Flasher Circuits

Two Transistor Flasher Ideas

The basic two-transistor flasher shown below has found its way into dozens of applications due to its simplicity and versatility. Applications have included such diverse circuits as a micropower low battery indicator, a lightning detector, a off-line switching power supply, a micropower high voltage supply, an unusual beeping capacitance probe, a windshield wiper controller, a lamp dimmer, a police siren, and several others. The simple circuit can be used at very low frequencies, RF frequencies, low voltages, or even very high voltages with careful selection of transistors. The power handling capability and power consumption are also easily modified to suit the requirement.

This circuit is great for beginners! If you build it, it will flash. And you can easily change the on-time and flash rate.

The basic flasher is shown below. Notice that it is a "two-wire" circuit and simply connects in series with the load and battery. The two resistors on the base of the PNP set a threshold voltage and when power is applied the capacitor begins charging toward this voltage. When the capacitor voltage is high enough the two transistors begin to conduct. The current flow causes the voltage across the circuit to drop slightly and this drop causes a drop in the threshold voltage. The lower threshold voltage causes even more current and this positive feedback causes the circuit to rapidly turn on. It stays on until the capacitor discharges at which point a reverse process causes the circuit to suddenly switch off.

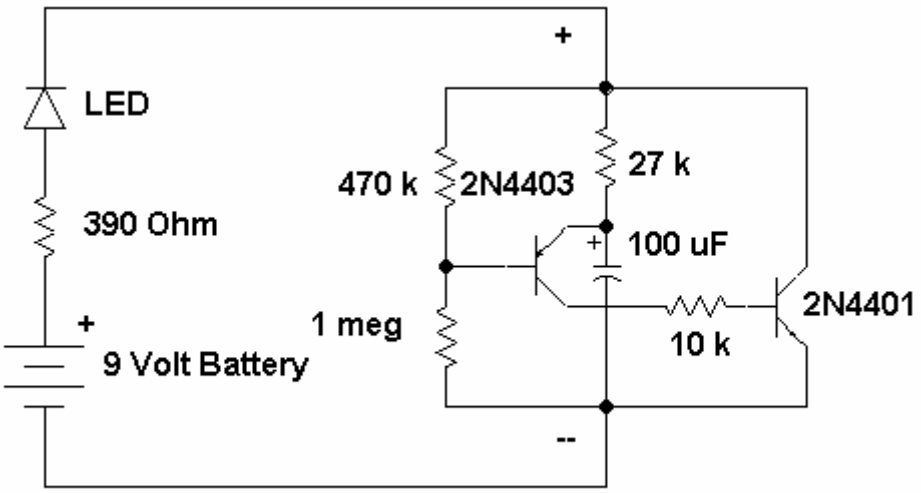


Figure 1: Two-transistor lamp flasher.

Power transistors may be added for handling higher current loads. The two circuits below are typical connections. In the first circuit a flasher circuit in series with a 220 ohm resistor turns on a power transistor. In the second circuit, a power FET is used in place of the NPN. A pull-down resistor is added to pull the gate low when the circuit turns off.

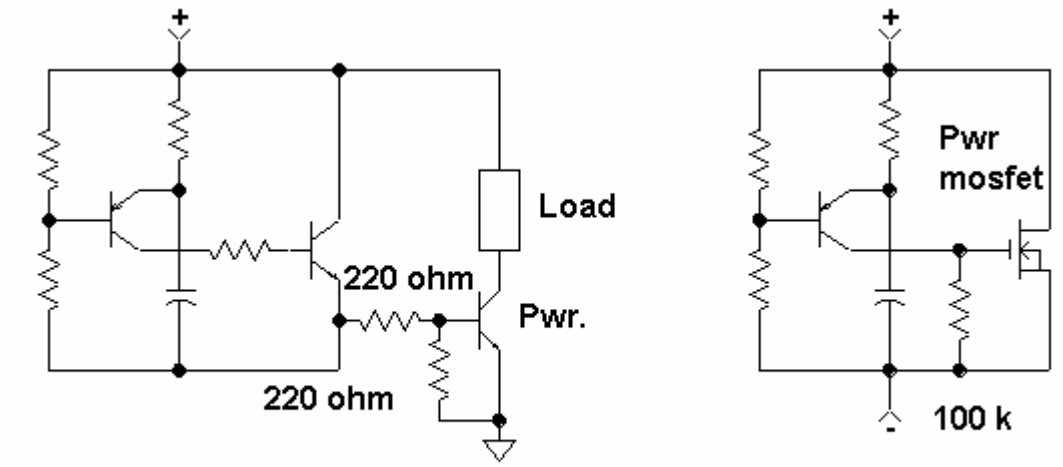
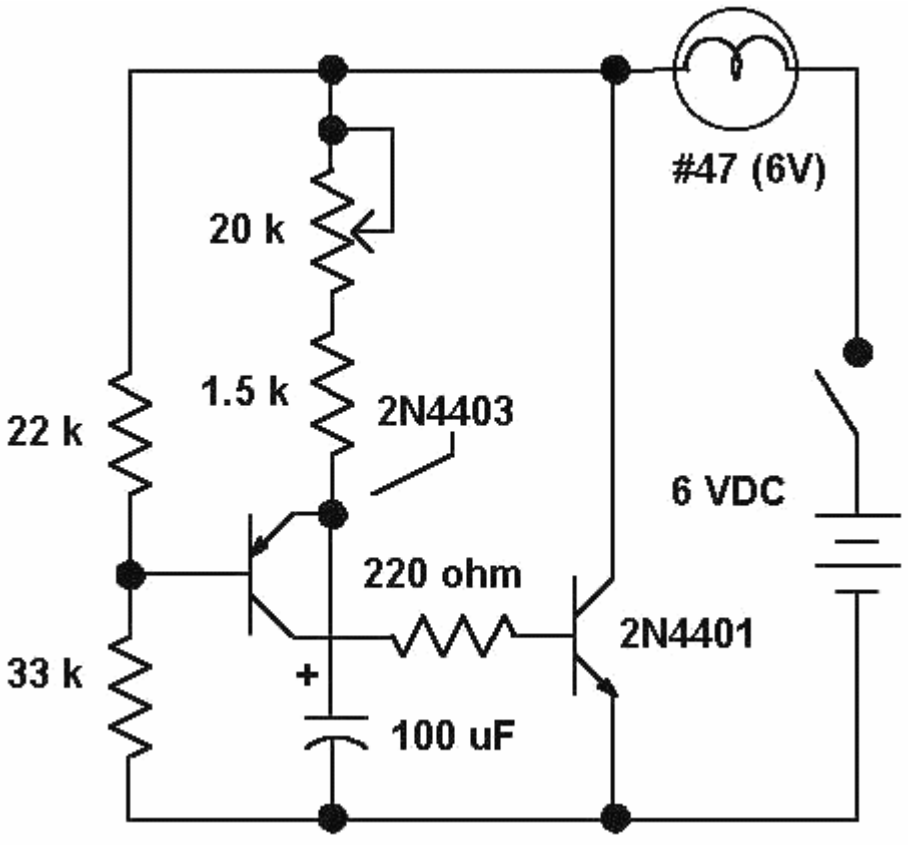


Figure 2: Some typical flasher connections.

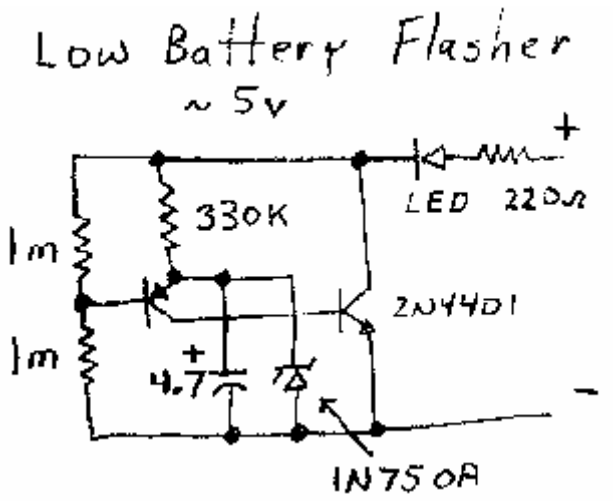
Don't hesitate to modify this basic circuit to meet your specific requirements. It is easy to troubleshoot and almost always works! Here are a few more ideas for the experimenter to try:

- A diode may be inserted in series with the capacitor charging resistor so that discharge current is blocked which gives a longer "on" time for a given flash rate. The NPN base resistor determines how fast the capacitor discharges.
- A signal can be coupled into the base of the PNP to modulate the flashing rate for FM applications.
- The PNP base divider resistors can be adjusted so that the voltage is just a little too high for a flash to occur when the capacitor fully charges. Then, a very tiny AC signal applied to the base will cause the circuit to "trigger". The frequency response of this detector can be surprisingly high.
- The capacitor charging current may come from any source making a simple current to frequency converter.
- You can reverse the polarity of everything and switch the transistor types.

The circuit below is a "silent" metronome that keeps the beat without becoming a member of the band. The circuit flashes the 6 volt lamp at a rate set by the 20k potentiometer which can have a dial for setting the desired tempo. Alternately, the potentiometer could be replaced with a rotary switch and selected resistors. The lamp is an ordinary #47 bulb which will give good omnidirectional brightness but an LED and resistor could be used instead - try a 100 ohm in series with a high-intensity LED. The batteries could be three C or D cells for good life. This circuit could be used to generate "clicks" in a speaker but such metronomes are not particularly pleasing. The ambitious might replace the lamp with a solenoid which taps on the wall of a hardwood box or wooden chime for a "professional" sound.

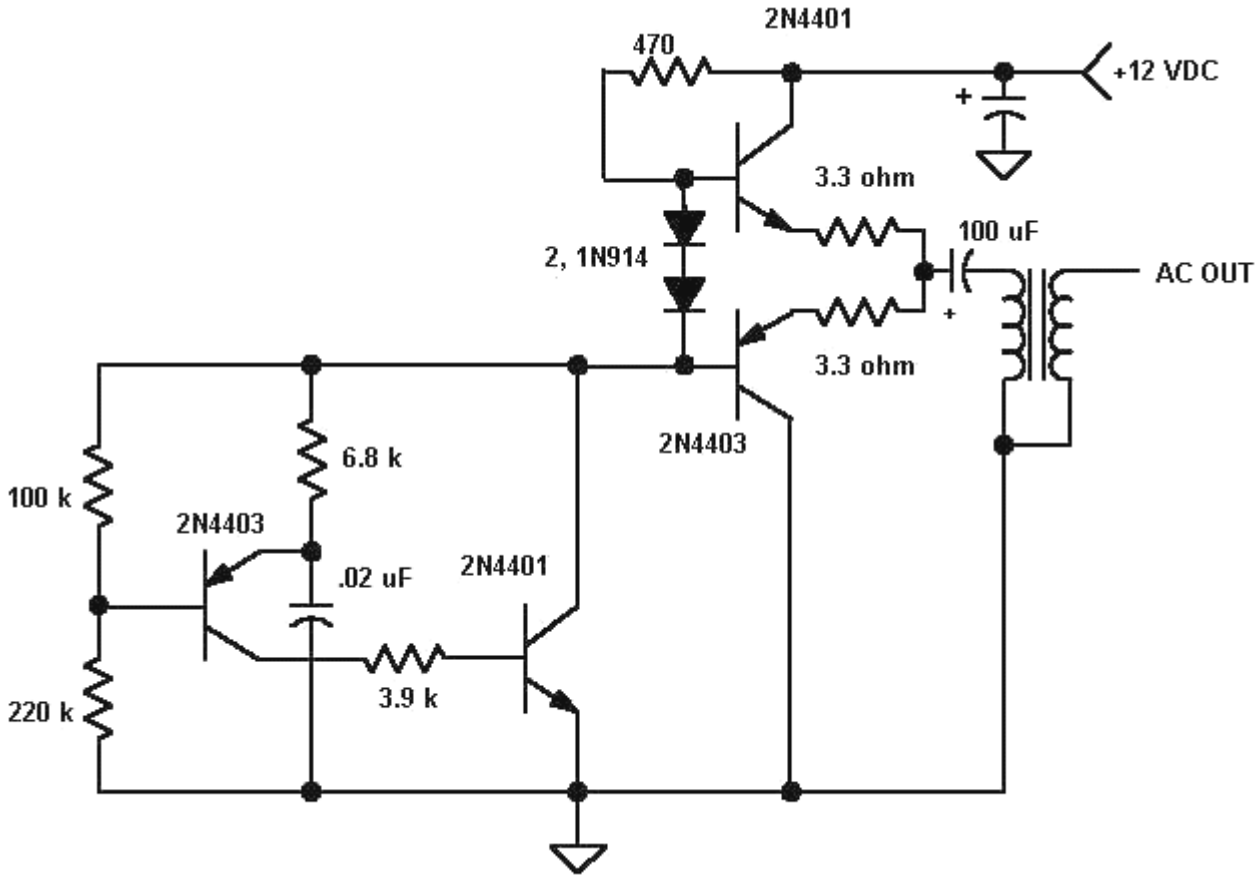


Here is a low battery indicator that flashes a lamp when the battery voltage falls below about 5 volts. The circuit draws about 25 microamps when not flashing so battery life is not significantly shortened by the circuit. The two 1 megohm resistors set the switching point at V/2 (plus a little due to the emitter-base diode drop) and when this voltage is above the zener voltage the circuit cannot turn on. When the battery voltage drops below 5 volts, the base voltage drops to 2.5 volts and the emitter can reach a voltage sufficient to turn on the PNP (2N4403 or similar). When the PNP conducts, the NPN also conducts dropping the voltage across the circuit even more and the circuit snaps on. When the 4.7 uF capacitor has discharged, the circuit turns off and the capacitor begins charging again.



The zener is a "4.7 volt" type but in this circuit it is operating at a very low current and is limiting the emitter voltage to about 2.5 volts. Some experimentation may be necessary if another zener series is used.

The following circuit uses the flasher circuit to drive a complementary output stage and step-up audio transformer. This circuit is used in a high voltage breakdown tester but it would be useful for a variety of applications.



The transformer may be an audio type connected for step-up or step-down depending upon the desired output voltage. An old tube radio output transformer with the speaker winding connected to the circuit gave about 250 VRMS.

Warning! This thing can produce lethal shocks when used to generate high voltages! Don't build it unless you are experienced and qualified to work with dangerous voltages.

Power transformers will also work but some experimentation may be necessary. The output transistors are shown as small-signal types but power transistors may be necessary if the load current is high. The duty cycle is not exactly 50/50 and other circuits would probably be better for high power inverters. This circuit is easily controlled, however. Pulling the 0.02 uF capacitor low is a good way to stop or reduce the output of the circuit. See the Geiger counter supply for an example that produces a regulated output voltage.

The AC out frequency is several hundred Hz which may be changed by changing the 0.02 uF cap or the 6.8k resistor. The high frequency is useful for driving diode voltage multipliers or D.C. rectifiers since smaller capacitors are needed then when using 50 or 60 Hz.