

## Mars Rover

### Motor Drive Module

The purpose of this module is to control the movement of the Mars Rover and to measure the distance travelled in x and y directions. This information can be transmitted to other modules to estimate the exact location of the Rover and to control its movement to achieve various objectives. This module consists of two main parts: 1) a motor drive PCB and 2) an optical sensor PCB.

A block diagram of this module is shown in Figure 1. The power connections are shown as thick solid wires while (one or more) communication and control lines between different blocks are shown as dotted lines with arrows pointing in the direction of the information flow. The motor drive module is powered through a USB power cable. In a real-world scenario, this can be a battery bank. A switch-mode-power supply (SPMS), working in BUCK mode is used to control the DC voltage  $V_M$  that is fed to a motor control IC (TB6612FNG). The SMPS output voltage can be controlled to control the speed of the motors. There are two H-bridge circuits built in the motor control IC. Each H-bridge control one motor. Depending on different control signals from the microcontroller, a motor can be turned on /off, and the direction of rotation can be controlled. More details about the motor control IC can be seen from the datasheet. You can also see how an H-bridge circuit works to better understand this control.

An Arduino Nano Every is used to control the SMPS, the motor control IC, and the optical flow sensor. You have worked on the SMPS control using Arduino Nano Every in your SMPS lab experiment. The same microcontroller can be used to control the two H-bridges that control the motors. It can also communicate with the optical flow sensor (using the SPI port) to measure the distance travelled in x and y directions. A serial communication port ( $T_x$ ,  $R_x$ , GND) is provided on the motor drive PCB to allow the Arduino Nano to communicate with other microcontrollers. The unassigned pins of the Arduino Nano are made available for connections using female headers. A female USB power port is also provided to power another microcontroller.

The schematics of the motor drive PCB are provided along with the datasheets of the motor control IC, and the optical sensor. Sample codes for control of the motors with an SMPS and measuring distance using optical sensors are also provided.

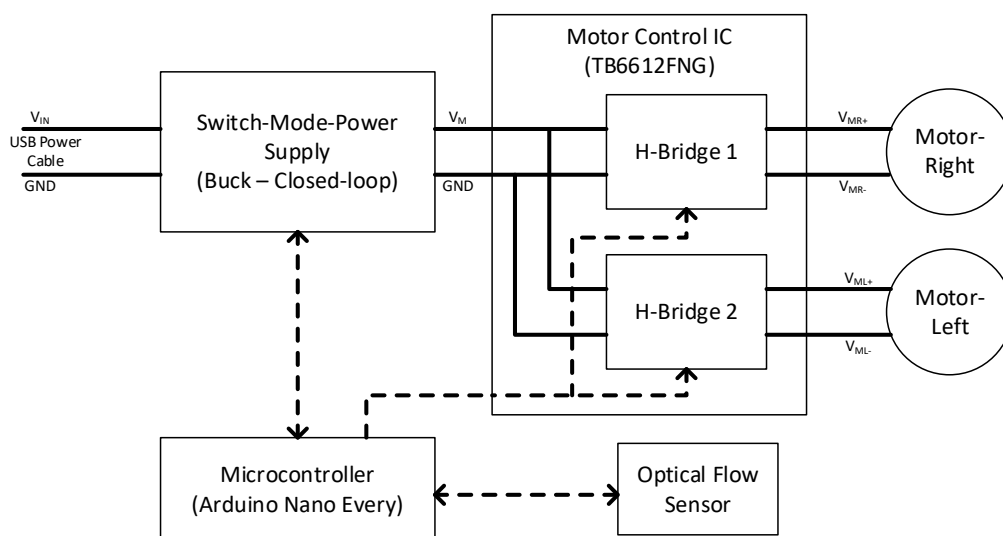


Figure 1 Block diagram of the motor drive module