

Controlling Voltage with a MOSFET

(G Payne – 2016)

WARNING: The following demonstration is limited to a maximum 12 volts and 1 amp of current load as limited by the TO-220 40V 1A N-channel MOSFET. DO NOT EXCEED these voltage and current ratings. For larger voltages and currents, you should consult other resources and professionals. ELECTRICITY CAN CAUSE DAMAGE TO PROPERTY AND INJURY OR DEATH. BE CAREFUL!

A MOSFET (Metal Oxide Semiconductor Field Effect Transistor) is a type of transistor that can switch voltages and currents larger than those that can be supplied by the Arduino directly.

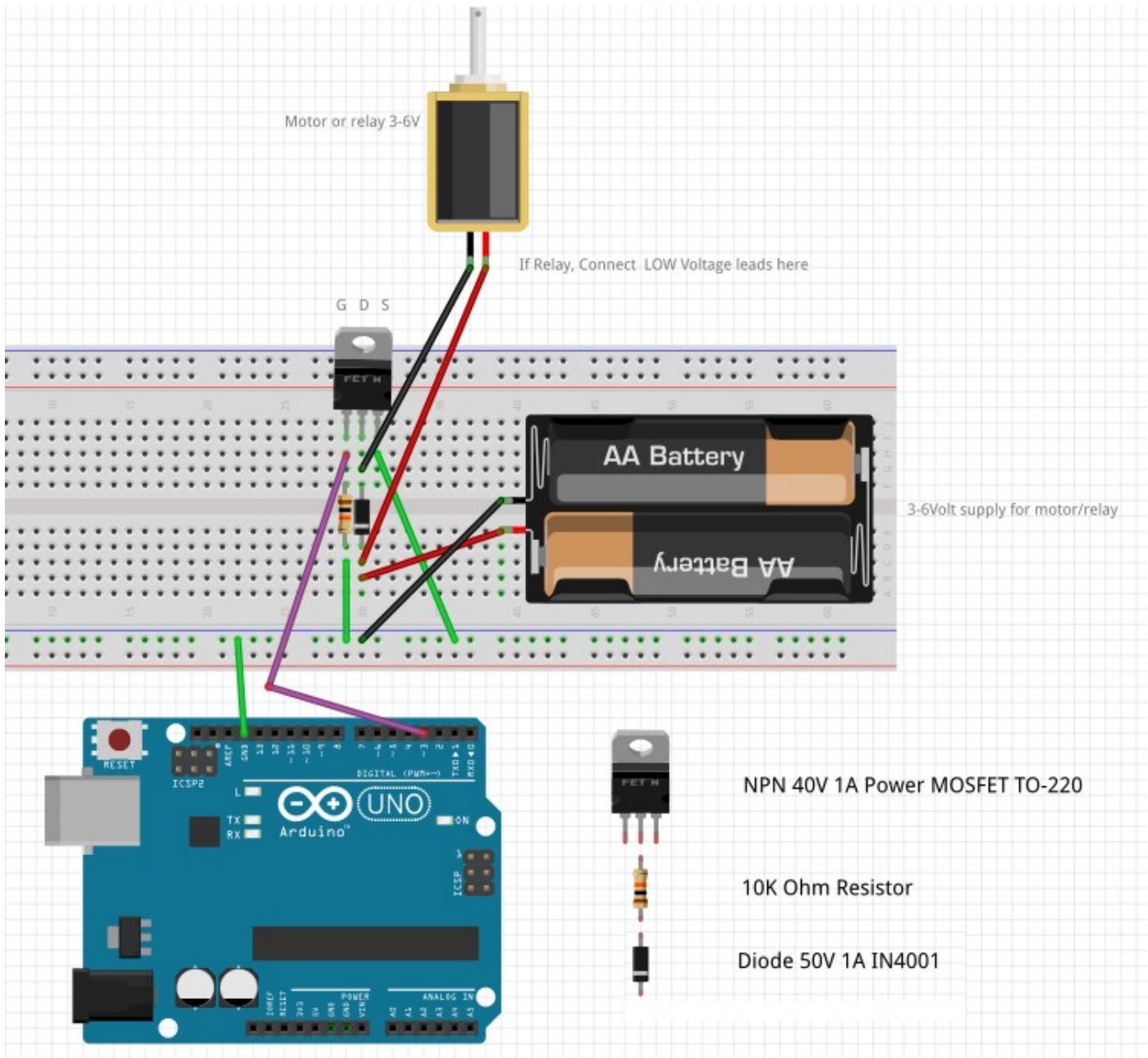
We will use a MOSFET to turn off/on a small motor based on characters entered in the Arduino Serial Monitor.

Parts Needed:

-Arduino board and breadboard	-1 IN4001 or similar diode
-1x NPN 40V 1A Power MOSFET (TO-220)	-1 x 10K resistor
-1x 3v-6v motor or SPST relay	-Connecting wires
-1x 3v-6v battery pack (match the load voltage)	

Demo:

Connect up the parts on the breadboard and connect it to the Arduino as shown.



The 10K resistor on the Gate pin of the MOSFET pulls the Arduino side of the circuit's voltage down to ground(GND) until pin 3 is energized. When pin 3 is energized it sends 5 volts to the Gate pin on the MOSFET. This now allows current to flow from the Source pin to the Drain pin on the MOSFET. The current flows from the Drain pin and closes the circuit allowing the LOAD (the motor, light or relay) to now operate. The diode is in place to prevent a back-current surge that can occur when the power is turned off. This potential surge can damage the MOSFET or the Arduino. THE STRIPE ON THE DIODE POINTS IN THE DIRECTION THE CURRENT SHOULD FLOW WHEN THE CIRCUIT IS ENERGIZED.

When pin 3 goes LOW, the Gate on the MOSFET stops the flow of voltage from Source to Drain and the load turns off.

Enter the code below and upload it to the Arduino.

```
// Demonstrates the use of a MOSFET to switch a LOAD voltage ON/OFF via the Serial Monitor
// 2016 - Gordon Payne
// works with MOSFET Arduino circuit
// Read data from the serial nibutir and turn ON or OFF a motor depending on the value

char val; // Data received from the serial port
int ledPin1 = 3; // Set the pin to digital I/O 3

void setup() {
  pinMode(ledPin1, OUTPUT);
  Serial.begin(9600); // Start serial communication at 9600 bps
  digitalWrite(ledPin1, LOW); // turn the pin OFF
}
void loop() {
  if (Serial.available()) { // If data is available to read,
    val = Serial.read(); // read it and store it in val
    Serial.println(val);
  }
  switch (val) {
    case '1': // If '1' was received
      digitalWrite(ledPin1, HIGH); // turn the motor ON
      break;
    case '0': // If '0' was received
      digitalWrite(ledPin1, LOW); // turn the motor OFF
      break;
    default:
      break;
  }
}
```

Now select the Serial Monitor from the Tools menu. Type a '1' and press the 'Send' button. The motor should turn ON. Type a '0' and press the 'Send' button. The motor should now go off.

Congratulations!

CHALLENGE – Instead of a motor, install a 3-6V SPST relay into the circuit where the motor leads were installed. You want to attach the SOURCE or LOW VOLTAGE leads of the relay (the green ones) to the breadboard. The LOAD or HIGH VOLTAGE leads can be connected to an external power source and device and you can then turn that device on/off with the circuit as before. **WARNING! DO NOT EXCEED THE MAXIMUM VOLTAGE AND CURRENT of the attached relay. Check with your teacher or other professional if in doubt.**

A quick note about motors. You cannot drive a motor in forward and reverse using just one or two MOSFETS. If you wish to be able to reverse a motor, you will need to use a 2 or 4 channel H-Gate chip like a Texas Instruments L293D or similar H-Gate. You can consult online tutorials for information on this technology.

For more information on MOSFET usage, see <http://bildr.org/2012/03/rfp30n06le-arduino/>

Now go out and MAKE SOMETHING AMAZING!!!!