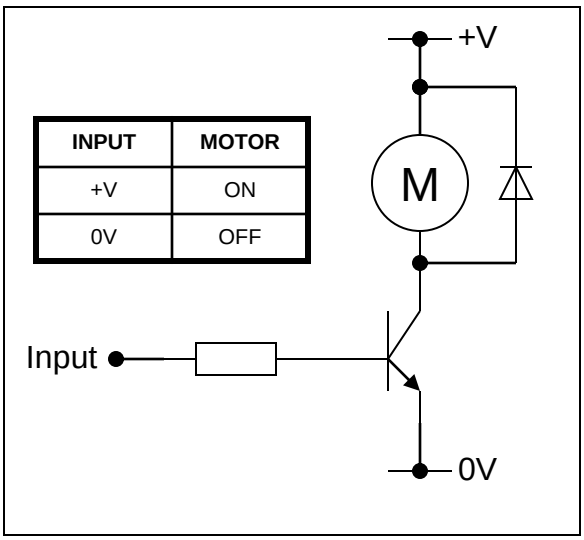
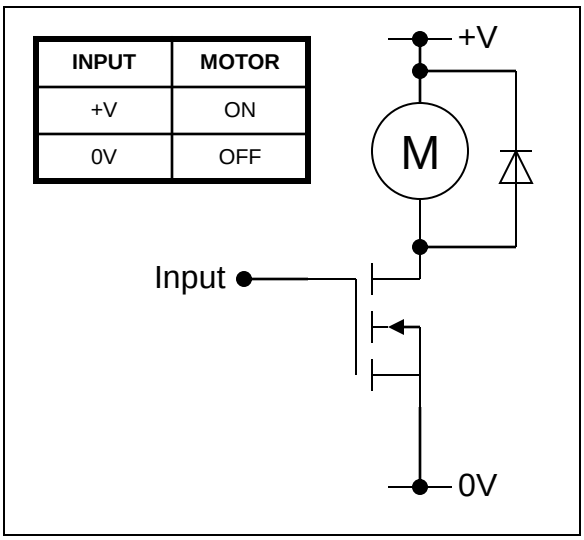
Unidirectional Motor Control

The circuits shown below allow digital and microcontroller signals to switch motors on and off. Bipolar transistors are usually cheaper than MOSFETS (Metal Oxide Smiconductor Field Effect Transistor) but not as efficient. Also MOSFETS can be capable of delivering very high currents.

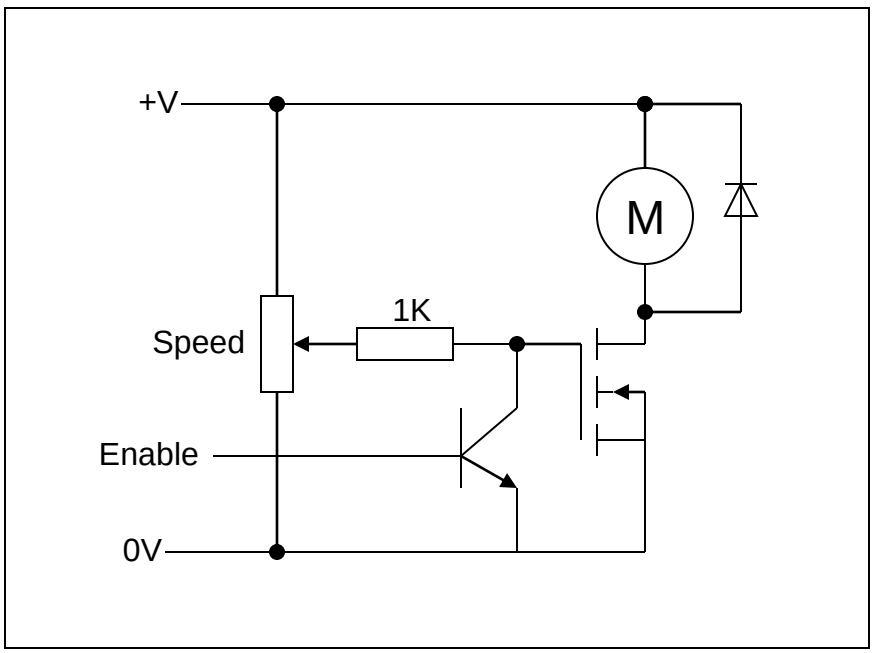
The diodes in all of the circuits are used to protect the transistors from any back EMFs generated by the motors. This is because motors are inductive components, just like relays.



An NPN bipolar transistor motor driver



N-channel MOSFET motor driver

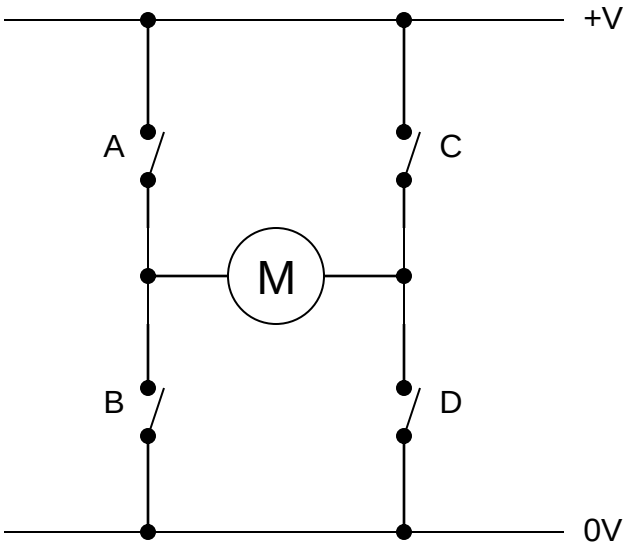


Motor driver with speed control

Bi-directional Motor Control
(H-Bridge Circuit)

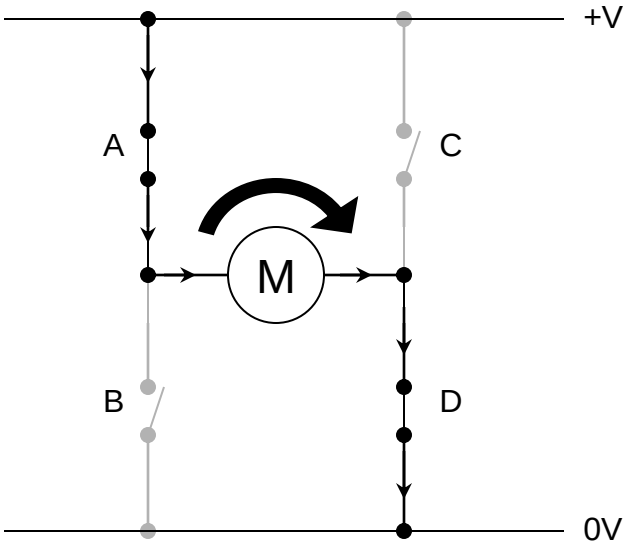
EJC

An H-Bridge allows directional control of a DC motor by directing current flow through the motor using and arrangement of switches. The example below shows a very simple switch operated system. In a real system the switches are generally replaced with relays or transistors.

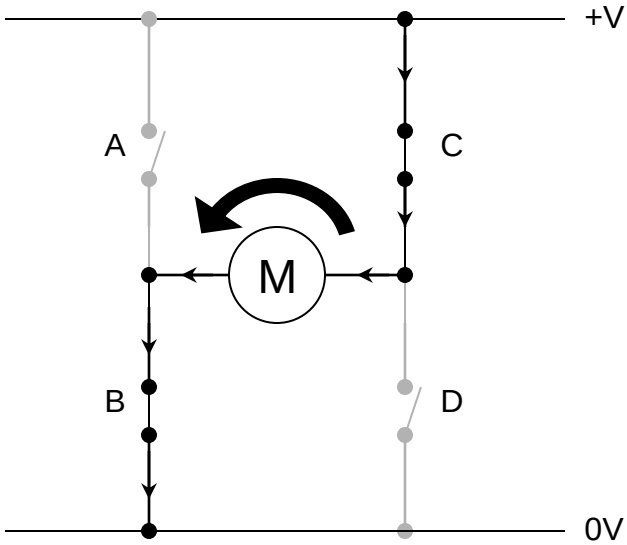


Basic switch based H-Bridge

A	B	C	D	Motor
OFF	OFF	OFF	OFF	OFF
ON	OFF	OFF	ON	Clockwise
OFF	ON	ON	OFF	Anti-clockwise
ON	ON	ON	ON	Not Allowed



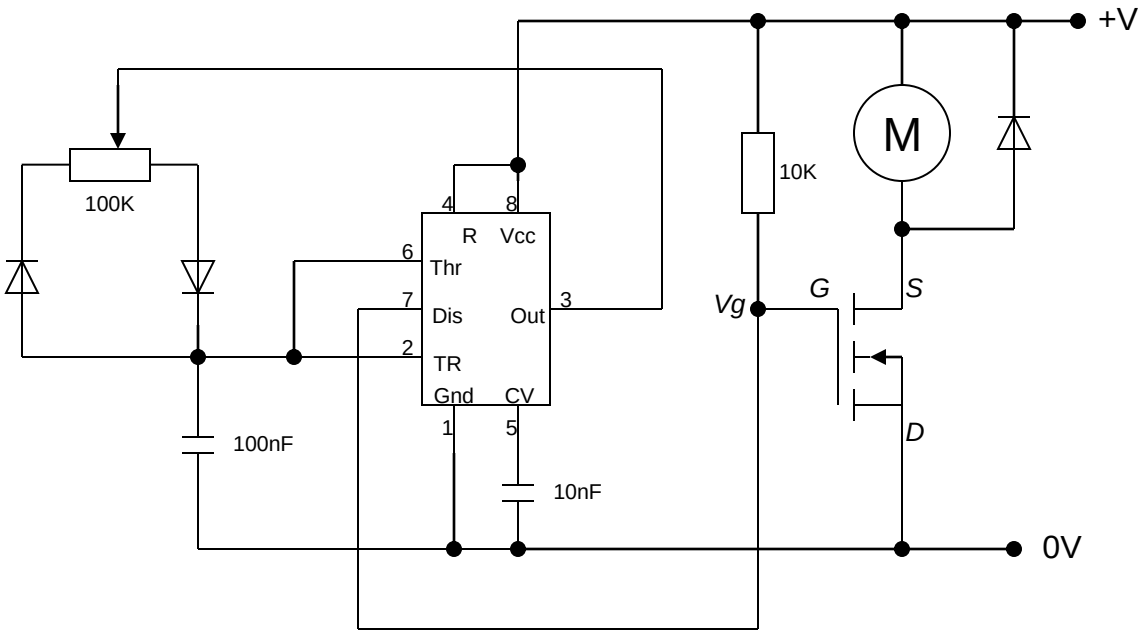
Motor running clockwise

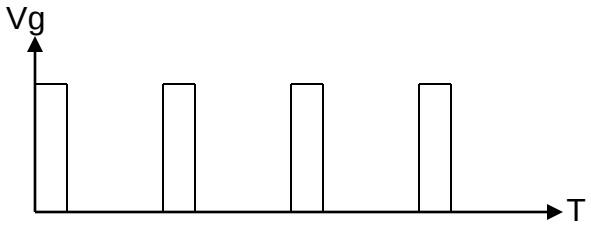


Motor running anti-clockwise

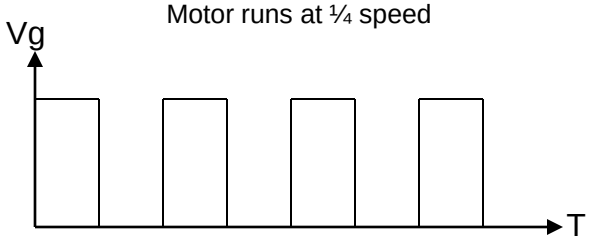
Motor Speed Control
Pulse Width Modulation (PWM)
(Unidirectional)

EJC

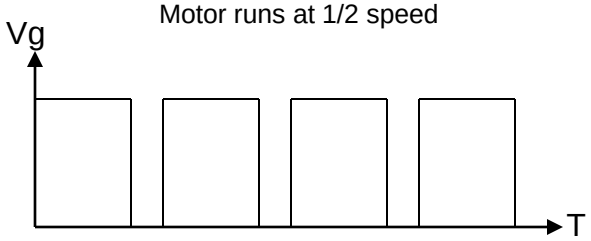




M/S Ratio: 1:4
Motor runs at ¼ speed



M/S Ratio: 1:2
Motor runs at 1/2 speed



M/S Ratio: 3:4
Motor runs at 1/2 speed

The 555 based circuit produces a train of pulses which causes the transistor to be switched on and off at the same rate. The frequency of the output of the 555 is always constant but the length of the pulses can be adjusted with the variable resistor.

If the pulse is long then the motor is turned on for a longer period per second. Therefore the motor runs faster.

If the pulse is short then the motor is turned on for a shorter period per second and therefore runs slower.