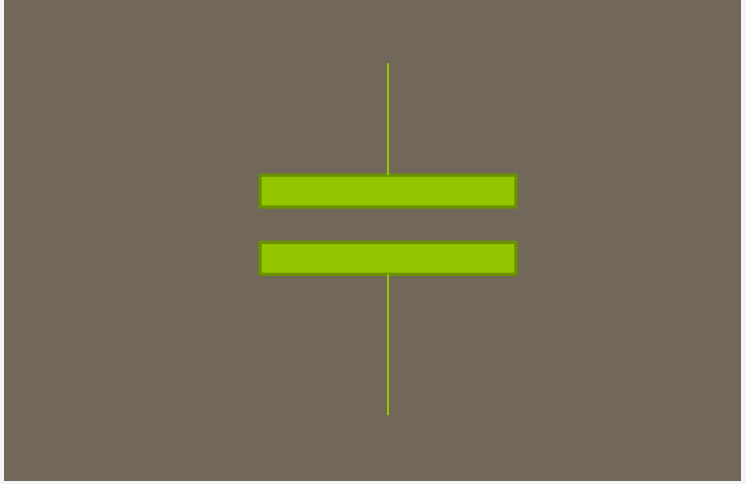


MOSFET Touch Sensor Project

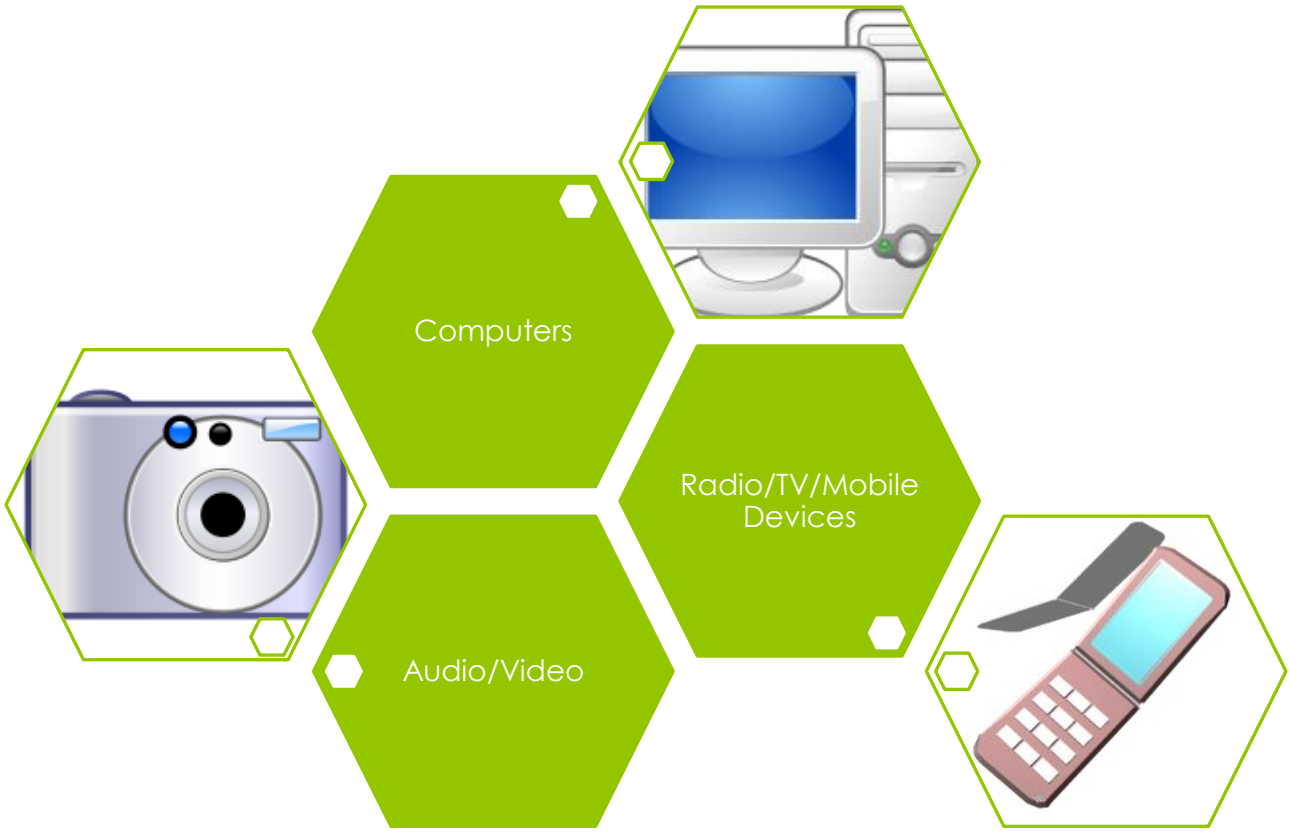
By Angsuman Roy

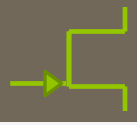
Overview and Objectives

- We will be building a touch controlled light circuit.
- After doing this project:
  - Understand basic electrical concepts and how to apply them in the real world
  - How to use a breadboard and connect electronic components together
  - Gain confidence to move on to more complicated circuits

What are electronics?

- The use of electricity for the creation and manipulation of information.

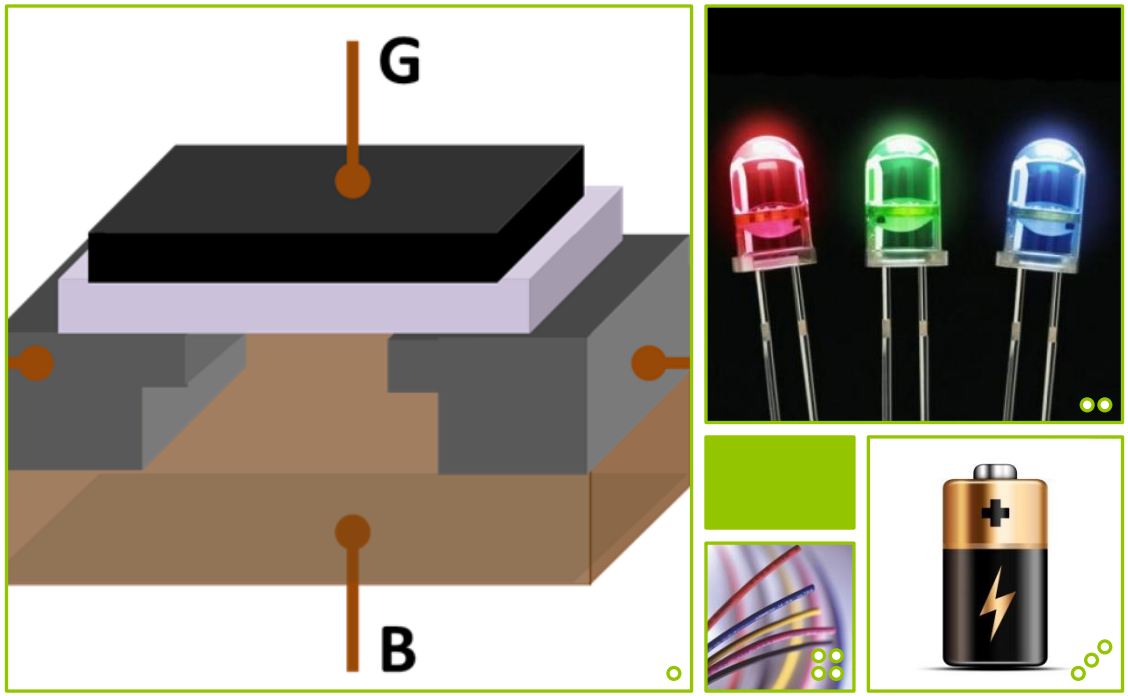




What do we want to make?

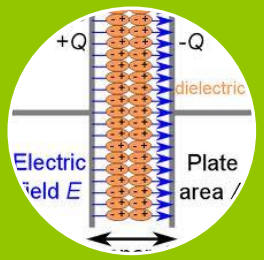
- Touch sensors are used everywhere, most commonly in mobile devices.
- We will investigate the principles that make this possible.
- Start with the simplest case of a touch switch turning a light on and off.

Is it possible? Do all the parts exist?



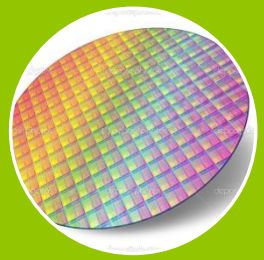
Switch Light Power Source Connections

Making a Switch by Using Physical Phenomena



Capacitance

- The ability of an object to store an electrical charge.

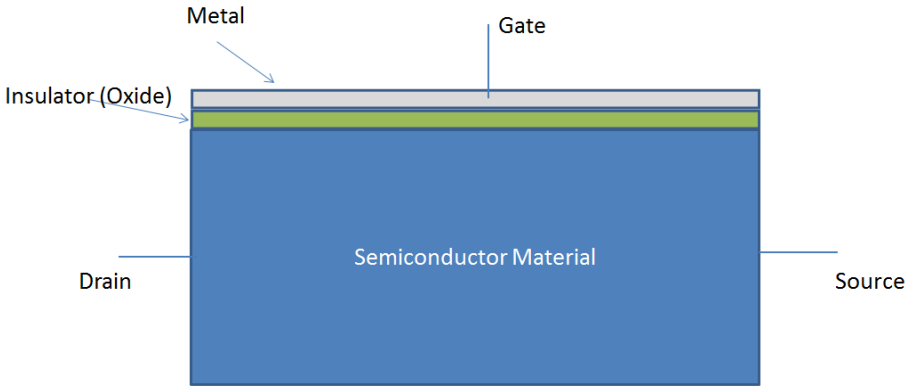


Semiconductors

- Act as insulators under some conditions
- Act as conductors under some conditions

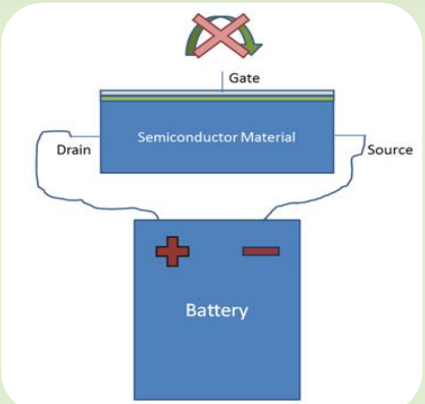
Marrying the two results in the MOSFET.

- Metal-Oxide-Semiconductor-Field-Effect-Transistor (MOSFET)
- A fancy name, but easy to understand.

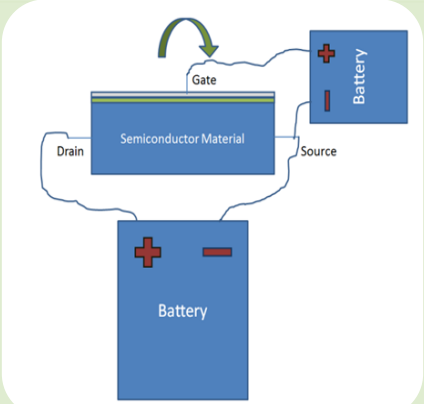


A very simple, conceptual diagram of a MOSFET

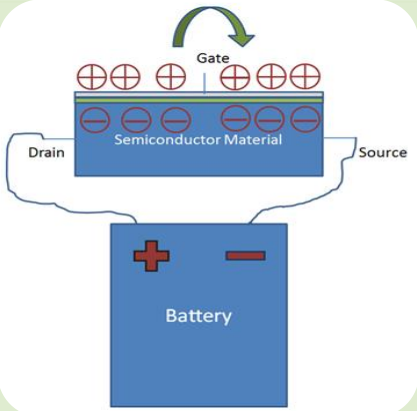
Using the MOSFET



No current flow through the MOSFET.



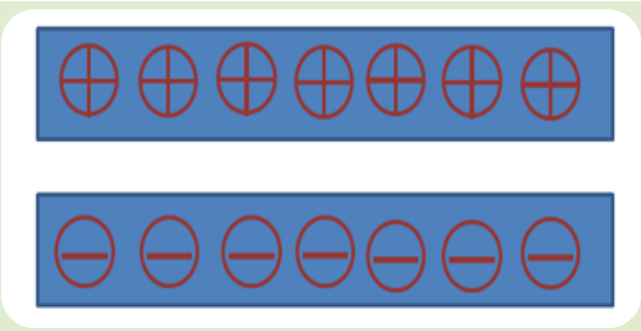
Voltage applied to gate causes current flow.



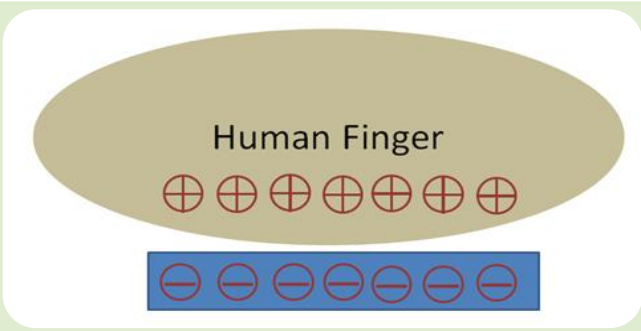
Charge on the gate is responsible for current flow.

Note how a capacitor is formed.

Using a Finger to Transfer Charge



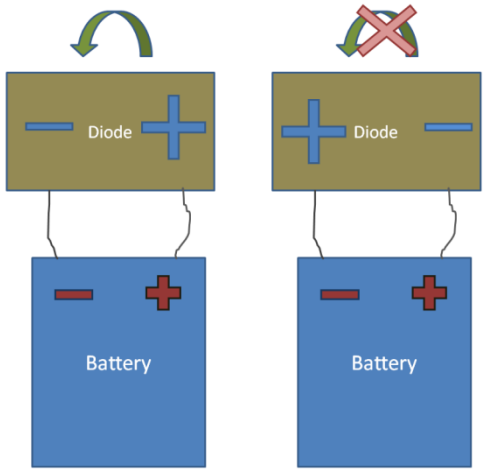
A simple capacitor formed by parallel conductive plates.



A capacitor formed by a finger and a conductive plate. Touching the MOSFET's gate transfers charge from the finger to the gate.

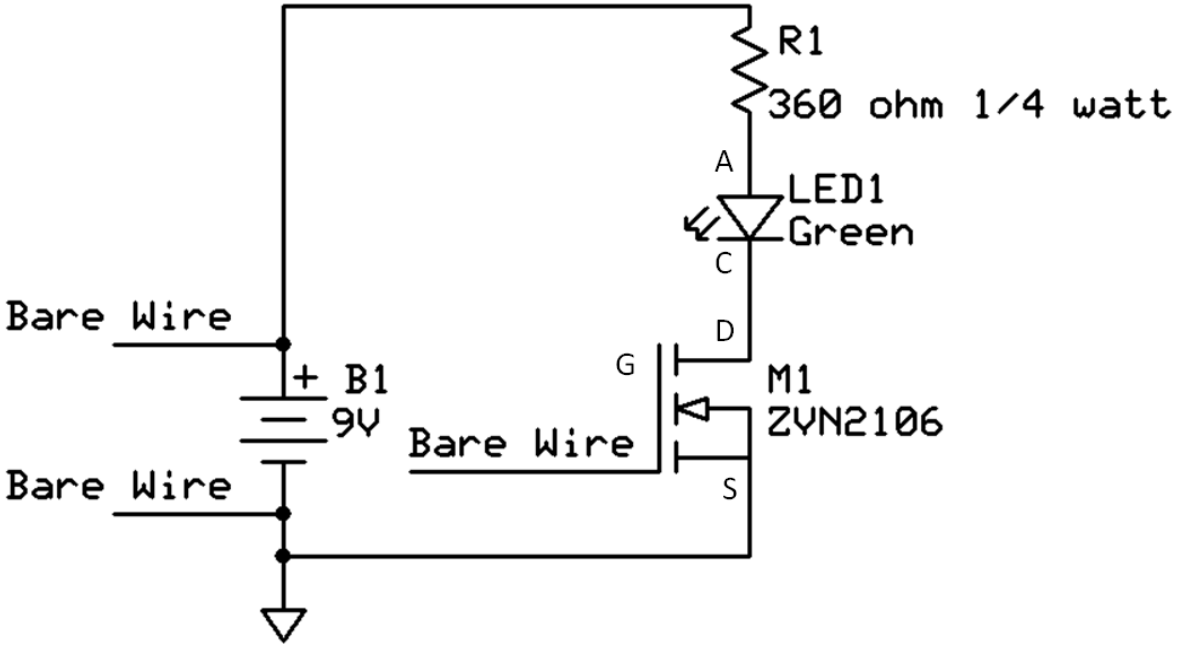
LEDs: A Source of Light

- A light emitting diode (LED) is a device which emits light when current flows through it.



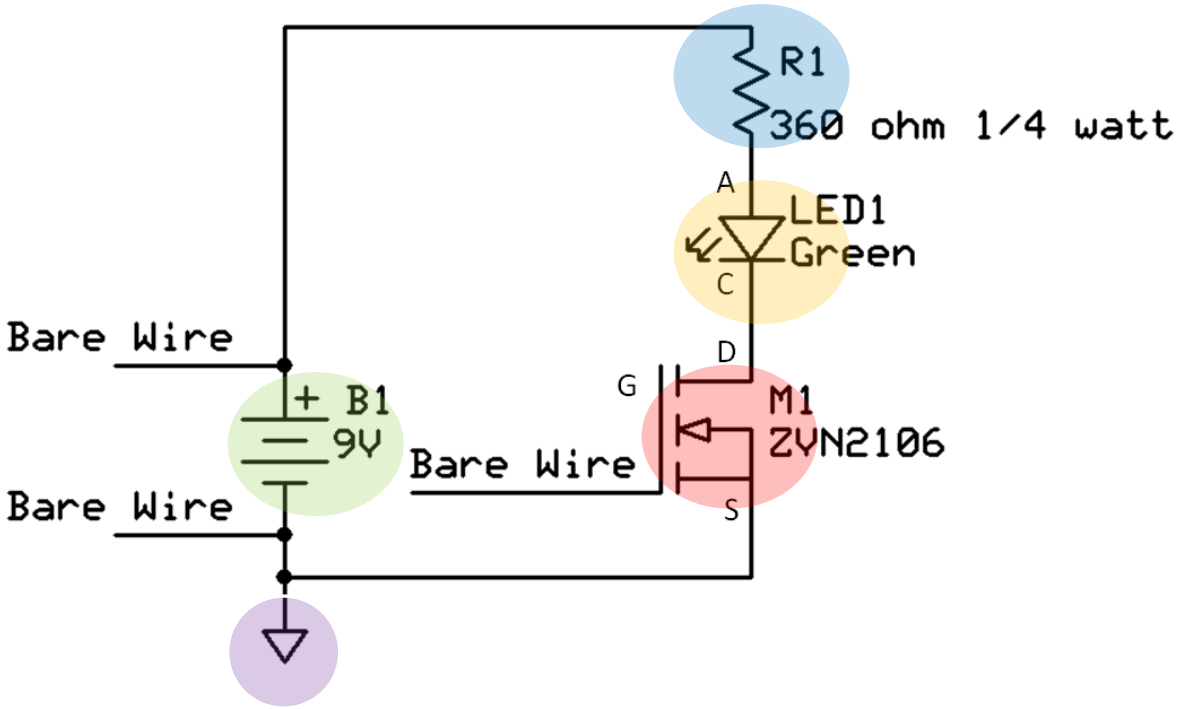
A diode is a device which only allows current to flow when connected in a particular orientation. An LED happens to emit light when connected In this manner.

Enough theory, let's build it already!



This is a schematic of our circuit.
A schematic is a standard way of drawing a circuit and allows other engineers to read your circuit.

Breakdown of Schematic

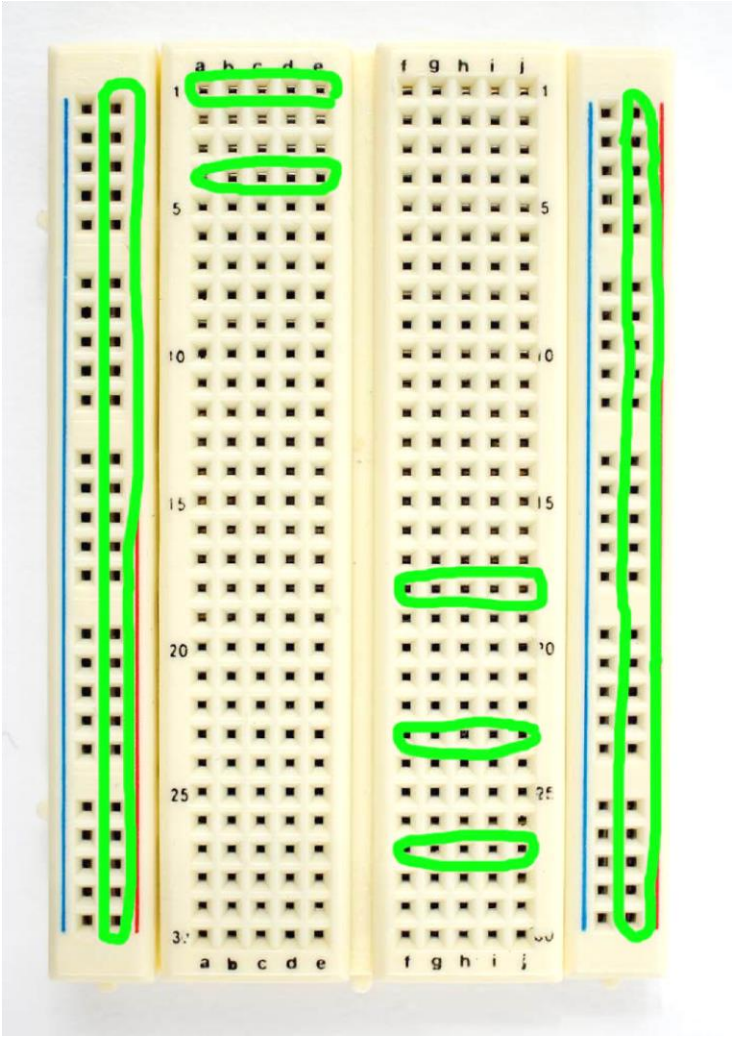


Battery (power source)
MOSFET (switch)
LED (light)
Resistor (used to limit current)
Ground symbol (the point in our circuit that is defined as 0 volts)

Schematics do not tell us how to build the circuit though.

- Infinite ways in which we can physically arrange our circuit.
- As long as the components connect as shown on the schematic, the circuit should work (As circuits become more advanced, this ceases to be true).
- We will use a breadboard to build our circuit.

The Breadboard



Every point in each green circle is connected to every other point in that same green circle.

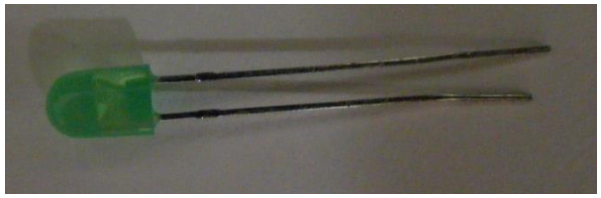
The long vertical columns on the sides of the breadboard are usually used for connecting power.

The area in the center is used for building the rest of the circuit.

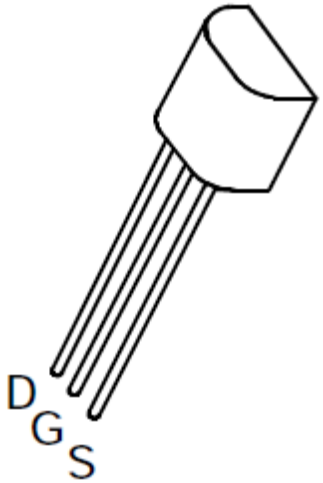
Each row of five points is connected together.

Practical Components

Real components have pin-outs which must be known in order to ensure the circuit built is the circuit on the schematic.

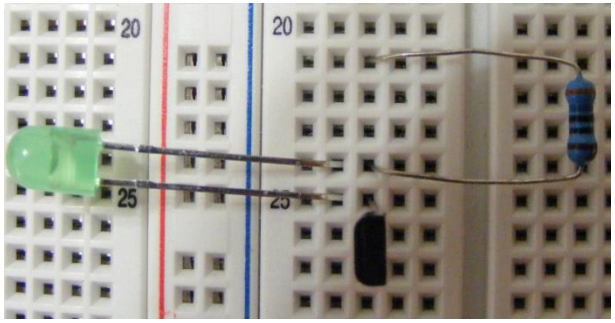


For a standard LED, the longer lead is the anode (+)
and shorter lead is the cathode (-)

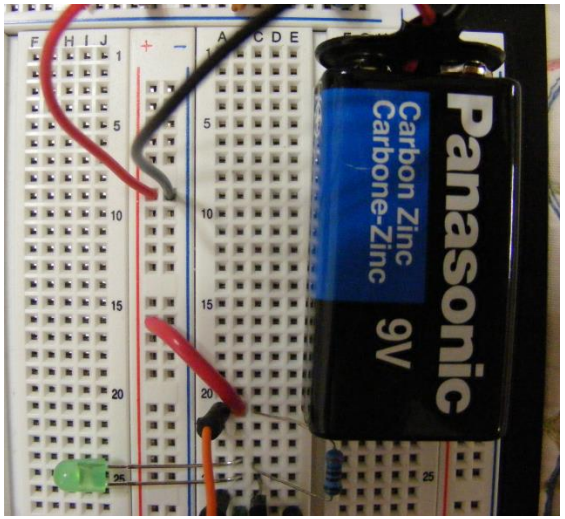


Pin-out of the MOSFET we are using

The Breadboarded Circuit



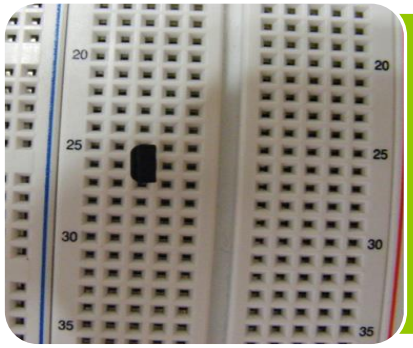
Components inserted into breadboard.



Battery connected to vertical power strips.

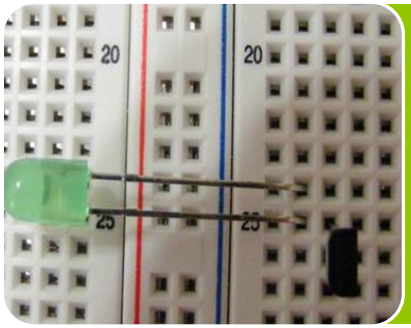
Clear and detailed instructions are given in the project handout.

Step-by-Step Instructions



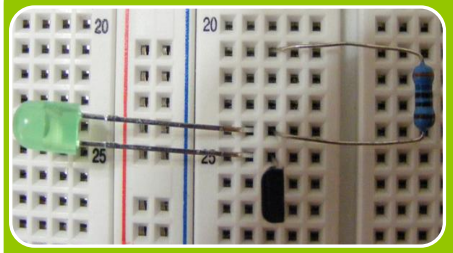
Place MOSFET into breadboard

Follow orientation shown.
Terminals are D, G, S from top to bottom.



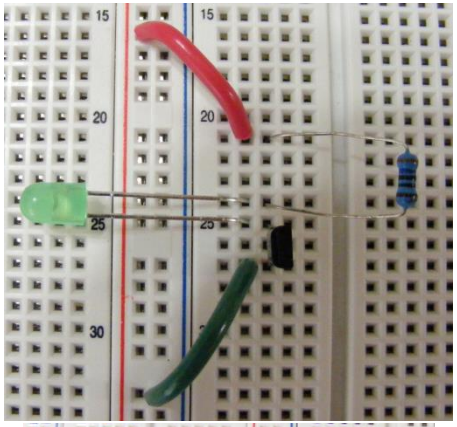
Place LED into breadboard

The shorter lead should be in the same row as the D terminal of the MOSFET.

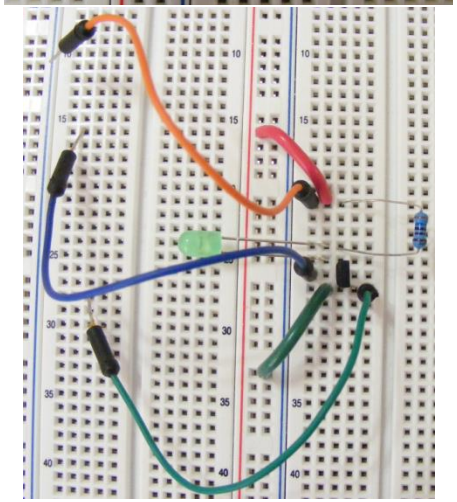


Place resistor in breadboard

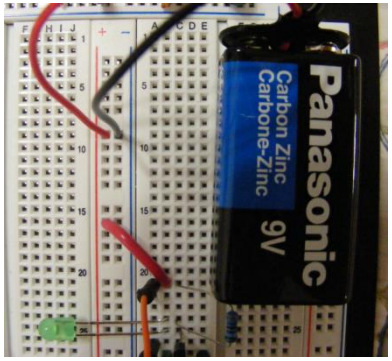
Orientation does not matter. One lead of resistor is in the same as the anode of the LED and the other is in its own row.



Connect two wires as shown, one from the resistor lead to the red vertical strip and the other from the source of the MOSFET to the blue vertical strip.

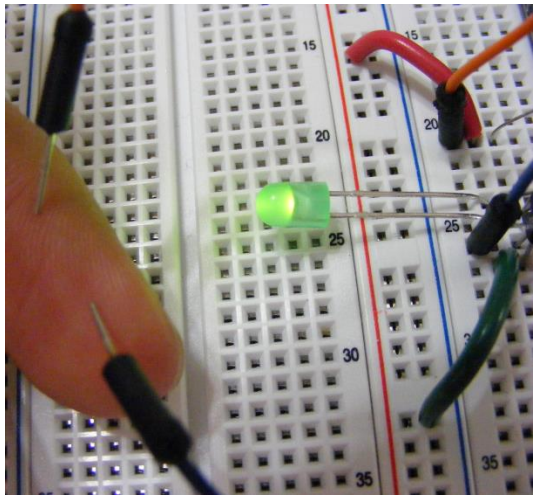


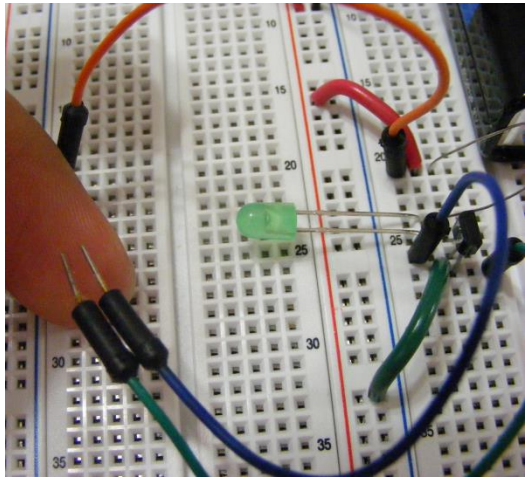
Connect three wires as shown, one to the resistor lead, one to the gate of the MOSFET and one to source of the MOSFET.



Connect the battery clip's positive (red) lead to the red vertical strip and the negative (black) lead to the blue vertical strip.

Circuit in Operation





Touching the wires connected to the positive terminal and gate with a finger turns the LED on.
The LED stays on until wires connected to the gate and source terminals are touched and stay off.