Mechatronics DC Motor Driver #s420

This document gives an overview of the s420 DC Motor Driver designed and built by the UWO Engineering Electronics Shop. The circuit uses the MC33887 H-Bridge with load current feedback. For a full description of this device, visit www.freescale.com.

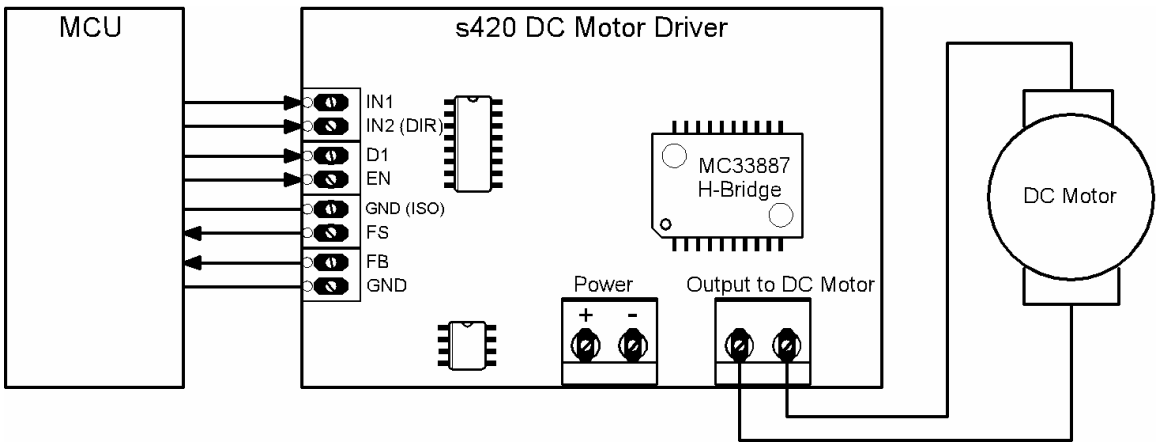


Figure 1: Circuit Board Layout and I/O Configuration

Power

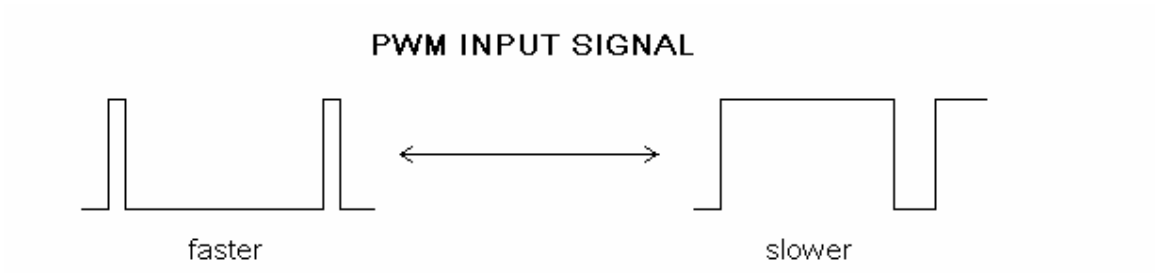
Hook up the DC voltage source (6V to 26V) to the power terminals shown in Figure 1. Ensure that the polarity is correct. This will be the voltage supplied to the motor and the H-bridge. Check the specifications of your motor to make sure that your supply voltage is an appropriate value. The 6V to 26V mentioned above refers to the minimum and maximum voltages that can be applied to the voltage regulator that supplies the required logic voltage.

Input Signals

All input signals should be TTL (LOW = 0V, HIGH = 5V.) The input signals are optically coupled in order to protect the microcontroller from voltage and current spikes.

IN1 – Logic input control 1

A pulse-width modulated (PWM) signal should be applied to this input. The PWM signal should have a frequency of less than 10 kHz. Vary the width of the pulse to change the speed of the motor -- smaller duty cycle will give faster speed.



IN2 – Direction (Logic input control 2)

This input controls the direction of rotation of the motor. Apply a LOW signal (0V -- or leave the input open,) to turn the motor in one direction. Apply a HIGH signal (5V) to turn the motor in the opposite direction.

D1 – Disable 1

The D1 (disable) input requires a HIGH signal for normal operation. A LOW signal will simultaneously disable both H-bridge outputs. D1 can also be toggled to clear a fault flag (see **FS** description below.)

EN – Enable

Apply a LOW signal to this input to allow full operation of the device. A HIGH signal will put the MC33887 chip into sleep mode, greatly reducing current consumption when the motor is not on.

GND (ISO) – Isolated Ground

Attach the input signal grounds to this terminal. This is part of the optically isolated inputs and will protect your microcontroller.

Output Signals

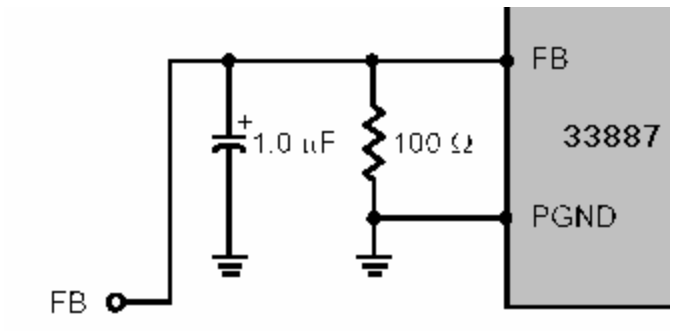
FS – Fault Status

In the case of an undervoltage condition, the outputs are disabled and the Fault Status is set logic LOW. Upon undervoltage recovery, the Fault Status is automatically returned to logic HIGH and the outputs are restored to their original operating condition.

When a short-circuit or overtemperature condition is detected, the outputs are disabled and the Fault Status is set logic LOW. The short-circuit or overtemperature must be corrected and D1 must be toggled (set LOW then HIGH) to resume normal operation.

FB – Feedback

The MC33887 has a feedback output that allows one to monitor the H-bridge high-side current. This signal provides the user with motor current feedback for motor torque control.



The feedback current (I_{FB}) is 1/375th (0.00266) of the load current (I_{load}). There is a 100 Ohm resistor from the FB pin on the MC33887 to ground. Using this information, one can determine the load current as follows:

$$I_{FB} = \frac{1}{375} I_{load}$$

$$\text{so } I_{load} = 375 \cdot I_{FB}$$

$$\text{and } V = I \cdot R$$

$$\text{so } V_{FB} = I_{FB} \cdot R_{FB}$$

$$I_{FB} = \frac{V_{FB}}{R_{FB}}$$

$$\therefore I_{load} = 375 \frac{V_{FB}}{R_{FB}}$$

$$= 375 \frac{V_{FB}}{100\Omega}$$

$$\boxed{I_{load} = 3.75 \cdot V_{FB}}$$

So, if your microcontroller is equipped with an analog-to-digital converter (ADC) you can read the feedback voltage and determine the load current. E.g. a V_{FB} of 1V corresponds to an I_{load} of 3.75A.

Heatsinking

If the motor driver gets excessively hot when used in your application some heatsinking may be required. Heatsinks can be installed by the Electronics Shop staff in room SEB 3105.