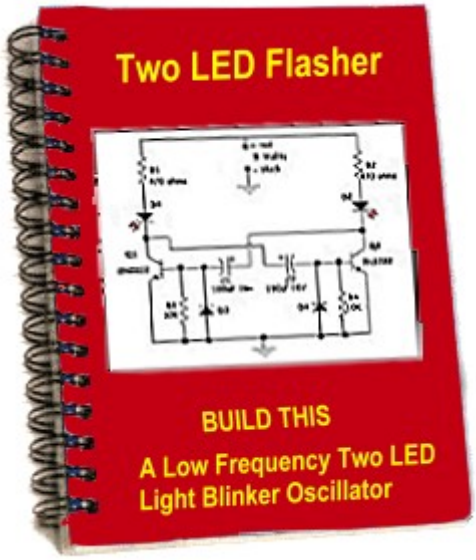
Low Frequency 2 LED Flasher



A Low Frequency Two LED Light Blinker Oscillator

By GS Carpenter

The project on this page will introduce you to the bi-polar transistor.

Transistor theory is a complex subject and too big for this website.

I can however show you some useful things about how to use a transistor in various circuits.

A transistor is a semiconductor whose conductance can be controlled from very high conductance to very low conductance using a very tiny control current. The connections to the transistor are the "base", "emitter", and "collector".

The base controls the current flow between the emitter and collector. Like the diode, the transistor must be biased correctly to operate. There are two types a PNP and a NPN version. The letters indicate the three layers of semiconductor material sandwiched together to make the transistor. This also determines voltage polarity to bias them correctly.

A PNP is a positive-negative-positive device and the NPN is a negative-positive-negative device. Don't worry, you will understand all that after awhile.

The schematic symbol looks like this  for an NPN

And like this  for PNP.

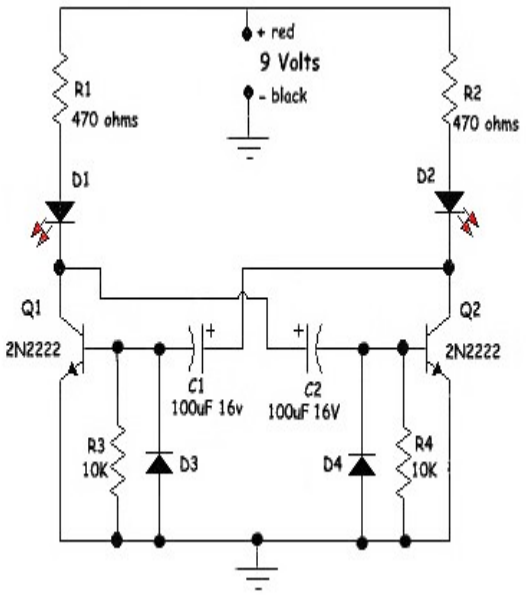
Connection leads starting at the bottom and going clockwise on these diagrams are "emitter"(has arrow) - "base" - "collector" (top)

Notice the direction of the arrows. They indicate the emitter and the polarity of bias required. The horizontal wire above the emitter is the 'base' and the last connection is the collector.

In this project we will be using two NPN transistors. The center letter of the three tells the polarity required to bias the transistor into the "on" mode. We will be using the transistors in the common emitter mode which means that both emitters will be connected to the negative side of the power supply or ground as it is called.

We will apply a small positive voltage to the base to cause the transistor to begin conducting. We will also apply a positive voltage to the collector through the LED diode so the diode will 'light' when the transistor conducts.

Here is the schematic: It is what is known as a "classic" multivibrator which is a type of square wave oscillator. (The name is funny because nothing actually vibrates!)



OK, let's start at the top and work down. The first thing is the battery connector. It has two wires one red and one black. Of course the red is positive and the black is negative. The red connects to two wires, one goes to the resistor R1 and the other goes to R2.

Now these wires can be the wires that come as part of the resistor or they can be separate wires, the choice is yours.

Here is the surprise, the black wire connects to this

symbol.  This is the symbol for ground or "common".

It is usually the chassis or metal box the circuit is built in. But in any case it is where the negative terminal of the battery reaches all the needed points.

Notice that the both emitters of transistors Q1 and Q2 connect there, as well as both base resistors R3 and R4. They are all connected to the same common point or ground.

At this point, we will look at only one half of the schematic since both halfs are identical. On the left side, the other end of R1 connects to LED diode D1's anode and D1's cathode connects to the collector of transistor Q1. Then Q1's emitter goes to ground. Now look at Q1's base. It connects to three parts, R3,D3 and the other is C1. R3 and D3's anode connect to ground. The other end of C1 connects over to transistor Q2's collector.

There are a couple of very important things to watch here. One is to be very sure you have identified the wires correctly for the transistors emitter, base and collector. They are shown on the package they come in. Next capacitor C1 and C2 are polarized.

They will have some type of a black mark indicating the negative lead. (usually) Or a big red + marking the positive lead.

Be sure to observe the polarity which is shown on the schematic.

How it works:

When the battery is connected both capacitors C1 and C2 begin to charge through the diodes and the base resistors R3 and R4 This will begin building a positive voltage on the transistor bases but because not all the parts will be exactly identical, one transistor will turn on before the other.

As soon as one turns on the collector of that transistor will pull down toward ground completing the circuit through one of the LED's. That LED will light because it's cathode is pulled to ground through the transistor but look closely and you will see that capacitor connected to that diode will begin to disharge back to ground. This will place a positive voltage on the opposite transistors base and turn on that transistor.

Now that action will cause a positive voltage to be applied to the other transistor's base turning it back on again which will cause the second transistor to turn on again and so on over and over again. Diode D3 and D4 discharge the capacitors C1 and C2 between cycles so they are ready to charge again on the next cycle.

The flash rate is determined by the value of R3, R4 and C1, C2.

Other Links Of Interest:

http://www.gregsbasicelectronics.com/resistors/resistors.htm

http://www.gregsbasicelectronics.com/capacitors/capacitors_inductors.htm

http://www.gregsbasicelectronics.com/soldering/soldertip.htm

http://www.gregsbasicelectronics.com/circuits/ledoscillator.htm

http://www.gregsbasicelectronics.com/circuits/audio_oscillator.htm