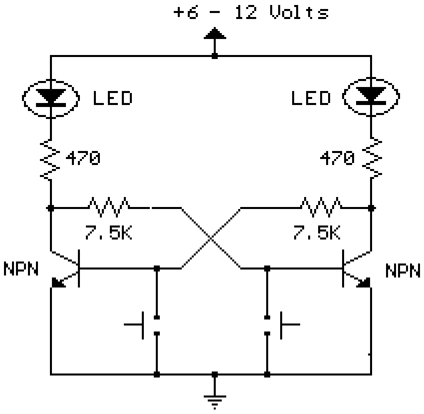
Set/Reset Flip Flop

This is an example of a set/reset flip flop using discrete components. When power is applied, only one of the transistors will conduct causing the other to remain off. The conducting transistor can be turned off by grounding it's base through the push button which causes the collector voltage to rise and turn on the opposite transistor.



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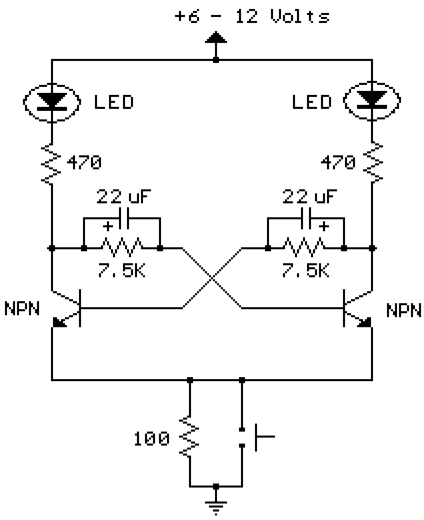
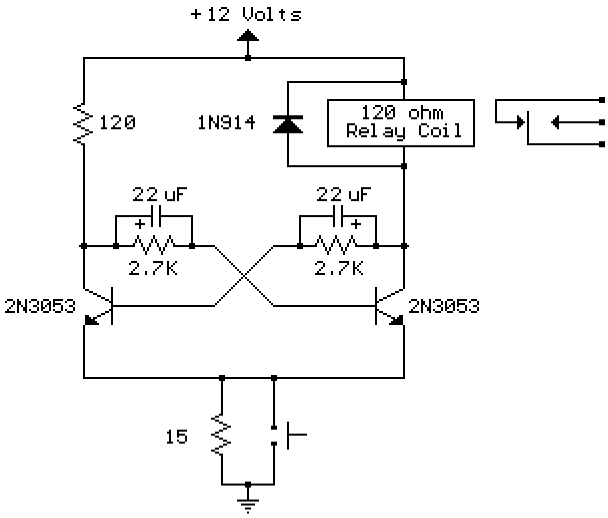
Bistable Flip Flop

Here are two examples of bistable flip flops which can be toggled between states with a single push button. When the button is pressed, the capacitor connected to the base of the conducting transistor will charge to a slightly higher voltage. When the button is released, the same capacitor will discharge back to the previous voltage causing the transistor to turn off. The rising voltage at the collector of the transistor that is turning off causes the opposite transistor to turn on and the circuit remains in a stable state until the next time the button is pressed and released. Note that in the LED circuit, the base current from the conducting transistor flows through the LED that should be off, causing it to illuminate dimly. The base current is around 1 mA and adding a 1K resistor in parallel with the LED will reduce the voltage to about 1 volt which should be low enough to ensure the LED turns completely off.





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High Current MOSFET Toggle Switch with Debounced Push Button.

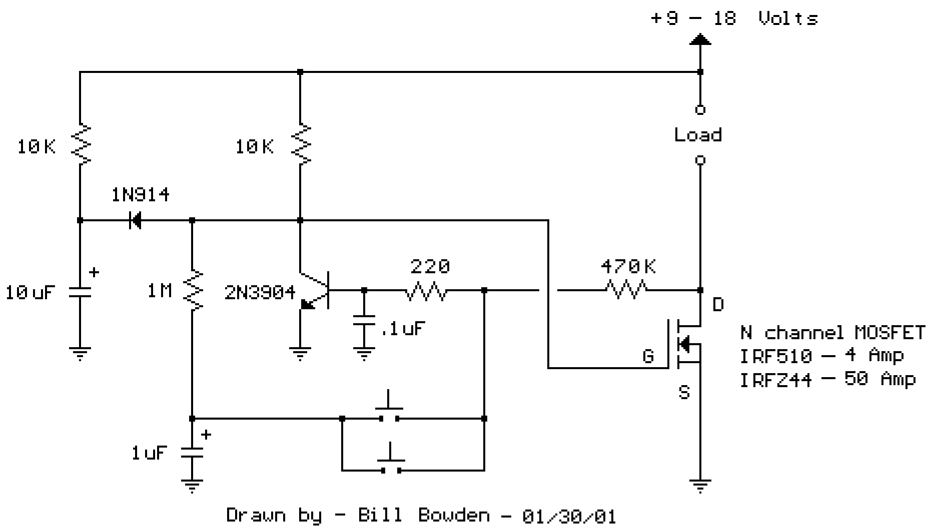
This circuit was adapted from the "Toggle Switch Debounced Pushbutton" by John Lundgren. It is particularly useful in controlling a load from several locations where the load may be switched on from one location and switched off from another. Any number of momentary (N/O) switches or push buttons may be connected in parallel.

The circuit uses a N-channel power MOSFET to control the load and can supply fairly large currents depending on the MOSFET used. The IRFZ44 is a 50 amp device available at Radio Shack for $2.99 and the IRF10 is a 4 amp device available for a dollar less.

The combination (10K, 10uF and diode) on the left side of the schematic insures the circuit powers on with the MOSFET turned off and the NPN transistor conducting. These components can be omitted if the initial power-on condition is not a concern. In this initial state (MOSFET off), the voltage at the gate of the MOSFET will be near zero and the voltage on the 1uF capacitor connected to the switches will also be near zero.

When a switch is closed, the 1uF capacitor is connected to the junction of the 220 ohm and 470K resistors causing the voltage to fall to near zero turning off the NPN transistor. As the transistor turns off, the collector voltage rises and turns on the MOSFET when the voltage climbs above about 3 volts. The drain terminal (D) of the MOSFET now moves close to ground preventing the NPN transistor from turning back on. When the switch is opened, the 1uF cap will charge through the 1M and 10K resistors to the full supply voltage. When a switch is again closed, the 1uF capacitor will cause the NPN transistor to turn back on due to the positive voltage on the capacitor applied to the junction of the two resistors (470K, 220). The MOSFET will now turn off and the drain voltage will rise to the supply voltage which in turn keeps the NPN transistor conducting with a positive voltage on the base. The circuit has now returned to the initial turn-on state.

The small (0.1uF) capacitor connected from the transistor base to ground functions to filter out noise that could cause false triggering if the switches are located far away from the circuit using long wires. If false triggering becomes a problem, either the capacitor value (0.1) or the 220 ohm resistor value can be increased to provide better filtering. Increasing these values however will increase the switching times of the MOSFET (rise and fall times) generating more heat when the MOSFET changes state. This is probably not a problem with small loads of a couple amps or less, but may be a problem at higher load currents. The circuit was tested at 1.5 amps using the IRF510 and 6 amps using the IRFZ44.



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Relay Toggle Circuit Using a 556 Timer

This toggle circuit operates by using a couple 555 timers wired as inverters. Pins 2 and 6 are the threshold and trigger inputs to the first timer and pin 5 is the output. The output at pin 5 will always