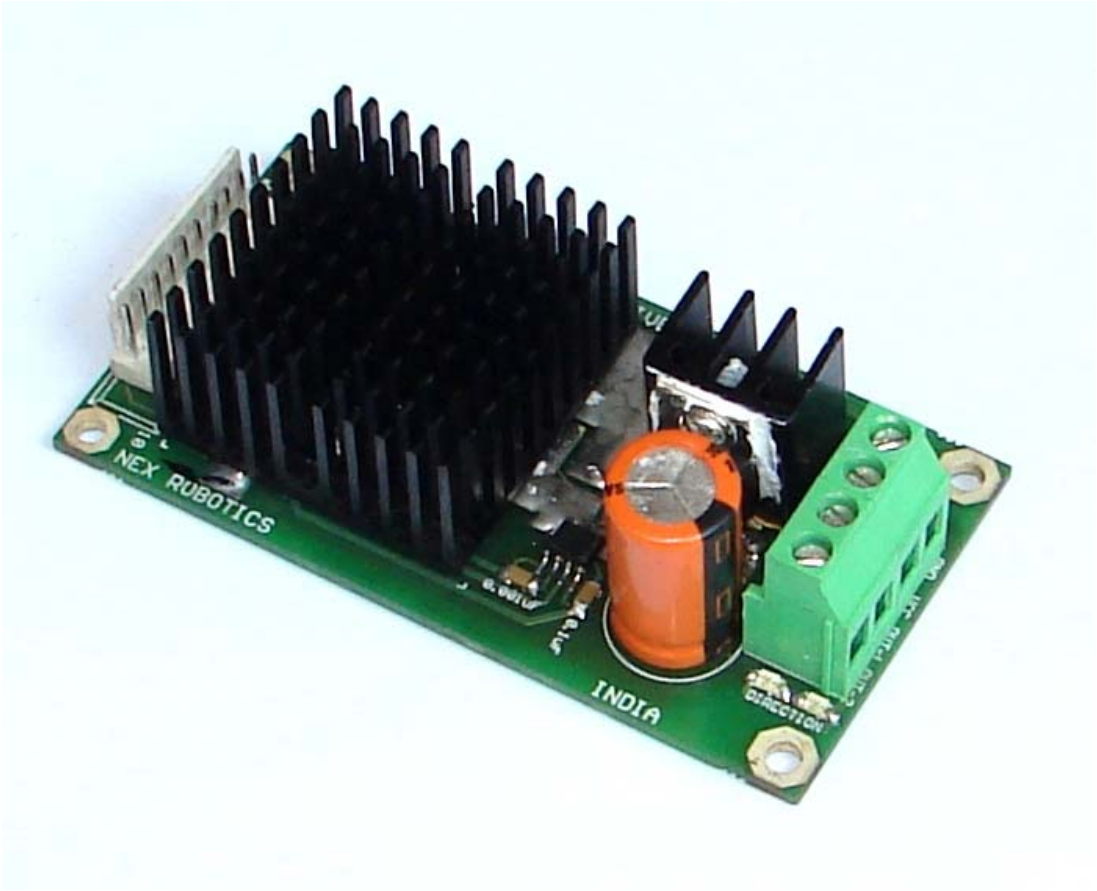
Hercules 6V-36V, 15Amp Motor Driver
October 2011



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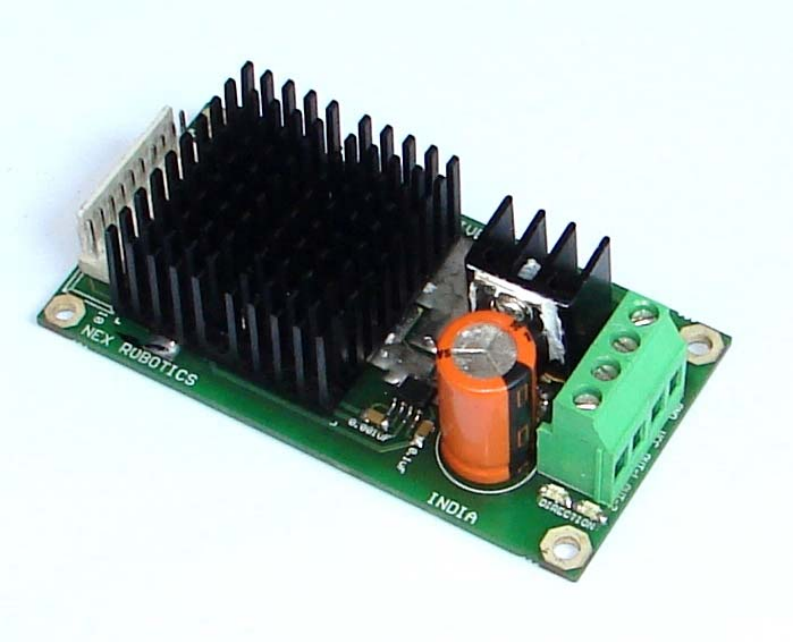


Introduction

Hercules 6V-36V, 15Amp Motor Driver can take up to 30A peak current load and can be operated up to 10 KHz PWM. Motor driver can be interfaced with 3.3V and 5V logic levels. Motor driver has built-in protection from under / over voltage, over temperature and short. Motor Driver has optional ACS714 current sensor for current sensing. You can choose current sensor installation option at the time of placing the order. The Motor driver has terminal block as power connector and 10 pin 2510 type relimate connector for the logic connection. It is suitable for high performance robots, Robocon, Robo-cup, US First, Battle robots etc.

Note:
ACS714 current sensor is an optional accessory. You can choose current sensor installation option at the time of placing the order.

Hercules 6V-36V, 17Amp Motor Driver can take up to 20Amp current if fan is installed on top of heat sink.

Specifications

- Operating voltage: 6V to 36V
- Continuous output current: 15Amp (17Amp if fan is installed)
- Peak output current: 30Amps
- Maximum PWM Frequency: 10KHz
- Over voltage and under voltage shutdown
- Thermal shutdown
- Protection against loss of GND and Vcc.

- Motor fault diagnostics outputs for over temperature or short circuit
- Power Connector: 4 Pin Terminal Block
- Logic Connector: 10 pin female 2510 relimate connector
- Size: 84.7mm x 44.7mm

Thermal and short circuit protection

Hercules Motor Driver has built in overheating and short circuit protection. If motor controller is shut down because of over temperature or short circuit then it needs to be restarted to resume operations.

Package contains:

Hercules 6V-36V, 15Amp Motor Driver (ACS714 is optional)
15cm, 10 pin female 2510 type relimate connector
Four 10mm mounting studs
Four M3 mounting nuts

Important

- Use multithread copper wire with at least 1.5mm^2 area of cross section for proper current handling capacity.
- It is highly recommended to use of 15A or 20A fuse in between motor driver's supply line.
- Motor driver is not reverse polarity protected. Applying reverse polarity will instantly damage the motor driver.
- Make sure that motor supply ground and logic ground is common.
- If you change motor's direction suddenly while motor is moving in one direction even at 4Amps, depending on the type of the motor, surge current may reach to very high value and motor driver may go in to protection mode. Do not reverse the motor's direction suddenly unless it is required. It's a good practice to give stop command to the motor for 10 to 100 milliseconds between sudden direction changes.

Correct Motor Driver Selection

For generic motion control applications we recommend Hercules series motor driver that provides satisfactory performance at affordable price. However, for precision servo control applications, Super Hercules series motor driver is strongly recommended. Following is the difference between these two series of the motor drivers.

In case of the Hercules series Motor Drivers, the PWM OFF signal switch off the lower MOSFETs. That is during PWM off period the motor is free wheeling. DC braking is achieved by connecting IN-1 and IN-2 to the logic 1 or logic 0 simultaneously.

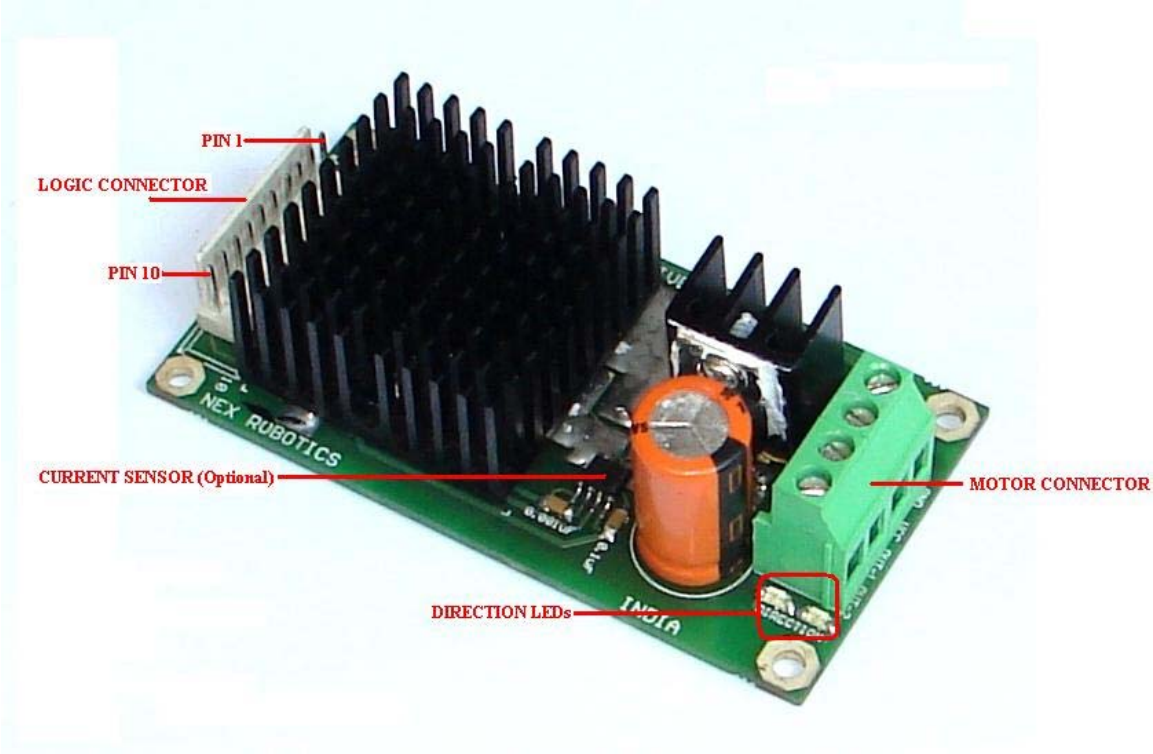
Super Hercules series Motor Drivers actually shorts the motor winding during PWM off cycle for tight motion control. It also uses Synchronous Rectification to reduce power dissipation across MOSFETs when motor windings are shorted. In order to do all this, it

uses high power MOSFETs and smart motion control methods. In this case, DC braking is achieved by simply setting PWM to logic low.

Parameters:

Parameter	Range
Vcc (Supply voltage)	6V to 36V DC
Supply current	15A. continuous at 25^0C; 20Amp continuous if cooling fan is used; 30A. pulsed;
PWM frequency	0 to 10KHz
VIL (Low level logic input)	>0.8V
VIH (High level logic input)	3.5V to 5V
Output at Diagnostic 1 (ENA) and Diagnostic 2 (ENB)	Open collector, Internally pulled up at 5V

Table 1: Parameters



Motor Connector Pin Functionality:

Pin	Function
Ground	Ground pin to be connected to the supply
Vcc	Motor supply 6V to 36V DC
OUT-1 (A)	Output 1 for the motor
OUT-2 (B)	Output 2 for the motor

Table 2: Motor Connector Pin Functionality

Logic input Connector Pin Functionality:

Pin No.	Pin	Functionality
1	GND of Motor driver IC	Ground
2	IN-1	Logic input for the motor direction.
3	Diagnostic 1 (DG-1)	Output pin with logic 1 output in normal operation. Represents side of the internal H bridge corresponding to IN-1. Pin is pulled to logic low by the motor driver in case of over temperature or overload due to short circuit.
4	PWM	Used to apply Pulse Width Modulation to control motor velocity
5	Diagnostic 2 (DG-2)	Output pin with logic 1 output in normal operation. Represents side of the internal H bridge corresponding to IN-2. Pin is pulled to logic low by the motor driver in case of over temperature or overload due to short circuit.
6	IN-2	Logic input for the motor direction.
7	CS	No Connection.
8	GND-ACS714*	Ground of current sensor ICACS714, it should be made common with ground of motor driver IC (pin no 1 on same connector) if ACS714 is installed.
9	CS-ACS714	Current Sense output from ACS714 IC, 100mV per Amp (if installed).
10	Vcc-ACS714*	Give 5V supply for ACS714 current sensor if installed

Table 3: Logic Input Connector Pin Functionality

* If you want true isolation between motor driver and logic circuit (microcontroller circuit etc) then for logic connections use opto-coupler such as MCT2E and connect Vcc and ground of the ACS714 sensor directly to the logic circuit. Vcc, ground and sensor out of the ACS714 are not connected with any of the circuit of the motor driver.

If you want to drive motor without using PWM then connect PWM pin to 5V logic level.

Truth Table in Normal Operating Conditions:

IN-1	IN-2	Diagnostic 1 (DG-1)	Diagnostic 2 (DG-2)	OUT-1 (A)	OUT-2 (B)	Mode of Operation
1	1	1	1	H	H	Brake to VCC
1	0	1	1	H	L	Clockwise(CW)
0	1	1	1	L	H	Counterclockwise (CCW)
0	0	1	1	L	L	Brake to GND

Table 4: Truth Table in Normal Operating Conditions

In all above cases logic 0 and logic 1 on PWM pin will turn off or turn on internal low side MOSFETs.

Fault condition detection

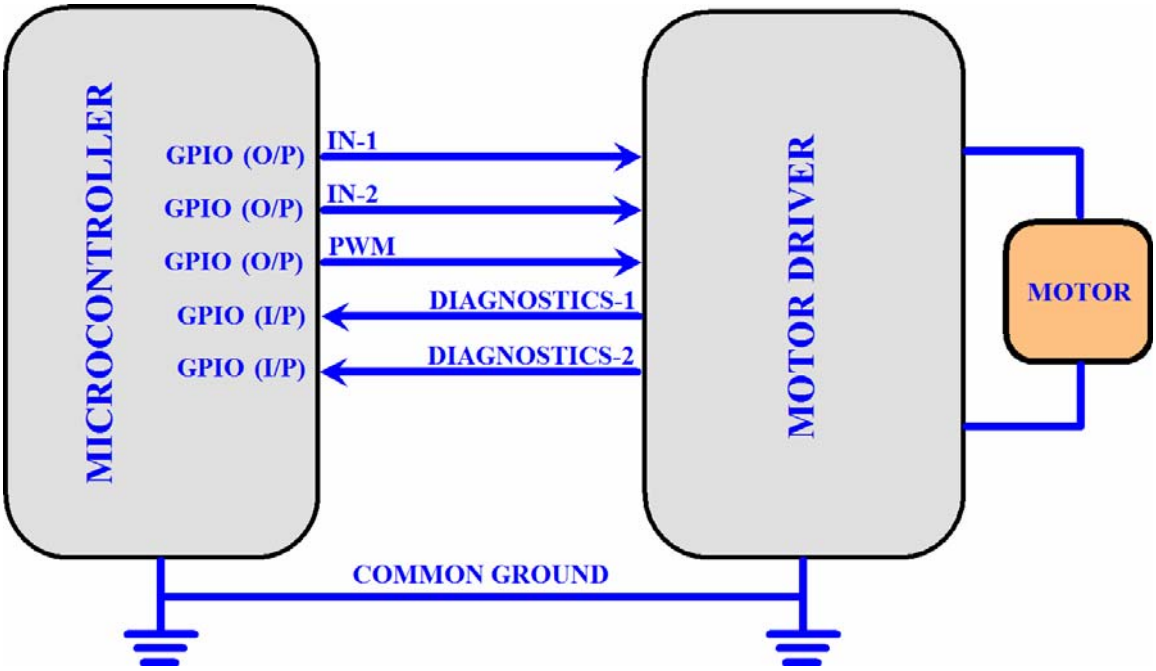
Motor driver can detect over temperature and short circuit faults at left and right sides of the H Bridge. In case of any of the fault conditions, Diagnostics pins corresponding to left or right side of the motor driver will be pulled low and that side of the motor driver will be disabled. To resume normal operation you need to restart the motor driver.

While restarting, make sure that you give sufficient time for the capacitor to discharge.

Important:

Diagnostics pins are internally pulled up using 5V Zener. While connecting these pins to the microcontroller, make sure that you don't overload them else motor driver will stop operating. Connect these pins to the microcontroller only if you want to detect any fault else you can leave them unconnected.

Interfacing motor driver with the microcontroller:



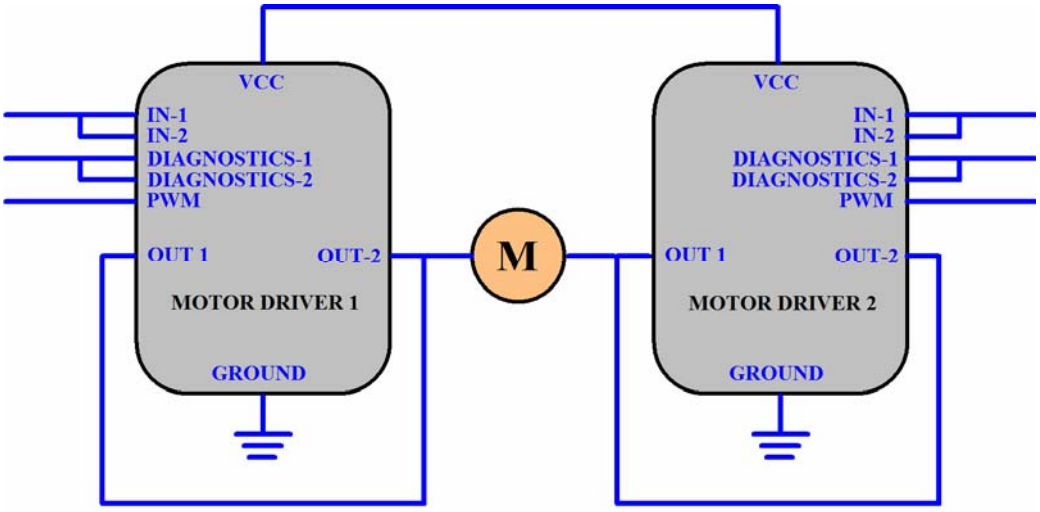
To drive the motor controller you just need PWM, IN-1 and IN-2 pins. These pins will accept 5V as well as 3.3V logic levels. Diagnostics 1 (DG-1) and Diagnostics-2 (DG-2) pins are internally pulled up at 5V at the motor driver side and are only required if you want to detect over temperature and short circuit faults. Most of the microcontrollers which operate at 3.3V have 5V tolerant input pins. If pins are not 5V tolerant then to interface them to 3.3V logic level you need to scale down 5V to 3.3V logic using open collector buffers or any other 5V to 3.3V logic converters.

If ACS714 current sensor is installed then connect its ground (pin 8) with the ground of the motor driver (pin 1). Give 5V to the Vcc of the ACS714 (pin 10). Connect CS out of the ACS714 (pin 9) to the ADC of the microcontroller.

Bridge Configurations:

1. Half-Bridge Configuration:

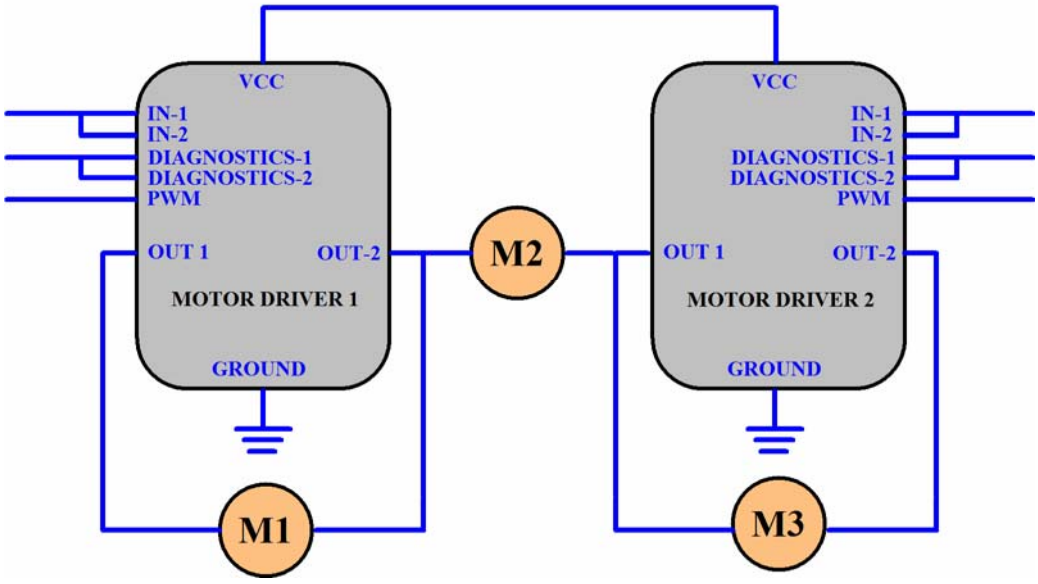
Hercules Motor Driver can be used as high power half-bridge driver to increase the current driving capacity. Suggested configuration is shown below.



Half-Bridge Configuration

2. Multi-motors Configuration:

Hercules Motor Driver can easily be used in multi-motor systems such as seat positioning systems where, only a single motor must be driven at a time. Diagnostic-x or ENx pins allow putting unused half-bridges in high impedance. Suggested configuration is as follows.



Multi-motor Configuration

Notice

The contents of this manual are subject to change without notice. All efforts have been made to ensure the accuracy of contents in this manual. However, should any errors be detected, NEX Robotics welcomes your corrections. You can send us your queries / suggestions at
info@nex-robotics.com

⚠ **Product's electronics is static sensitive. Use the product in static free environment.**

⚠ **Read the user manuals completely before start using this product**

Recycling:

Almost all the part of this product are recyclable. Please send this product to the recycling plant after its operational life. By recycling we can contribute to cleaner and healthier environment for the future generations.