Arduino 201

Making it do some work

Midcoast Mini Maker's Faire
9/12/2015

Giving the Arduino muscle

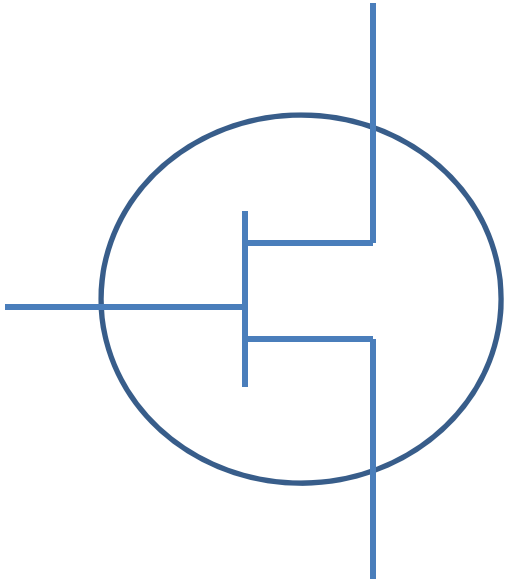
On its own the Arduino is pretty smart but puny. The Atmel microcontroller (a.k.a. “The brain”) can only output a few milliamps. That is nowhere near enough to drive a steel shredding battlebot. To get more muscle or power we use something called a transistor. One of its forms looks like this:

The three pins coming out the bottom are :

We often use this schematic shorthand

Equals

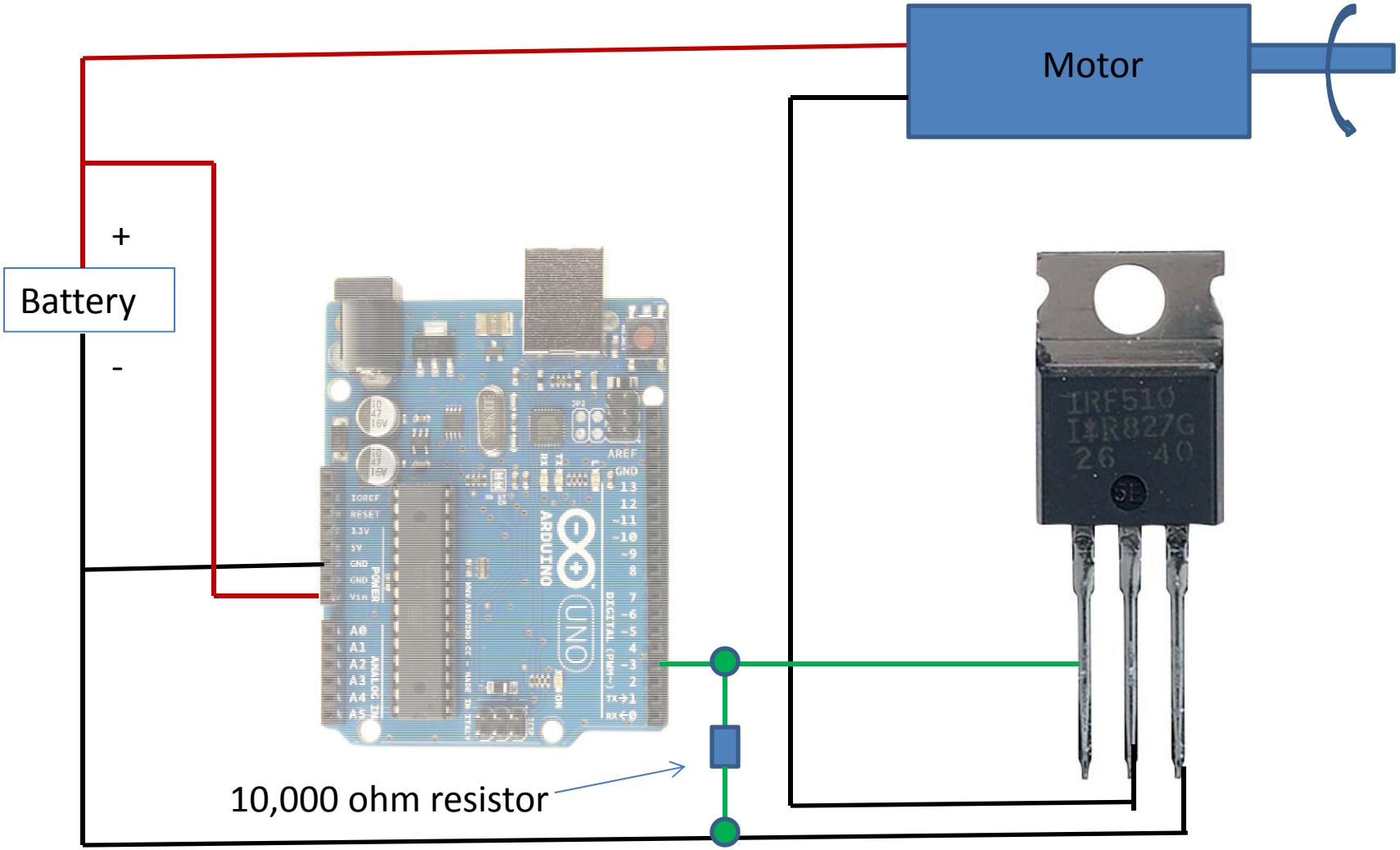
Gate
(The control pin)



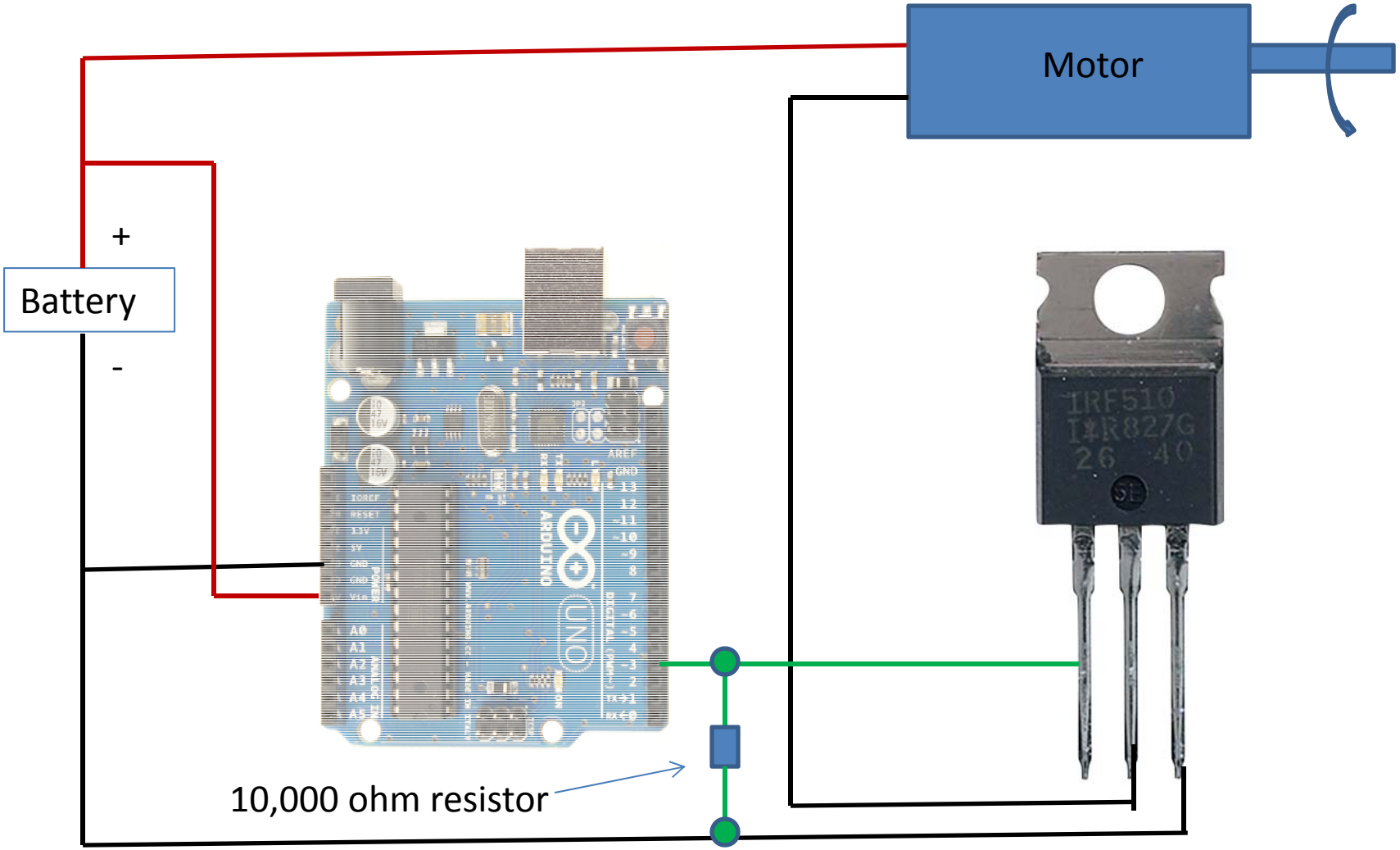
Drain
(Load current in)

Source
(Load current out)

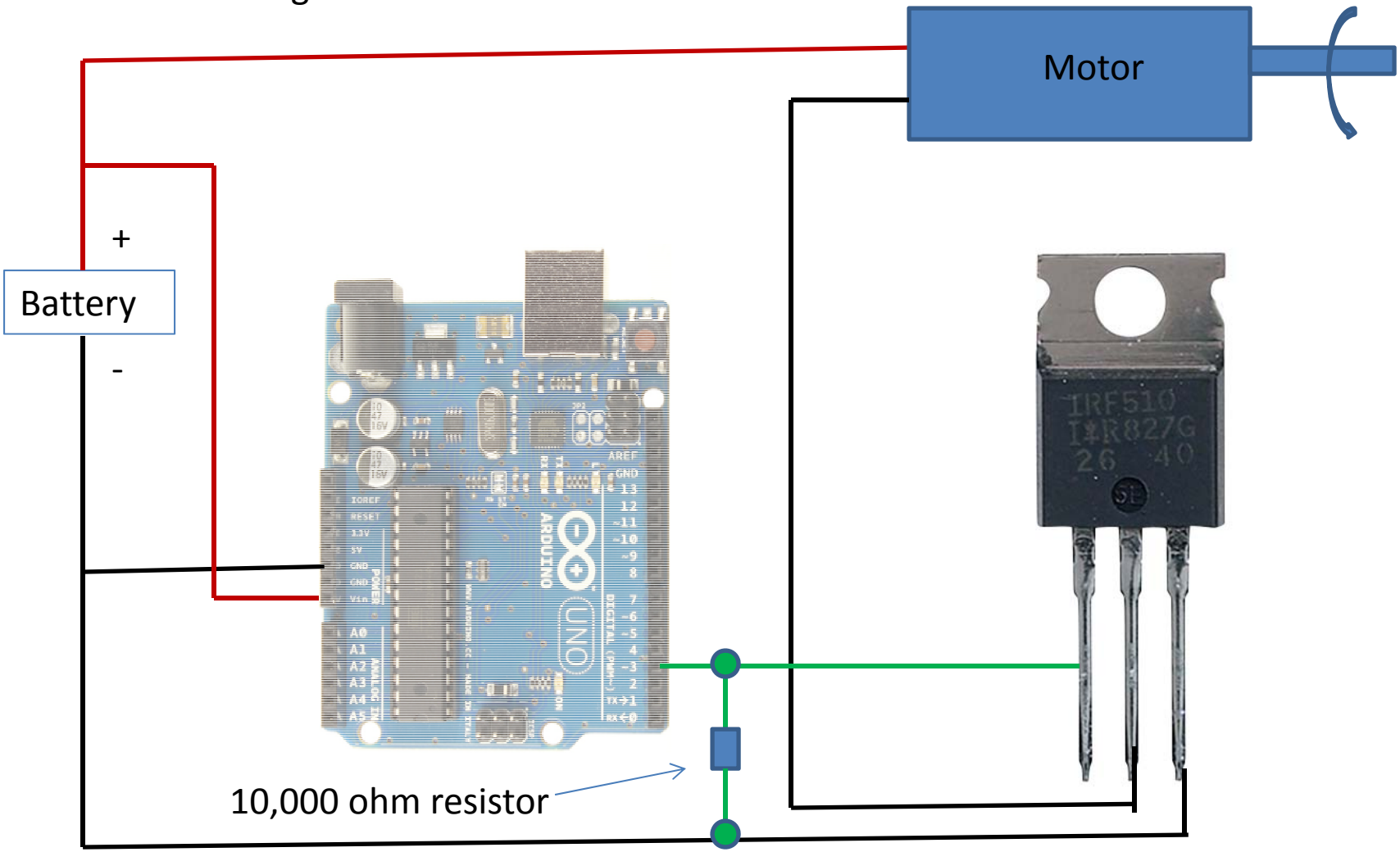
For this example we will use the N-channel metal oxide field effect transistor(MOSFET) as a switch on a motor's negative wire. If you want the ARDUINO to turn on a large DC motor you could wire it like this:



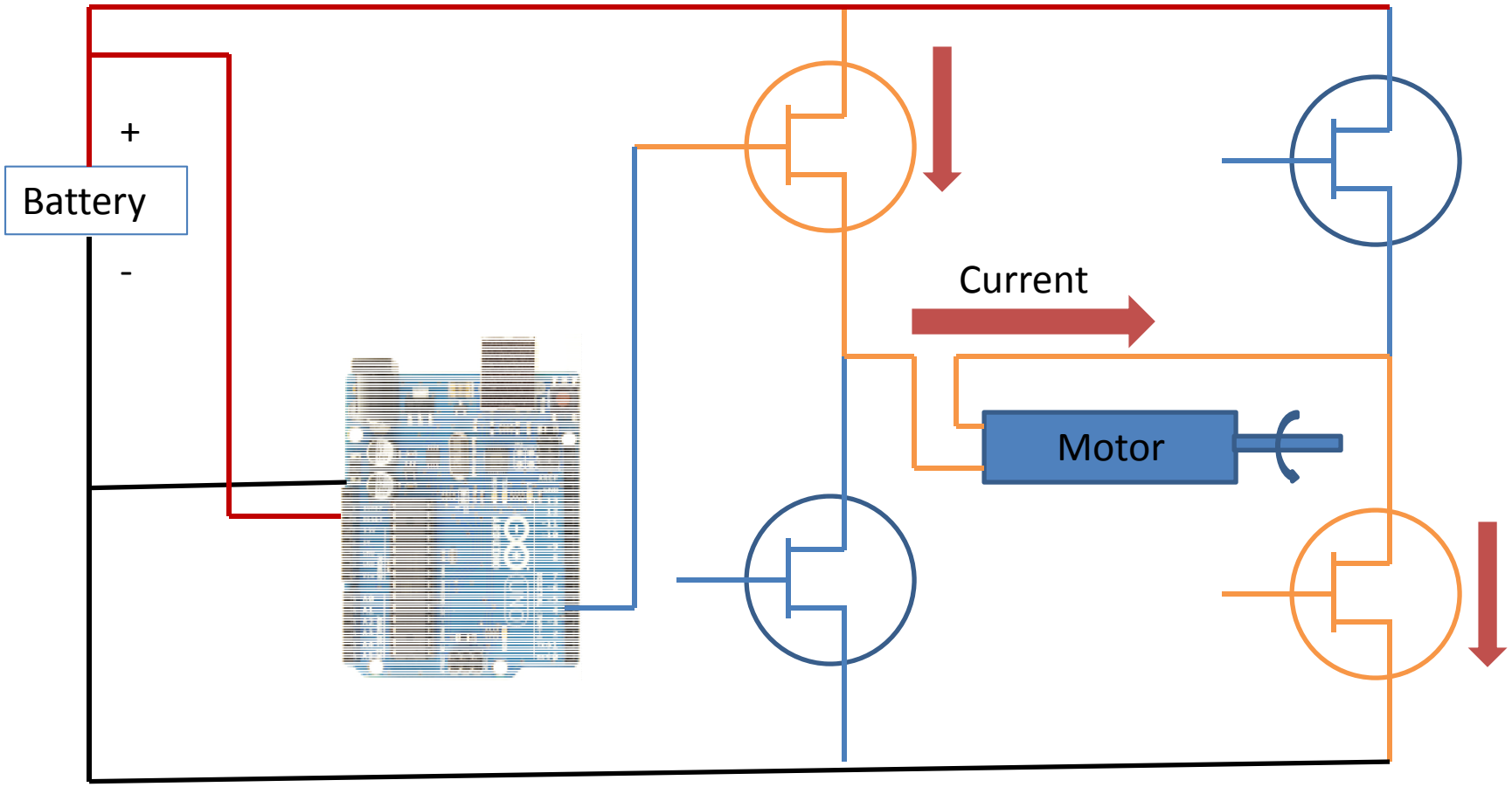
Now whenever we tell the Arduino to make pin 3 “high” or have 5V on it, the motor will spin. DO NOT leave out the 10k ohm resistor or the transistor will not discharge and the motor will keep running once it has been started.



If we really want to be trick we can turn on pin 3's pulse width modulation and make the motor run at variable speeds. PWM outputs a very fast set of pulses which are "on" a variable percentage of the time. The result is that the motor "feels" like it is receiving more or less voltage.



OK great. I can make a rock crushing, steel shredding robot go forward, but what if I need it to back up??? This is where we use something called an H-bridge.

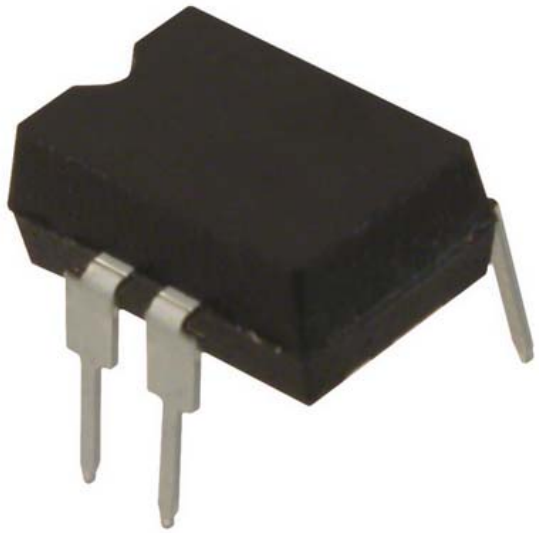


By turning on opposite diagonals on the bridge we can reverse the motor current and therefore the rotation direction.

BUT!! There is a problem. Transistors in general want to see about 5V between the gate and source. Things get dicey when there are parts stacked up and motors have varying voltages so you can't blindly run a line from the Arduino output pin.

The better way is to have an optically isolated independent voltage generating source like this:

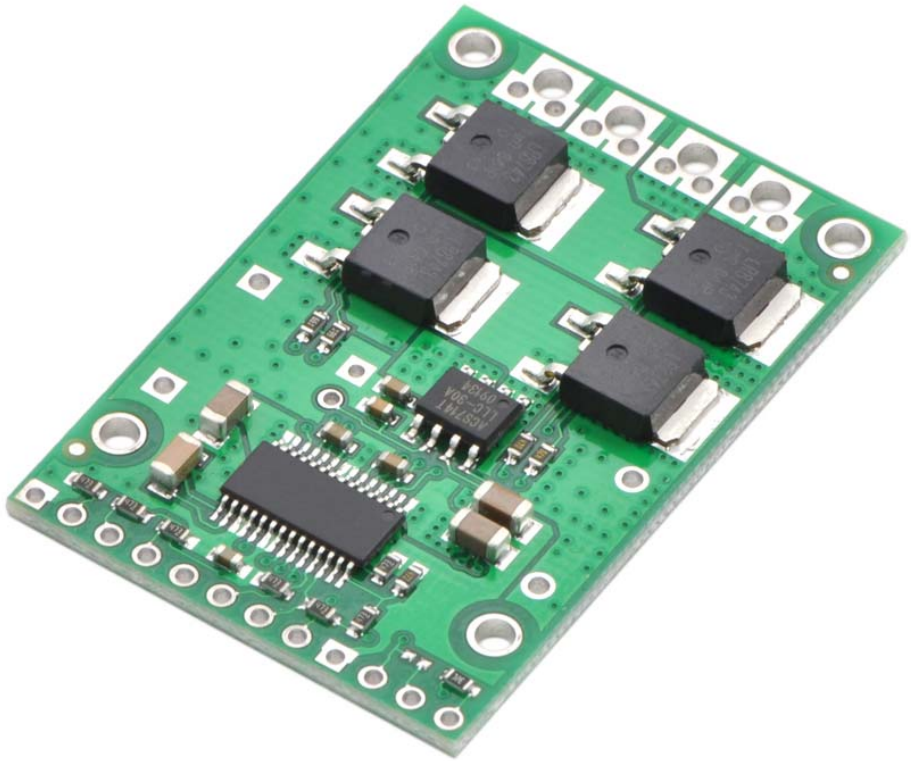
http://www.irf.com/product-info/datasheets/data/pvin.pdf



It is a PVI-N from International Rectifier. Inside the case is an LED shining on a photovoltaic cell so it can make a completely independent 5 or 10VDC. They are specifically designed to drive power MOSFET's. Just place the positive output on the transistor gate and the negative output on the source. Light the LED to turn things on.

Still sounding too hard??? You can always buy one of these:

https://www.pololu.com/product/1455



30V and 25A is a lot of power for $60

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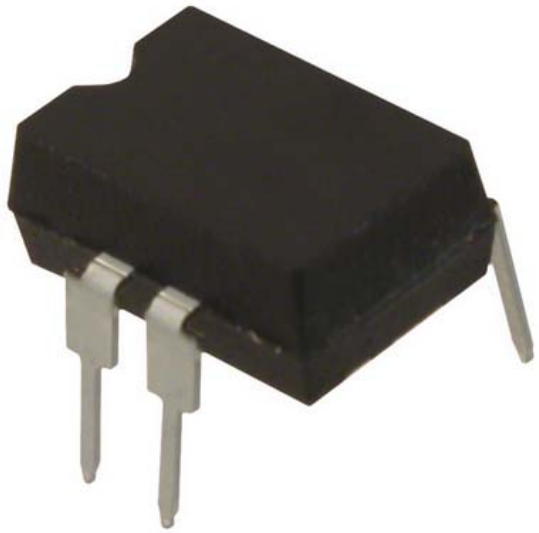

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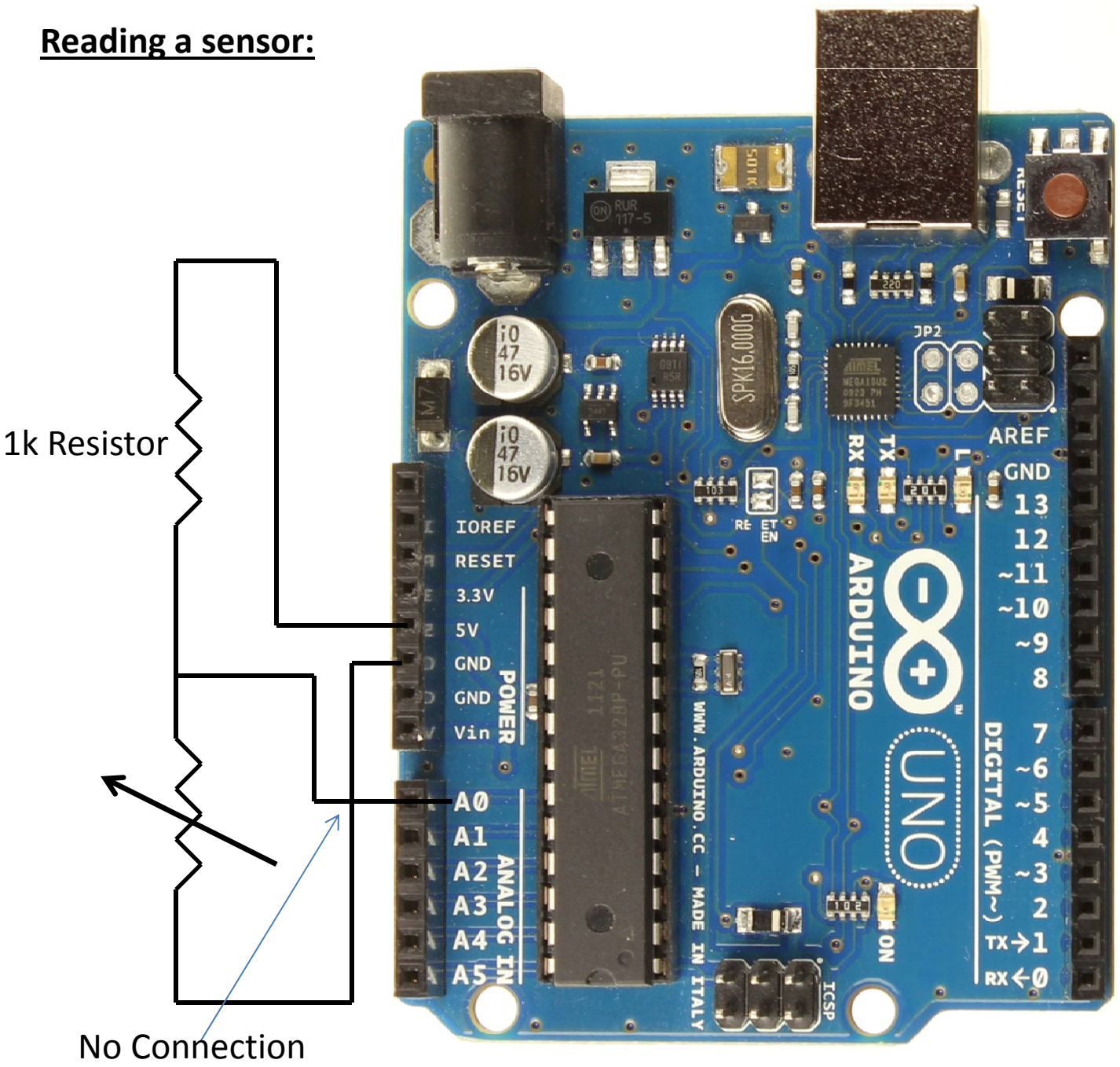
Reading a sensor:



This is how a photocell or thermistor is read.

Running an RC servo:

Running a model airplane servo with an Arduino is a very simple task. In fact there is a prewritten example for it. A servo is controlled by sending out a pulse fifty times per second. The longer the pulse is, the more the servo arm deflects :