

Getting started with the EVLSPIN9P1-3PH



Introduction

The **EVLSPIN9P1-3PH** evaluation board is a three-phase power board based on the STSPIN9P1 system-in-package.

The board supports either a three-shunt or a single-shunt current sensing topology. It supports field-oriented control (FOC) and six-step algorithms, with or without Hall sensors.

The board can be stacked with an X-NUCLEO microcontroller unit (MCU) board through ST Morpho connectors, or driven directly by external pins.

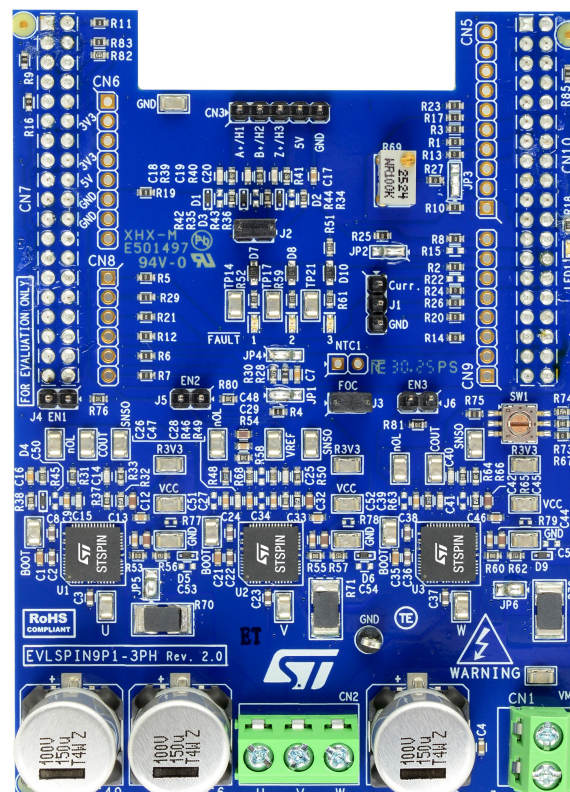
This configuration allows the driving of permanent magnet synchronous motors (PMSMs) and brushless DC (BLDC) motors.

The board includes two power supply domains:

- **VM:** motor power supply, internally used by the device to generate VCC, VBOOT (driver supplies), and REG3V3 (embedded logic). VM must be provided externally through a CN1 connector.
- **VDD (+3.3 V):** logic power supply, provided externally through an ST Morpho CN7 connector.

Debug and configuration of firmware can be performed with standard STM32 tools through an STLINK debugger on the Nucleo control board.

Figure 1. EVLSPIN9P1-3PH evaluation board



1 Main features

The EVLSPIN9P1-3PH evaluation board has the following features:

- Input voltage V_M from 7 V_{DC} to 75 V_{DC}
- Power system-in-package integrating gate drivers and high-current power MOSFETs:
 - $R_{DS(ON)} = 16 \text{ m}\Omega$
 - Max 10 A_{rms} output current
- 100 V / 450 μF bulk capacitor
- Programmable output slew rate
- Integrated comparator for cycle-by-cycle current regulation
- Digital Hall sensors and encoder input for sensed control algorithm
- Back electromotive force (BEMF) detection network for six-step sensorless control algorithm
- Bus voltage sensing
- Open-load detection
- Thermal shutdown, undervoltage lockout (UVLO), and overcurrent protection (V_{DS} monitoring)
- Standby mode
- X-Nucleo form factor with ST Morpho connectors
- RoHS compliant

1.1 Target application

- Stage lighting
- Factory automation
- Automated teller machines (ATMs) and money handling machines
- Textile machines
- Home appliances
- Robotics

2 Hardware and software requirements

The EVLSPIN9P1-3PH evaluation board can be used as a standalone board, connected to a three-phase load by driving the input signals through the on-board connector.

It can be interfaced with any external MCU-based control unit.

To use the board with STM32 MCU-based tools, the following hardware and software components are required:

- A Windows PC (XP, Vista, Windows 7, Windows 8, Windows 10, or Windows 11) to install the software package
- An STM32 Nucleo board with the corresponding USB cable to connect to the PC
- The STM32 PMSM FOC/Six-Step Software Development Kit (available at www.st.com)
- A three-phase BLDC or PMSM motor with compatible voltage and current ratings
- An external DC power supply.

3 Getting started

The maximum ratings of the board are as follows:

- Power stage supply voltage up to 75 V_{DC}
- Overcurrent protection threshold set to approximately 20 A_{peak}

To start your project with the board:

- Check the jumper positions according to the target configuration (see [Section 4](#)).
- Connect the ST Nucleo board to the EVLSPIN9P1-3PH through the ST Morpho connector.
- Connect motor phases to the CN2.1, CN2.2, and CN2.3 terminals, ensuring the correct motor phase sequence.
- Supply the board through the CN1 connector, ensuring the correct polarity.

Develop your application using the STM32 FOC MC Library. Refer to the respective user manual for details.

4 Hardware description and configuration

Figure 2 shows the position of the main circuitry blocks of the board.

Figure 2. EVLSPIN9P1-3PH - Board function description, top view

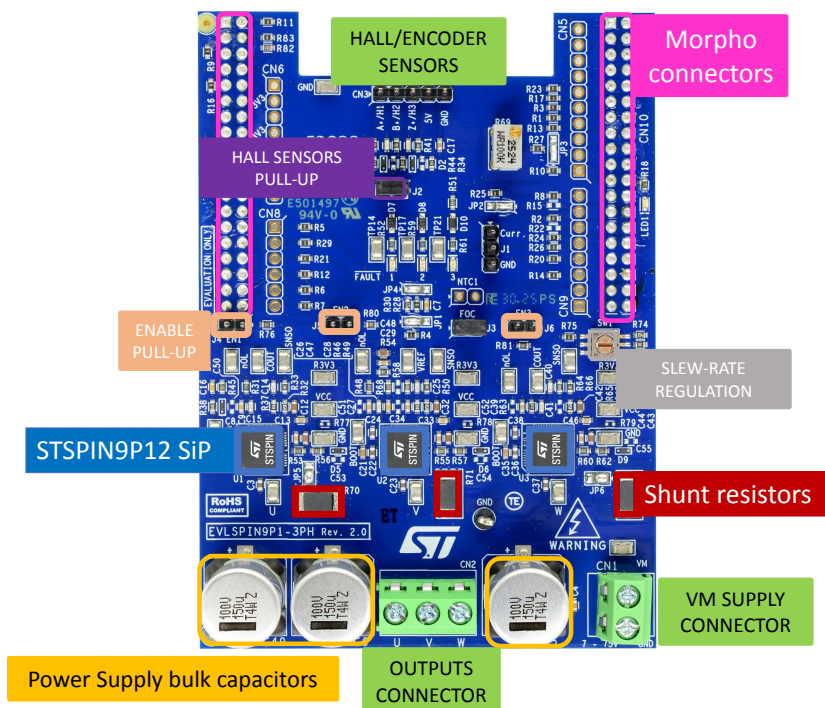


Figure 3 shows the position of connectors and jumpers of the board.

Figure 3. EVLSPIN9P1-3PH - Position of main components and connectors

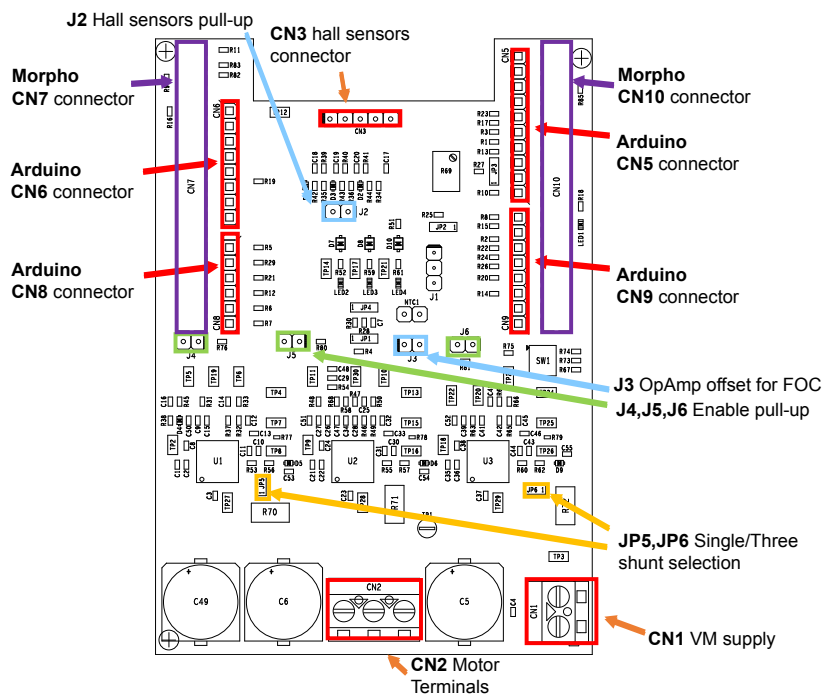


Table 1. Jumpers hardware settings

Jumper	Description	Default condition
JP1	BEMF1 Morpho connector pin selection	1-2 CLOSED
JP2	Z+/H3 Morpho connector pin selection	1-2 CLOSED
JP3	SPEED Morpho connector pin selection	1-2 CLOSED
JP4	Temp Morpho connector pin selection	1-2 CLOSED
JP5	SENS1 single-shunt / three-shunt (default) selection	1-2 CLOSED
JP6	SENS2 single-shunt / three-shunt (default) selection	1-2 CLOSED
J2	3V3 pull-up for Hall sensors outputs	CLOSED
J3	Op amp 2 voltage offset	CLOSED
J4	EN1 3V3 pull-up	OPEN
J5	EN2 3V3 pull-up	OPEN
J6	EN3 3V3 pull-up	OPEN

Table 2. Connectors description

Name	Pin	Label	Description
CN1	1-2	VM-GND	External motor voltage supply terminal block
CN2	1	Phase U	Motor phases connection
	2	Phase V	
	3	Phase W	
CN3	1	A+/H1	Hall/encoder sensors connector
	2	B+/H2	
	3	Z+/H3	
	4	5V	Hall sensors/encoder supply
	5	GND	

Table 3. Test points description

Name	Label	Description
TP1	SGND	Signal ground
TP2	BOOT1	Device 1 boot
TP3	VM	Motor voltage
TP4	R3V3_1	Device 1 3V3 regulator
TP5	nOL1	Device 1 open load
TP6	SNSO_1	Device 1 op amp output
TP7	VCC_1	Device 1 VCC voltage
TP8	GND	Device 1 ground
TP9	BOOT2	Device 2 boot
TP10	SNSO_2	Device 2 op amp output
TP11	nOL2	Device 2 open load
TP12	GND	Hall sensors ground
TP13	R3V3_2	Device 2 3V3 regulator
TP14	nFLT1	Device 1 FAULT

Name	Label	Description
TP15	VCC_2	Device 2 VCC voltage
TP16	GND	Device 2 ground
TP17	nFLT2	Device 2 FAULT
TP18	BOOT3	Device 3 boot
TP19	COUT_1	Device 1 comparator output
TP20	COUT_3	Device 3 comparator output
TP21	nFLT3	Device 3 FAULT
TP22	nOL3	Device 3 open load
TP23	SNSO_3	Device 3 op amp output
TP24	R3V3_3	Device 3 3V3 regulator
TP25	VCC_3	Device 3 VCC voltage
TP26	GND	Device 3 ground
TP27	U	Phase U
TP28	V	Phase V
TP29	W	Phase W
TP30	CURRENT REF	MCU current reference

5 Board description

5.1 Sensorless mode

To configure the evaluation board for six-step sensorless mode, enable the BEMF detection network. Set the JP1 jumper according to the Nucleo board used.

To configure the evaluation board for FOC sensorless mode, enable the offset on the op amp 2 by closing the J3 jumper.

5.2 Hall or encoder motor speed sensor

The EVLSPIN9P1-3PH evaluation board supports the digital Hall and quadrature encoder sensors for motor position feedback.

Sensors can be connected through the CN3 connector as listed in Table 4.

Table 4. Hall / encoder connector

Name	Pin	Description
Hall1/A+	1	Hall sensor 1/encoder out A+
Hall2/B+	2	Hall sensor 2/encoder out B+
Hall3/Z+	3	Hall sensor 3/encoder zero feedback
5V	4	Sensor supply voltage
GND	5	Ground

A protection series resistor of 1.8 k Ω is mounted in series with the sensor outputs.

For sensors requiring external pull-up, three 10 k Ω resistors are mounted on the output lines and connected to the 3V3 voltage by means of the J2 jumper.

The external MCU can decode Hall/encoder sensor outputs through its timers or peripherals. Set the JP2 jumper according to the Nucleo board used.

5.3 Six-Step Current mode

If Six-Step is used in current mode, remove J3 to eliminate the offset on op amp 2, which amplifies the current read across the shunt and compares it to the reference current from the MCU.

5.4 Bus voltage monitoring

The EVLSPIN9P1-3PH evaluation board provides bus voltage sensing. This signal is set through a voltage divider (R38, R45) from the motor supply voltage (VM) and sent to the corresponding MCU ADC channel.

The default voltage divider is set to a value of 26.7.

5.5 Temperature monitoring

Mounting an NTC resistor in the NTC1 position allows monitoring of the temperature of a portion of the board. Through a twisted pair of wires, it is possible to move the sensor to the desired position.

Usually, the power stage of the system-in-package (SiP) is the hottest place on the board, although the device itself is already protected against overtemperature.

5.6 Open load detection

If an open load is detected on one device, the nOL signal is asserted low and can be monitored by the MCU.

5.7 Setting the output slew rate

To change the output slew rate, turn SW1 to the desired position according to Table 5. Turning clockwise increases the slew rate value.

Table 5. Output slew rate configuration (SW1)

SW1 position	Slew rate [V/ns]
4	1
3	0.5
2	0.3
1	0.2

5.8 Debug

The EVLSPIN9P1-3PH evaluation board can be connected to an external Nucleo board with an embedded ST-LINK/V2-1 debugger/programmer. ST-LINK supports the following features:

- USB software re-enumeration
- Virtual COM port interface on USB, connected to the UART pins of the ST-LINK MCU (UART1)
- Mass storage interface on USB.

The power supply for ST-LINK is provided by the host PC.

The programming/debugging phase of the MCU can be performed through the Serial Wire interface available on the ST Nucleo board. Please refer to the relevant Nucleo board user manual for additional details.

6 References

This user manual provides information on the hardware features and use of the EVLSPIN9P1-3PH evaluation board.

For additional information, refer to:

- EVLSPIN9P1-3PH data brief, schematic, bill of materials, and layout
- STSPIN9P1 datasheet
- STM32 Nucleo board user manual.

Revision history

Table 6. Document revision history

Date	Version	Changes
18-Feb-2026	1	Initial release.

Contents

1	Main features	2
1.1	Target application	2
2	Hardware and software requirements	3
3	Getting started	4
4	Hardware description and configuration	5
5	Board description	8
5.1	Sensorless mode	8
5.2	Hall or encoder motor speed sensor	8
5.3	Six-Step Current mode	8
5.4	Bus voltage monitoring	8
5.5	Temperature monitoring	8
5.6	Open load detection	8
5.7	Setting the output slew rate	9
5.8	Debug	9
6	References	10
	Revision history	11
	List of tables	13
	List of figures	14

List of tables

Table 1.	Jumpers hardware settings	6
Table 2.	Connectors description	6
Table 3.	Test points description	6
Table 4.	Hall / encoder connector	8
Table 5.	Output slew rate configuration (SW1)	9
Table 6.	Document revision history	11

List of figures

Figure 1.	EVLSPIN9P1-3PH evaluation board	1
Figure 2.	EVLSPIN9P1-3PH - Board function description, top view	5
Figure 3.	EVLSPIN9P1-3PH - Position of main components and connectors	5

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