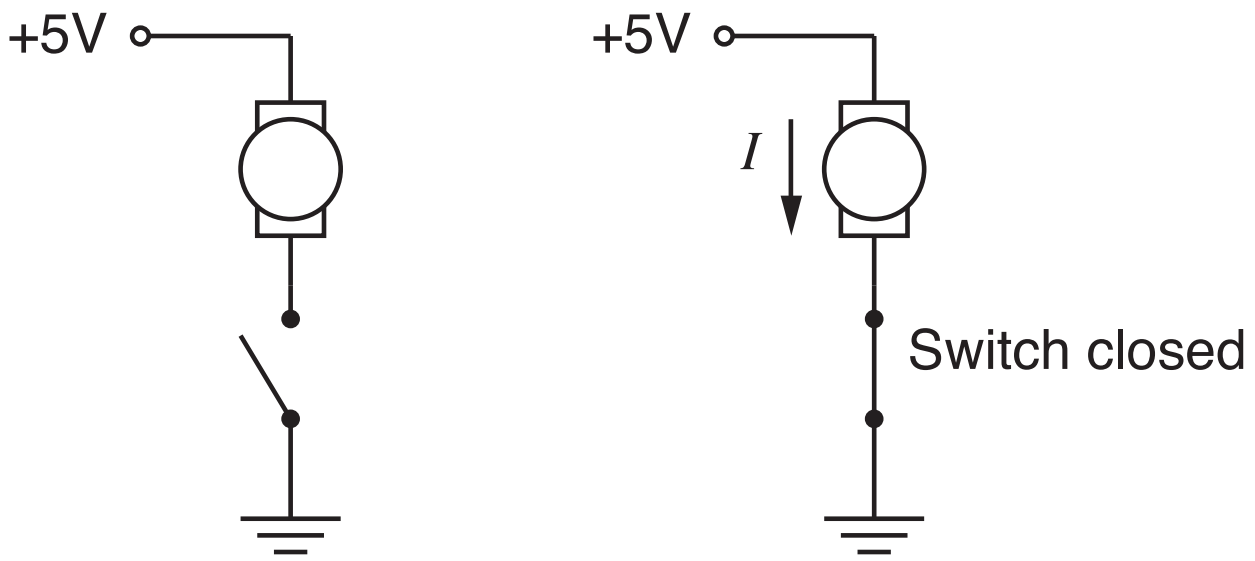
Basic DC Motor Circuits

Desktop fan project
EAS 199A, Fall 2011

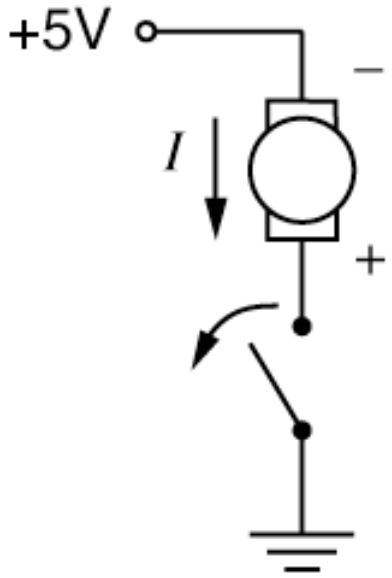
Simplest DC Motor Circuits

Connect the motor to a DC power supply



Current continues after switch is opened

Opening the switch does not immediately stop current in the motor windings.

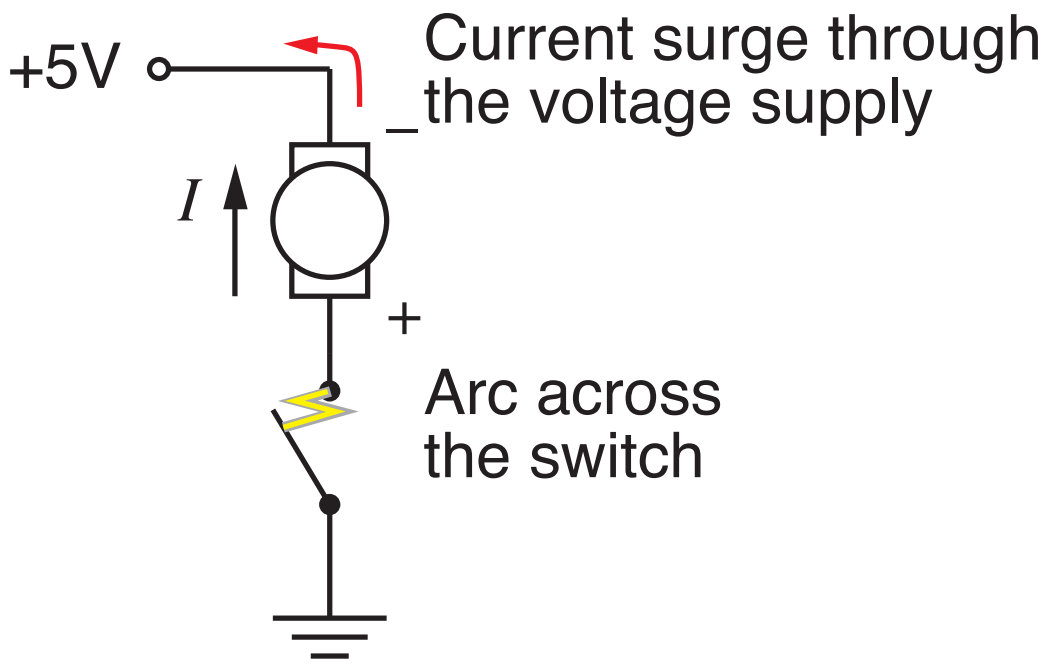


Inductive behavior of the motor causes current to continue to flow when the switch is opened suddenly.

Charge builds up on what was the negative terminal of the motor

Reverse current

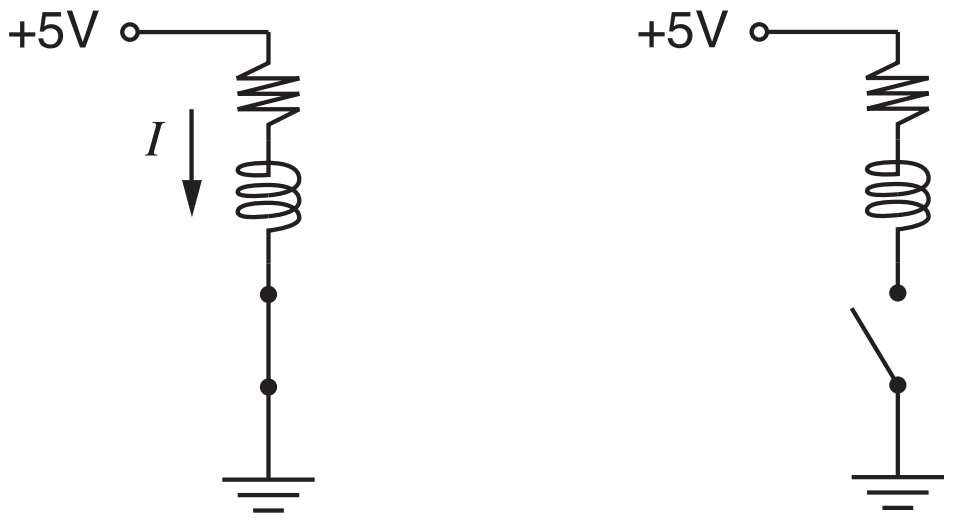
Charge build-up can cause damage



Motor Model

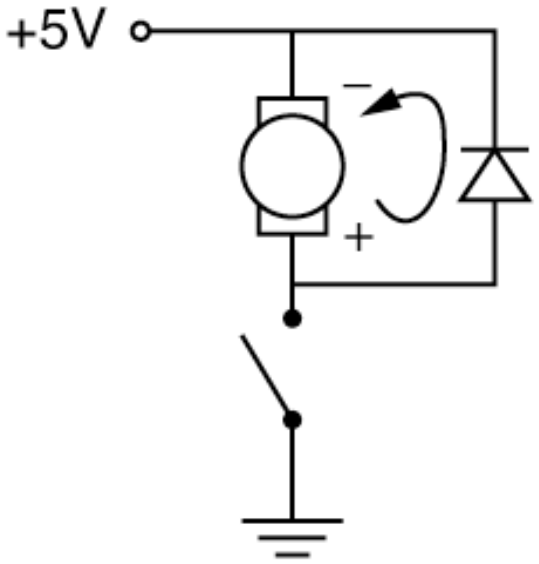
Simple model of a DC motor:

- Windings have inductance and resistance
- Inductor causes a storage of electrical charge in the windings
- We need to provide a way to safely dissipate the charge stored in the motor windings



Flyback Diode

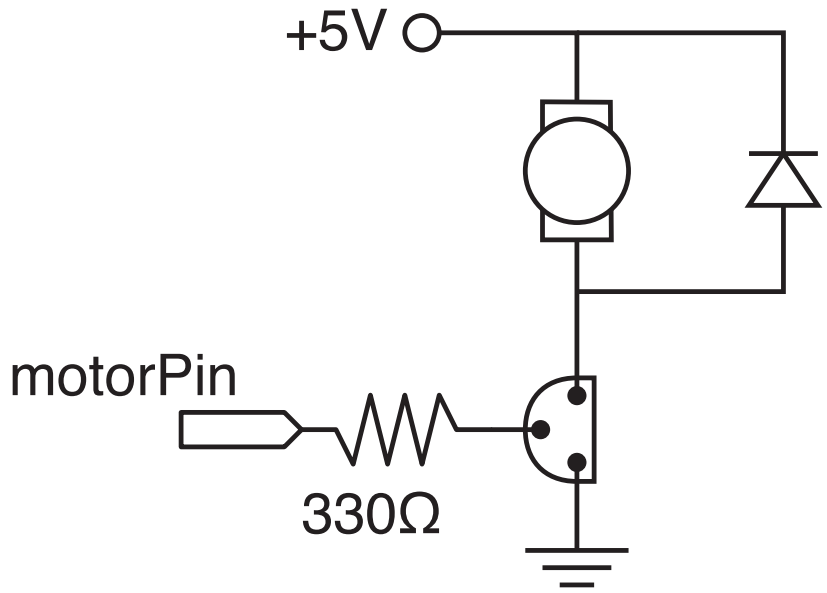
A flyback diode allows the stored charge to dissipate safely



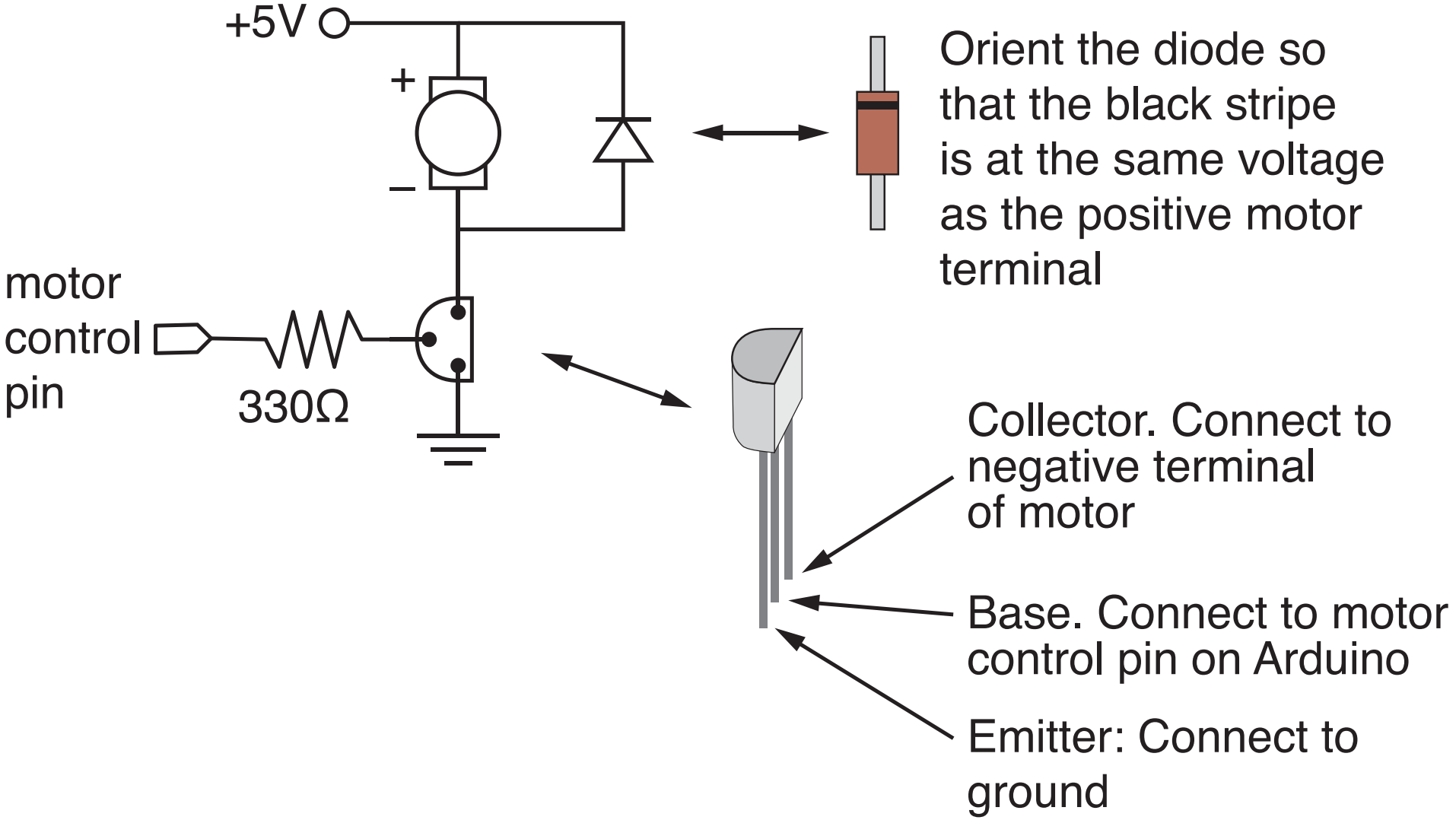
The flyback diode allows charge to dissipate without arcing across the switch, or without flowing back to ground through the +5V voltage supply.

Replace the Switch with a Transistor

A transistor allows on/off control to be automated and it allows switching of more current than an Arduino digital pin can supply.



Diode and transistor orientation



Control the DC motor with PWM Output

```
//  Function:  PWM_output
//
//  PWM output to control a DC motor

int  motor_pin = 5;        // must be a PWM digital output

void setup()
{
  pinMode(motor_pin,  OUTPUT)
}

void loop()
{
  int  motor_speed=200;   // must be >0 and <= 255

  analogWrite( motor_pin, motor_speed);
}
```