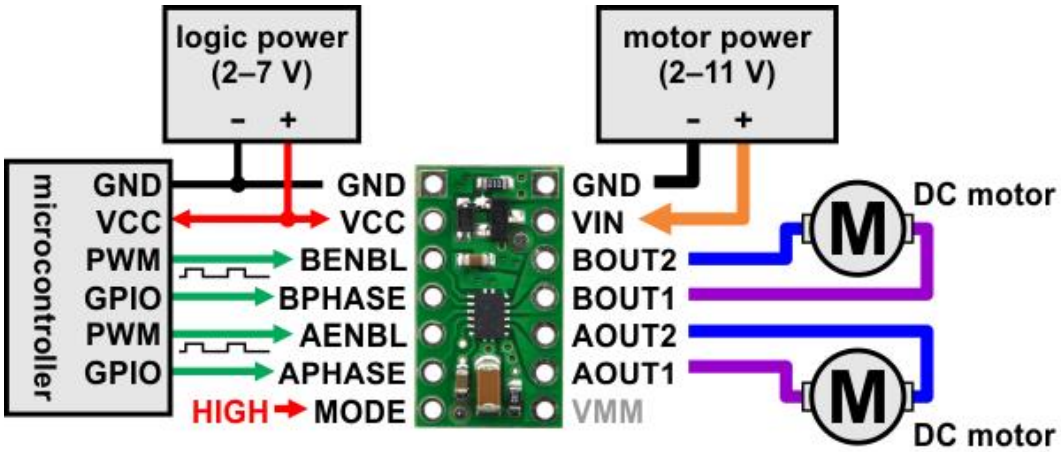
# POLOLU DRV8835 DUAL MOTOR DRIVER CARRIER

# USER'S GUIDE

## USING THE MOTOR DRIVER




Minimal wiring diagram for connecting a microcontroller to a DRV8835 dual motor driver carrier in phase-enable mode.

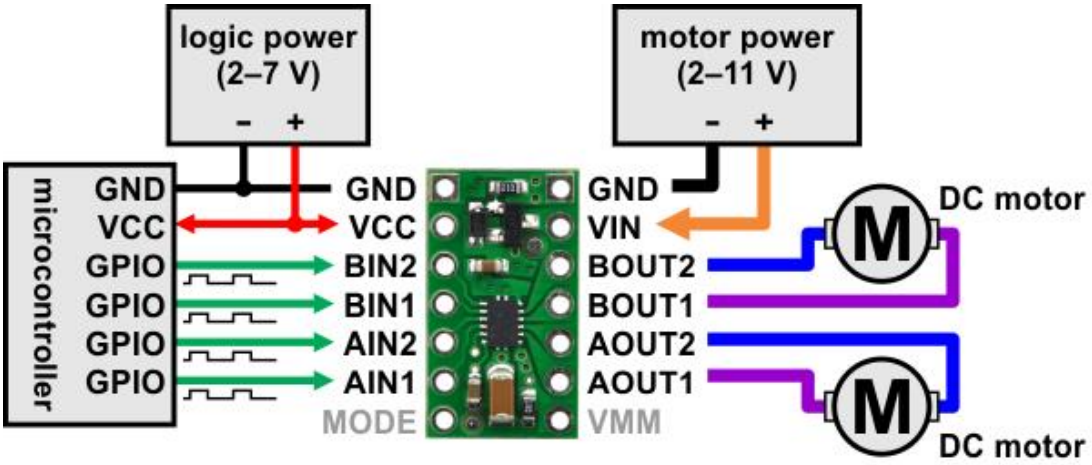
Motor and motor power connections are made on one side of the board and logic power and control connections are made on the other. The driver requires a motor voltage between 0 V and 11 V to be supplied to the VIN or VMM pin and a logic voltage between 1.8 V and 7 V to be supplied to the VCC pin; the logic voltage can typically be supplied by or shared with the controlling device. The VIN pin is the reverse-protected motor supply input and is the recommended point for connecting motor power. However, driver performance will start getting worse when the input voltage to the reverse-protection circuit is below a few volts, and 1.5 V is the lower limit of where the VIN pin can be used. For very low voltage applications, the motor supply should be connected directly to VMM, which bypasses the reverse-protection circuit.

The DRV8835 features two possible control modes: IN/IN and PHASE/ENABLE. The MODE pin determines the control interface. Each control input is pulled low through a weak pull-down resistor (approximately 100 kΩ), so the driver will be in the IN/IN mode

if the MODE pin is left disconnected, and the driver outputs will be disabled by default. Setting the MODE pin high, either with a pull-up resistor or a driving-high I/O line, sets the driver to PHASE/ENABLE mode, where the PHASE pin determines the motor direction and the ENABLE pin can be supplied with a PWM signal to control the motor speed. This mode is generally easier to use as it only requires one PWM per channel, but it only allows for drive/brake operation. (Drive/brake operation usually provides a more linear relationship between PWM duty cycle and motor speed than drive/coast operation, and we generally recommend using drive/brake operation when possible.)

| Simplified drive/brake operation with MODE=1 (PHASE/ENABLE) | | | | |
|---|---|---|---|---|
| xPHASE | xENABLE | xOUT1 | xOUT2 | operating mode |
| 0 | PWM | PWM | L | forward/brake at speed *PWM %* |
| 1 | PWM | L | PWM | reverse/brake at speed *PWM %* |
| X | 0 | L | L | brake low (outputs shorted to ground) |

## ADVANCED USAGE WITH IN/IN MODE

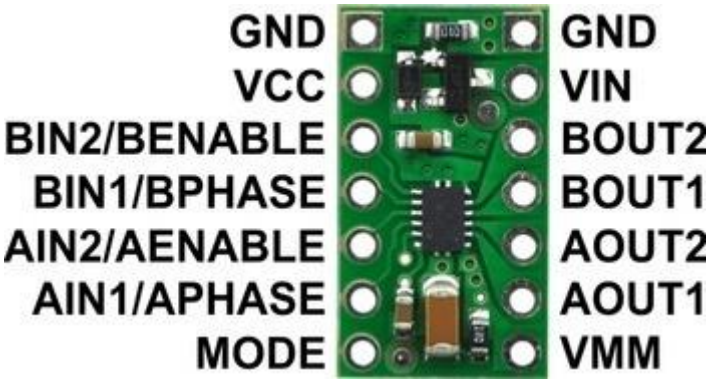



Minimal wiring diagram for connecting a microcontroller to a DRV8835 dual motor driver carrier in in-in mode.

When the MODE pin is disconnected or low, the control interface is IN/IN, which allows for slightly more advanced control options. The following truth table show how to achieve drive/coast and drive/brake operation using the IN/IN control interface:

| Drive/coast or drive/brake operation with MODE=0 (IN/IN) | | | | |
|---|---|---|---|---|
| xIN1 | xIN2 | xOUT1 | xOUT2 | operating mode |
| 0 | 0 | OPEN | OPEN | coast (outputs off) |
| PWM | 0 | PWM | L | forward/coast at speed *PWM %* |
| 0 | PWM | L | PWM | reverse/coast at speed *PWM %* |
| 1 | PWM | PWM | L | forward/brake at speed *100% – PWM %* |
| PWM | 1 | L | PWM | reverse/brake at speed *100% – PWM %* |
| 1 | 1 | L | L | brake low (outputs shorted to ground) |

## PINOUT



| PIN | Default State | Description |
|---|---|---|
| VIN | | Reverse-protected motor power supply input. While the driver can operate from a motor supply of 0 V to 11 V, the reverse-protection circuit will start negatively affecting performance below a few volts, and 1.5 V is the lower limit of where it can be used. Power can be supplied directly to VMM to bypass the reverse-protection circuit. |
| VCC | | 1.8 V to 7 V logic power supply connection. Logic supply current draw is typically only a few milliamps at most, so in many applications this pin can optionally be dynamically powered by a microcontroller digital output. |
| VMM | | 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 (such as in cases where the motor supply voltage is too low for the reverse-protection circuit). |
| GND | | Ground connection points for the motor and logic power supplies. The control source and the motor driver must share a common ground. |
| AOUT1 | | The motor A half-bridge 1 output. |
| AOUT2 | | The motor A half-bridge 2 output. |
| BOUT1 | | The motor B half-bridge 1 output. |
| BOUT2 | | The motor B half-bridge 2 output. |
| AIN1/APHASE | LOW | A logic input control for motor channel A. |
| AIN2/AENABLE | LOW | A logic input control for motor channel A. |
| BIN1/BPHASE | LOW | A logic input control for motor channel B. |
| BIN2/BENABLE | LOW | A logic input control for motor channel B. |
| MODE | LOW | Logic input that determines the control interface. Logic low on this pin results in IN/IN mode while logic high results in PHASE/ENABLE mode. |

## REAL-WORLD POWER DISSIPATION CONSIDERATIONS

The DRV8835 datasheet recommends a maximum continuous current of 1.5 A per motor channel. However, the chip by itself will overheat at lower currents. For example, in our tests at room temperature with no forced air flow, the chip was able to deliver 1.5 A per channel for approximately 15 seconds before the chip's thermal protection kicked in and disabled the motor outputs, while a continuous current of 1.2 A per channel was sustainable for many minutes without triggering a thermal shutdown.

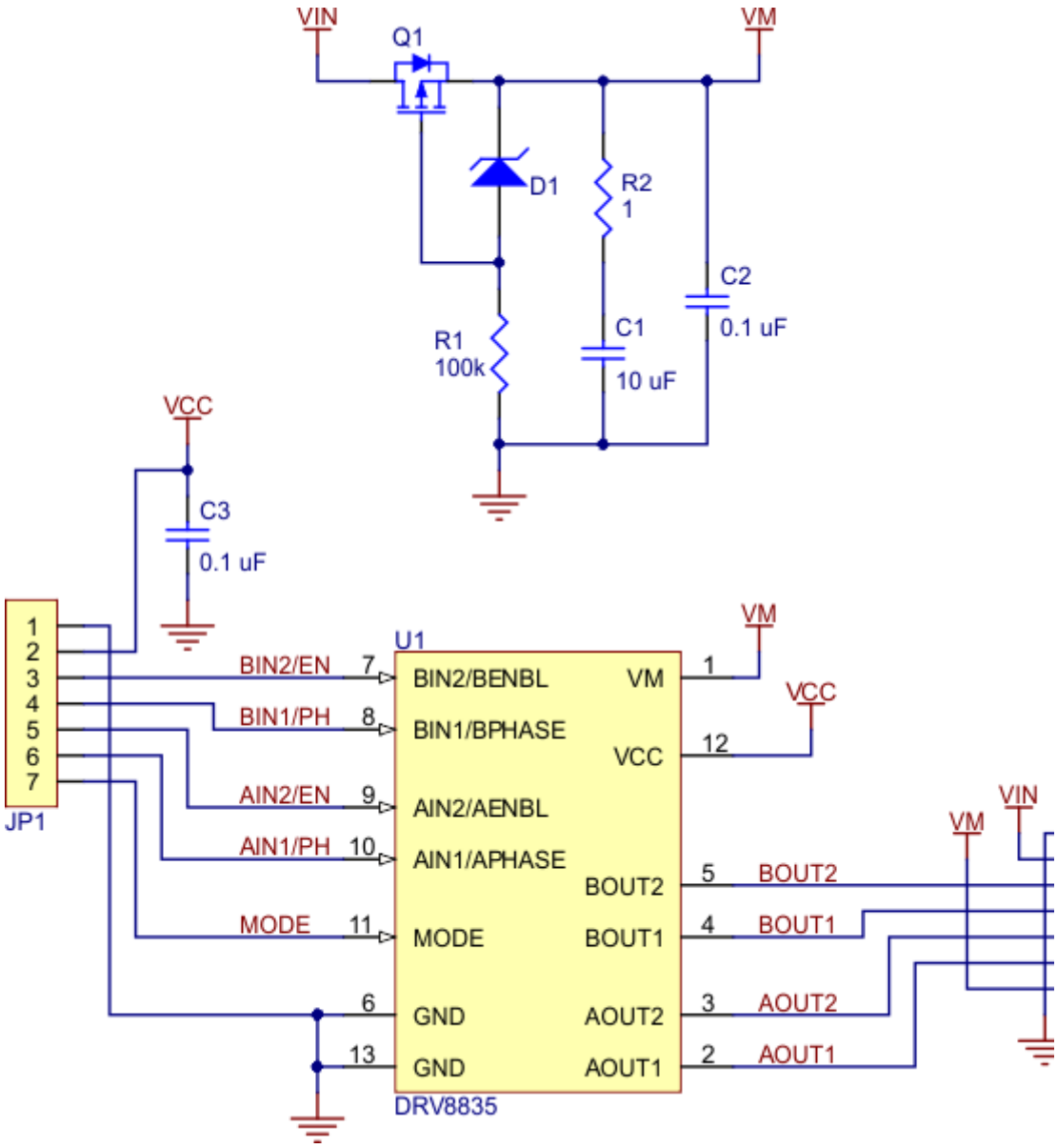
Note that when both the logic and motor supply voltages are low (on order of a few volts), the driver will start overheating sooner and the maximum achievable output current will be lower than what we observed in the tests mentioned above.

The actual current you can deliver will depend on how well you can keep the motor driver cool. The carrier's printed circuit board is designed to draw heat out of the motor driver chip, but performance can be improved by adding a heat sink. Our tests were

conducted at 100% duty cycle; PWMing the motor will introduce additional heating proportional to the frequency.

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.

## SCHEMATIC




Schematic of the DRV8835 dual motor driver carrier.