

Power Reversing Circuits (Expert Option)

Name: _____

Date: _____

Instructions

The expert H-bridge option has a single power reversing circuit option that you can attempt; however, there are two circuits that are needed for this design to work. The first circuit is a “**control circuit**” and the other is a “**digital H-bridge**” that uses a several different types of components. Your task is to build both circuits, test them, and then explain how these circuits work.

As stated above, this particular **H-bridge** design is comprised of 2 halves. The first half of this circuit is a **dedicated control panel** that uses 2 **push switches**. The second half uses a combination of **transistors**, **resistors**, and **diodes** to create a digital **H-bridge** design that is compatible with a microcontroller. While this circuit can be used with a microcontroller (*which makes it a great design choice for advanced robotic applications*) the use of a simple control circuit allows an operator too easily control this circuit without the use of a computer.

Questions

1. What are **transistors**, **resistors**, and **diodes**. What is the specific function of each of these components, and how do each of these components work?

2. Review the design for this particular “**Digital H-bridge**” design and make some predictions as to how and why this circuit could be used with a **microcontroller**.

3. This circuit can be created with or without **diodes**. Using the internet conduct some research to determine the function of the **diodes** and their importance.

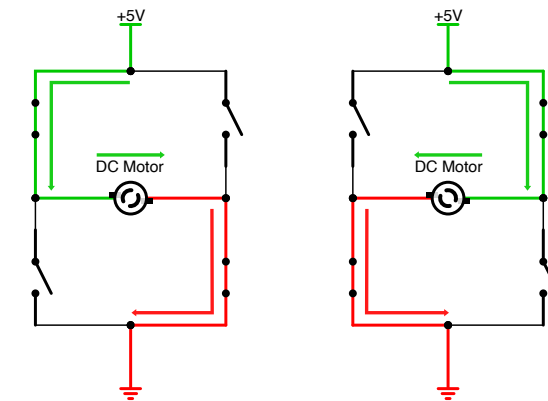
Introduction:

A power reversing circuit is used to control which direction a DC motor turns. Power reversing circuits are incredibly versatile circuits and can be used for a wide variety of applications. For instance, these simple circuits can be used to control simple devices such as a crane winch; however, if you have two or more power reversing circuits you can control advanced robotic devices such as a battle-bots.

In the field of electrical engineering power reversing circuits are commonly referred to as an “**H-Bridge**”. This is because the most basic **H-Bridge** design contains four switching element, with the load at the centre, in an H-like configuration:

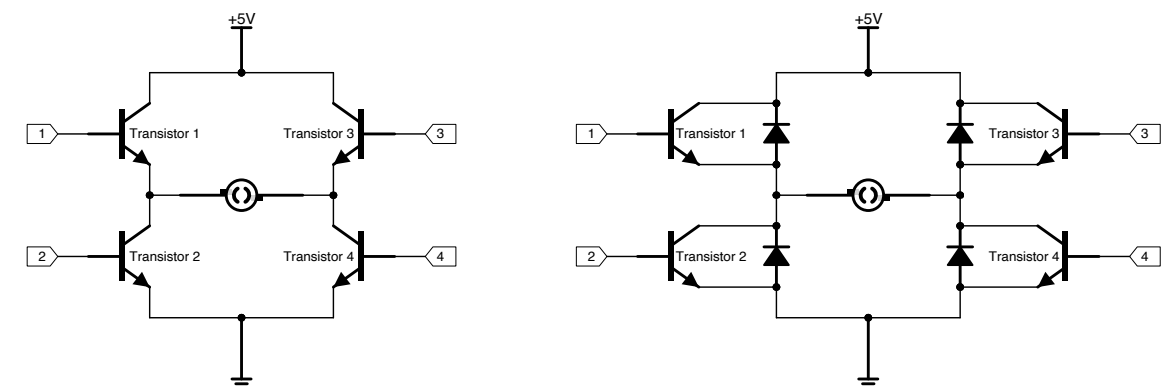
H-Bridge: Noun

A simple circuit that lets you control a DC motor to go backward or forward.



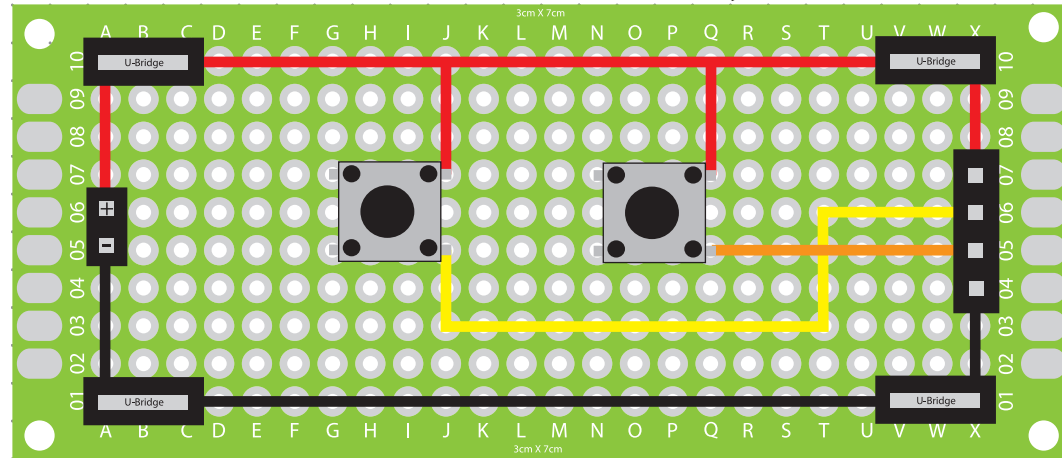
A simple H-Bridge using 4 simple switches. The flow of electricity is marked with arrows.

More advanced H-Bridge designs build on this one simple circuit design. A slightly more efficient design will replace the 4 one way switches with 2 SPDT (single pole double throw) switches, or with 1 DPDT (double through double pole) switch. However the most popular H-bridge design uses transistors and can be controlled using a simple control circuit or computerized microcontroller.

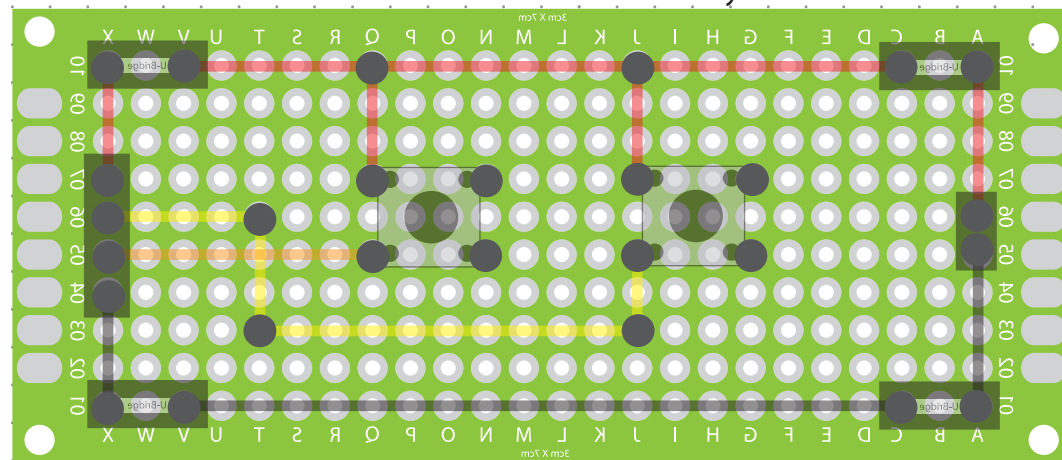


H-Bridge designs using transistors [NOTE: although the circuit can work using only transistors, diodes are usually added to protect the transistors from power surges that are caused by the motor].

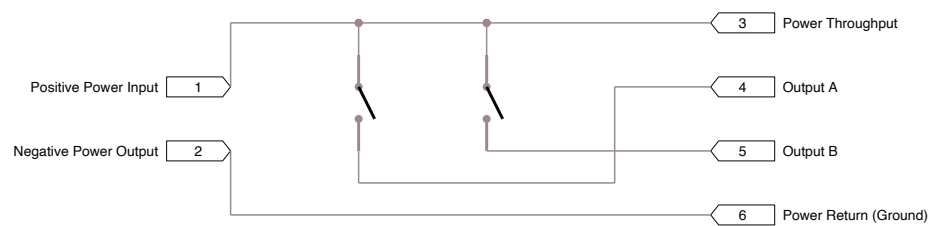
Front View: Circuit Board Layout



Back View: Circuit Board Layout



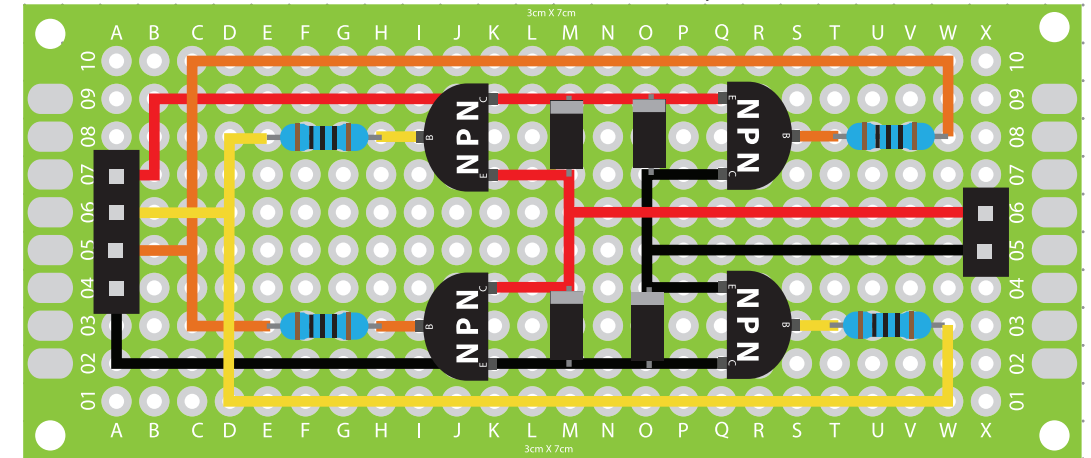
Electrical Schematics



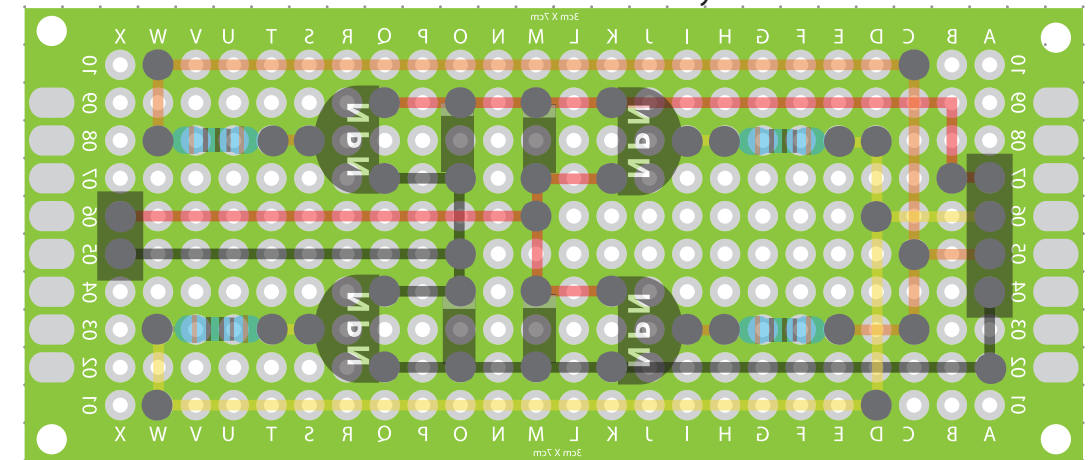
Materials:

- 1 3x7cm circuit board
- 2 6x7mm push switch
- 6 Pin type bridge connectors
- 2 U-Bridge connectors
- 4 Colors of assorted wires

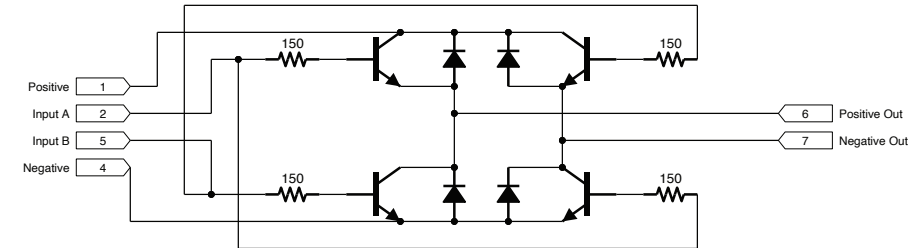
Front View: Circuit Board Layout



Back View: Circuit Board Layout



Electrical Schematics



Materials:

- 1 3x7cm Circuit Board
- 4 Bridge Pins
- 1 2-Pin Female Bridge
- 4 N4001 Diodes
- 4 S9013 NPN Transistor
- 4 100Ω Resistor
- 4 Colors of assorted wires

Notes: This circuit can drive a small motor (i.e. 10rpm geared motor that operates between 5-9v)

Project: Digital H-Bridge Control Circuit

Client:

5mm Dot Grid
Scale:
2:1

Designer: Scott A. Campbell

Builder:

Project: Transistor Based Digital H-Bridge

Client:

5mm Dot Grid
Scale:
2:1

Designer: Scott A. Campbell

Builder: