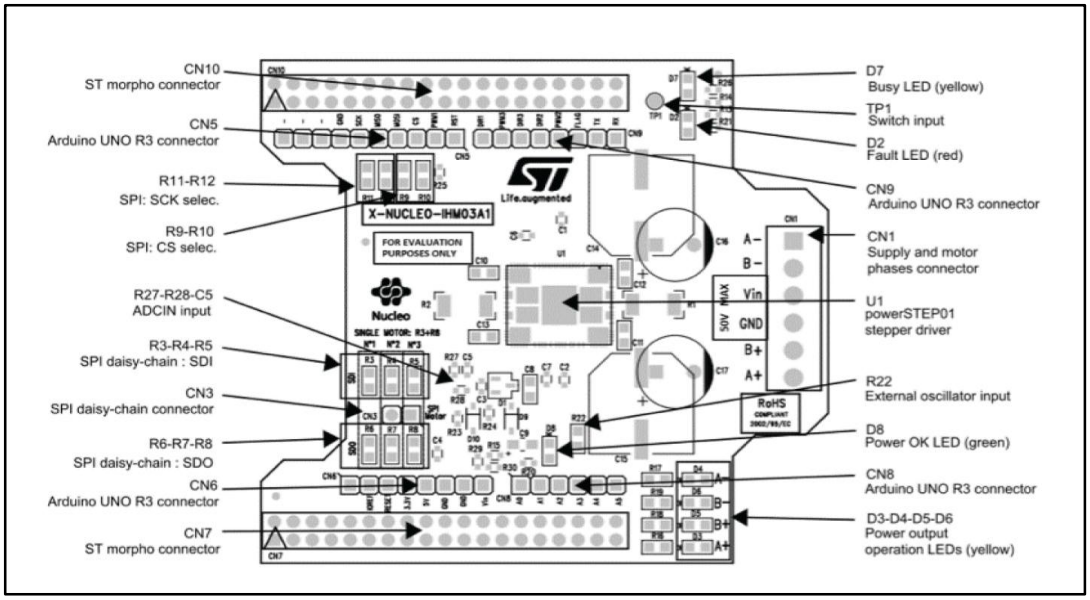
1. Check the jumper position based on your configuration (see *Section 2: "Hardware description and configuration"*).
2. Plug the board to the STM32 Nucleo board through Arduino UNO R3 for the X-NUCLEO-IHM03A1.
3. Supply the board through the input 1 (VS) and 2 (ground) of the connector CN1. The power OK (green) and fault (red) LEDs will turn on.
4. Develop your application using the examples provided with the firmware library, X-CUBE-SPN3, high power stepper motor driver software expansion for STM32Cube. Further support material is available on the powerSTEP01 (www.st.com/powerstep) and STM32 Nucleo web pages (www.st.com/stm32nucleo).

Up to three expansion boards can be stacked on the same STM32 Nucleo board as described in *Section 2.2: "Multi-motor configuration"*.

2 Hardware description and configuration

Figure 2: "Jumper and connector positions" shows the position of the connectors and the configuration jumpers of the board.

Figure 2: Jumper and connector positions



Below are the pinout details for the Arduino UNO R3 and the ST Morpho connectors.

Table 1: Arduino UNO R3 connector table

Connector	Pin [(1)]	Signal	Remarks
CN5	1	powerSTEP RESET	
	2	Step clock input	
	3	SPI CS	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*
	4	SPI MOSI	See *Section 2.2: "Multi-motor configuration"*
	5	SPI MISO	See *Section 2.2: "Multi-motor configuration"*
	6	SPI SCK	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*
	7	Ground	
CN9	3	FLAG	
	4	SPI SCK	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*

Connector	Pin [1]	Signal	Remarks
	5	BUSY / SYNC	
CN6	2	VDD	
	6	Ground	
	7	Ground	
CN8	1	VDD	
	3	Ground	

Notes:

[1]All the unlisted pins are not connected.

Table 2: ST Morpho connector table

Connector	Pin [1]	Signal	Remarks
CN10	9	Ground	
	11	SPI SCK	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*
	13	SPI MISO	See *Section 2.2: "Multi-motor configuration"*
	15	SPI MOSI	See *Section 2.2: "Multi-motor configuration"*
	17	SPI CS	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*
	19	Step clock input	
	21	powerSTEP RESET	
	29	BUSY/SYNC	
	31	SPI CK	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*
	33	FLAG	
CN7	12	VDD	
	20	Ground	
	22	Ground	
	28	ID	
	32	SPI CS	See *Section 2.1: "Selecting the chip select and clock lines of the SPI"*

Notes:

[1]All the unlisted pins are not connected.

2.1 Selecting the chip select and clock lines of the SPI

The chip select and the clock lines of the SPI interface can be selected via the appropriate resistors indicated in *Table 3: "Chip select line selection"* and *Table 4: "Clock line selection"*.

Table 3: Chip select line selection

R9	R10	CS line
Not mounted	0 Ω	CN5 pin3, CN10 pin 17 (default)
0 Ω	Not mounted	CN8 pin 3, CN7 pin 32

Table 4: Clock line selection

R11	R12	SCK line
0 Ω	Not mounted	CN5 pin6, CN10 pin 9 (default)
Not mounted	0 Ω	CN9 pin 4, CN10 pin 31

2.2 Multi-motor configuration

The expansion boards can be stacked on a single STM32 Nucleo board in order to drive up to the three stepper motors (one expansion board for each motor is required).

The configuration is changed by mounting the resistors from R3 to R8 as listed in *Table 5: "Multi-motor setup table"*.

The other resistors are not mounted.

By default, the stepper driver board is configured for a single-motor setup, so the board configuration must be changed in multi-motor setups before stacking the boards on the STM32 Nucleo.

Table 5: Multi-motor setup table

Number of motors	Of Board	Mounted resistors
1	-	R3 – R8
2	1 (bottom)	R3 – R6
	2 (top)	R4 – R8
3	1 (bottom)	R3 – R6
	2	R4 – R7
	3 (top)	R5 – R8

Figure 3: Schematic diagram

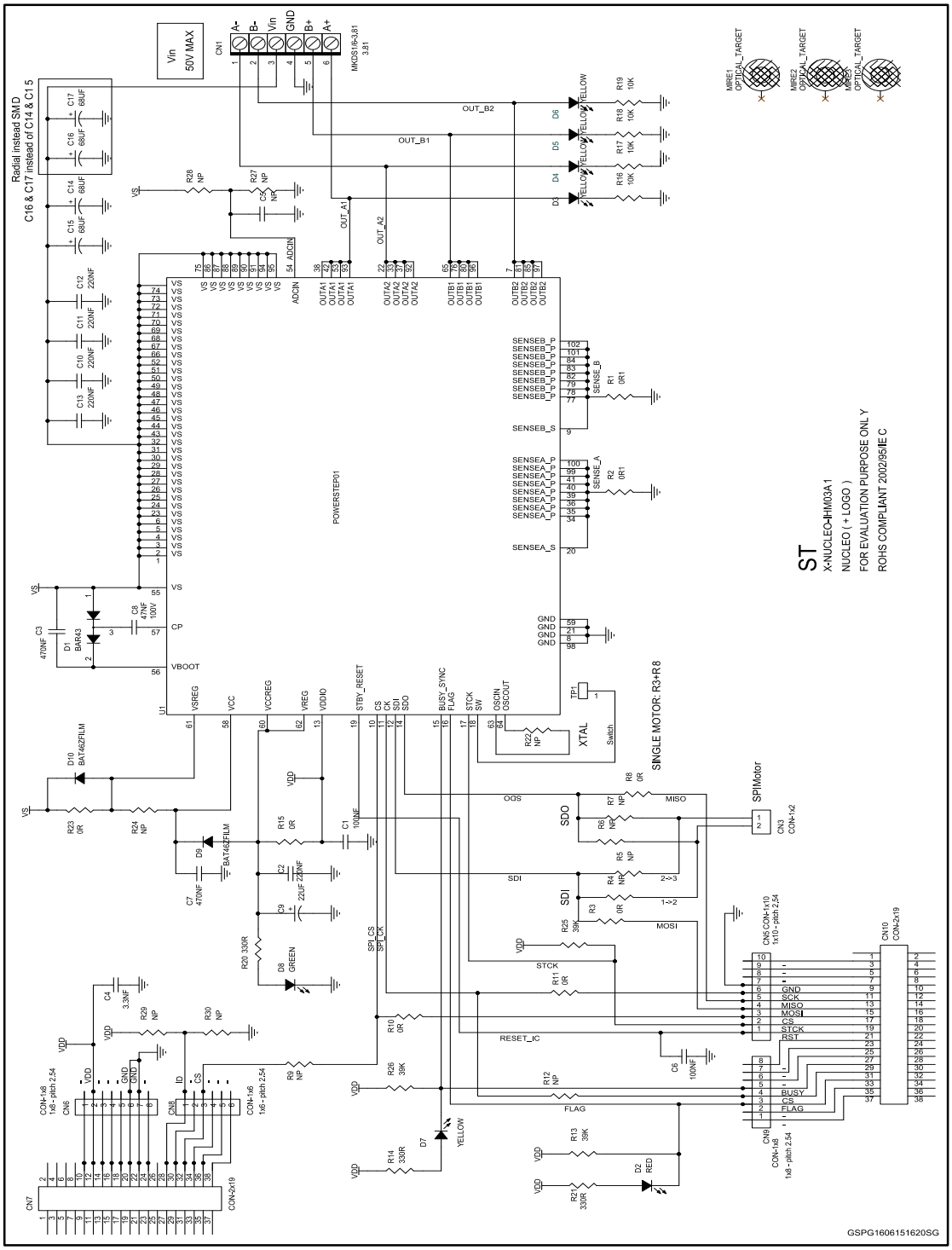


Table 6: BOM list (Part 1)

Item	Reference	Value	Q.ty	Description	Part number
1	C1 C6	100NF	2	CAP CER 100nF 50V X7R 0603	100NF_50V_X7R_0603

Item	Reference	Value	Q.ty	Description	Part number
2	C2	220NF	1	CAP CER 220nF 35V X7R 0603	220NF_35V_X7R_0603
3	C3 C7	470NF	2	CAP CER 470nF 25V X7R 0603	470NF_25V_X7R_0603
4	C4	3.3NF	1	CAP CER 3.3nF 50V X7R 0603	3.3NF_50V_X7R_0603
5	C5	NP	1	CAP NP 0603	C_NP_0603
6	C8	47NF	1	CAP CER 47nF 100V X7R/X7S 0805	47NF_100V_X7R/X7S_0805
7	C9	22UF	1	CAP TANT 22uF 6V3 10% PACK-A	22UF_6V3_TANT_PACK-A
8	C10-C13	220NF	4	CAP CER 220nF 100V X7R 0805	220NF_100V_X7R_0805
9	C14 C15	68UF	2	CAP ALU 68uF 100V SMD 17x17	EEV-FK2A680Q
10	C16 C17	NP	2	CAP ALU 68uF 100V Radial 10x6-P5	UHE2A680MPD
11	CN1	MKDS1/6-3.81	1	Screw connector 6 poles MKDS 1/6-3.81	MKDS1/6-3.81
12	CN3	CON-1x2	1	THOUGH-HOLE-1x2-Pin height 14.8 - Body 8.5mn - pitch 2.54	SSQ-102-04-F-S
13	CN5	CON-1x10	1	THOUGH-HOLE-1x10-Pin height 14.8 - Body 8.5mn - pitch 2.54	SSQ-110-04-F-S
14	CN6 CN9	CON-1x8	2	THOUGH-HOLE-1x8-Pin height 14.8 - Body 8.5mn - pitch 2.54	SSQ-108-04-F-S
15	CN7 CN10	CON-2x19	2	THOUGH-HOLE-2x19-Pin height 14.8 - Body 8.5mn - pitch 2.54	SSQ-119-04-L-D
16	CN8	CON-1x6	1	THOUGH-HOLE-1x6-Pin height 14.8 - Body 8.5mn - pitch 2.54	SSQ-106-04-F-S
17	D1	BAR43	1	Double Diode High Speed Switching Diode	BAR43
18	D2	RED	1	LED RED - 0805 -2mcd - 621nm	LED _RED
19	D3-D7	YELLOW	5	LED YELLOW - 0805 - 6mcd - 588nm	LED_YELLOW
20	D8	GREEN	1	LED GREEN - 0805 -6mcd - 569nm	LED_GREEN
21	D9 D10	BAT46ZFILM	2	DIODE SCHOTTKY 150MA	BAT46
22	MIRE1-MIRE3	OPTICAL_TARGET	3	OPTICAL_TARGET	OPTICAL_TARGET

Item	Reference	Value	Q.ty	Description	Part number
23	R1 R2	0R1	2	RES 0.1 OHM 5% 2W 2512	0R1_5%_2512
24	R3 R8 R10 R11	0R	4	RES 0 OHM 5% 1/8W 0805	0R_5%_0805
25	R4-R7 R9 R12 R22	NP	7	RES NP 0805	R_NP_0805
26	R13 R25 R26	39K	3	RES 39K OHM 5% 1/10W 0603	39K_5%_0603
27	R14 R20 R21	330R	3	330R OHM 5% 1/10W	330R_5%_0603
28	R15 R23	0R	2	RES 0 OHM 5% 1/10W 0603	0R_5%_0603
29	R16-R19	10K	4	RES 10K OHM 5% 1/10W 0805 SMD	10K_5%_0805
30	R24 R27-R30	NP	5	RES NP 0603	R_NP_0603
31	TP1	KEYSTONE-5000	1	TEST POINT RED	KEYSTONE 5000
32	U1	POWERSTEP01	1	Fully integrated stepper motor driver	POWERSTEP01

Table 7: BOM list (Part 2)

Item	Manufact.	Manuf. Part number	Distributor	Distributor Part number
1				
2				
3				
4				
5				
6				
7				
8				
9	PANASONIC	EEV-FK2A680Q		
10	NICHICON	UHE2A680MPD		
11	PHOENIX CONTACT	MKDS1/6-3.81	RS	220-4377
12	SAMTEC	SSQ-102-04-F-S		
13	SAMTEC	SSQ-110-04-F-S		
14	SAMTEC	SSQ-108-04-F-S		
15	SAMTEC	SSQ-119-04-L-D		
16	SAMTEC	SSQ-106-04-F-S		
17	STMICROELECTRONICS	BAR43SFILM	RS	714-0470
18	LITE-ON	LTST-C170-EKT	RS	692-0890
19	LITE-ON	LTST-C170-YKT	RS	692-0925
20	LITE-ON	LTST-C170-GKT	RS	692-0900
21	STMICROELECTRONICS	BAT46ZFILM	RS	714-6850

Item	Manufact.	Manuf. Part number	Distributor	Distributor Part number
22				
23				
24				
25				
26				
27				
28				
29				
30				
31	KEYSTONE	KEYSTONE 5000	FARNELL	1463076
32	STMICROELECTRONICS	POWERSTEP01		

3 Revision history

Table 8: Document revision history

Date	Revision	Changes
06-Jul-2015	1	Initial release.

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