**AMIS-30543 Stepper Motor Driver Carrier**

Previous

Next

Top of Form

Bottom of Form

This is a breakout board for ON Semiconductor’s AMIS-30543 microstepping bipolar stepper motor driver, which features SPI-adjustable current limiting, 11 step modes (from full-step through 1/128-step), back-EMF feedback that can be used for stall detection or optional closed-loop control, and over-current and over-temperature protection. The board operates from 6 V to 30 V and can deliver up to approximately 1.8 A per phase without a heat sink or forced air flow (it is rated for 3 A per coil with sufficient additional cooling).

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| [https://a.pololu-files.com/picture/0J6376.250.jpg?375ec3680380ae30ff2a0589dc2b530c](https://a.pololu-files.com/picture/0J6376.1200.jpg?375ec3680380ae30ff2a0589dc2b530c) | |
| **AMIS-30543 stepper motor driver carrier, bottom view with dimensions.** | |
| [https://a.pololu-files.com/picture/0J6381.450.jpg?7f3cb8d3569f0e5e6b69d125187895de](https://a.pololu-files.com/picture/0J6381.1200.png?7f3cb8d3569f0e5e6b69d125187895de) | |

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| **PIN** | **Description** |
| VMOT | Reverse-protected 6 V to 30 V board power supply connection. **Note:** Available VDD current is reduced for input voltages under 8 V, and sleep mode is not available for input voltages under 9 V. |
| VBB | This pin gives access to the motor power supply after the reverse-voltage protection MOSFET (see the board schematic below). It can be used to supply reverse-protected power to other components in the system. It is generally intended as an output, but it can also be used to supply board power. |
| GND | Ground connection points for the motor power supply and control ground reference. The control source and the motor driver must share a common ground. |
| MOTXP | Motor output: “positive” end of phase X coil. |
| MOTXN | Motor output: “negative” end of phase X coil. |
| MOTYP | Motor output: “positive” end of phase Y coil. |
| MOTYN | Motor output: “negative” end of phase Y coil. |
| VDD (5V OUT) | The board is powered by an internal 5V regulator, and this pin gives access to the regulated 5 V **output**. This can be used to supply the neighboring IOREF pin when using this board in 5V systems, and it can be used to power an external microcontroller. When VMOT is over 8 V, approximately 30 mA is available for external components; when VMOT is less than 8 V, the available current drops to less than 10 mA. |
| IOREF | All of the board signal outputs (except SLA) are open-drain outputs that are pulled up to IOREF, so this pin should be supplied with the logic voltage of the controlling system (e.g. 3.3V for use in 3.3V systems). For convenience, it can be connected to the neighboring VDD pin when it is being used in a 5V system. |
| NXT | Changes on this input move the motor current one step up or down in the translator table (even when the motor is disabled). The edge that triggers the step depends on the NXT-polarity configuration bit, which can be changed through the SPI interface (rising edge by default). |
| DIR | Input that determines the direction of rotation. The direction can also be controlled through the SPI interface. |
| DO | SPI data output. (This pin is also often referred to as “MISO”.) |
| DI | SPI data input. (This pin is also often referred to as “MOSI”.) |
| CLK | SPI clock input. |
| CS | SPI chip select input. Logic transitions on this pin are required for SPI communication, even if this is the only device on the SPI bus. |
| CLR | Chip reset input. A logic high on this input clears all internal registers, except in sleep mode. |
| ERR | Error output. This pin drives low to indicate that an error condition has occurred. The specific error can be determined by using the SPI interface to check the error flags. |
| POR/WD | Power-on reset/watch dog function output. This pin provides an active-low signal that can be used as a reset input for an external microcontroller. |
| SLA (filtered) | SLA (speed and load angle) output after a low-pass filter. The result is an analog voltage between 0  V and 5 V that indicates the level of the back-EMF voltage of the motor. This signal can be used for stall detection or closed-loop control of the torque and speed based on the load angle. **Note:** Since the output of this pin ranges from 0 V to 5 V regardless of IOREF, extra precautions should be taken when connecting this pin to a 3.3V device (such as passing it through an appropriate voltage divider). |

**General minimal wiring diagram**

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| [https://a.pololu-files.com/picture/0J6382.600.jpg?f018a60ff18103b96b30dad1df06d3b5](https://a.pololu-files.com/picture/0J6382.1200.png?f018a60ff18103b96b30dad1df06d3b5) |
| **Minimal wiring diagram for connecting a microcontroller to an AMIS-30543 stepper motor driver carrier.** |

While the AMIS-30543 allows control of a stepper motor through a simple step (NXT) and direction (DIR) interface, it first needs to be enabled and configured through its SPI interface. This means that the controlling microcontroller must be capable of acting as an SPI master (either with an SPI peripheral or software SPI), and it must be connected to the DI, CLK, and CS pins. While the DO and ERR pins are not required to use this driver, it is generally a good practice to use them to monitor for error conditions.

**Minimal wiring diagram (5 V systems only)**

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| [https://a.pololu-files.com/picture/0J6383.600.jpg?e6c1bdb22450da4e5607d2be30fbc105](https://a.pololu-files.com/picture/0J6383.1200.png?e6c1bdb22450da4e5607d2be30fbc105) |
| **Minimal wiring diagram for connecting a microcontroller with a logic voltage of 5 V to an AMIS-30543 stepper motor driver carrier.** |

The AMIS-30543 has an internal 5 V regulator that can be used to supply IOREF in cases where the board is being used in 5 V systems. This internal regulator can also be used to supply the external microcontroller’s logic voltage if the regulator can deliver the required current, in which case there would be a wire from the AMIS-30543 VDD to the microcontroller VDD in the above diagram, and the “logic power supply” box would not be present.

**Arduino library and example code**

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| [https://a.pololu-files.com/picture/0J6396.600.jpg?6d2c05f3a86f90d9134fbcab29e633c4](https://a.pololu-files.com/picture/0J6396.1200.jpg?6d2c05f3a86f90d9134fbcab29e633c4) |
| **Controlling an AMIS-30543 stepper motor driver carrier with an Arduino-compatible #3104 A-Star 32U4 Mini SV.** |

If you are new to the AMIS-30543 or stepper motors in general, our [AMIS-30543 Arduino library](https://github.com/pololu/amis-30543-arduino/) can help you get started. The library provides basic functions for configuring and operating the driver using an [Arduino](https://www.pololu.com/category/125/arduino) or [Arduino-compatible controller](https://www.pololu.com/category/149/a-star-programmable-controllers). It also provides access to many of the driver’s advanced features and includes example sketches that show you how to use them.

**Power dissipation considerations**

The AMIS-30543 driver IC has a maximum current rating of 3 A per coil, but the actual current you can deliver depends on how well you can keep the IC cool. The carrier’s printed circuit board is designed to draw heat out of the IC, but to supply more than approximately 1.8 A per coil continuously, a heat sink or other cooling method is required. However, it is possible to use the SPI-configurable current limit to selectively deliver higher currents than this for short durations without overheating the driver.

This product can get **hot** enough to burn you long before the chip overheats. Take care when handling this product and other components connected to it.

Please note that measuring the current draw at the power supply will generally not provide an accurate measure of the coil current. Since the input voltage to the driver can be significantly higher than the coil voltage, the measured current on the power supply can be quite a bit lower than the coil current (the driver and coil basically act like a switching step-down power supply). Also, if the supply voltage is very high compared to what the motor needs to achieve the set current, the duty cycle will be very low, which also leads to significant differences between average and RMS currents.

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