Discrete Version Of The LM3909 Oscillator IC

A De-Integrated Circuit

This page features a replacement circuit for the LM3909 LED Flasher / Oscillator using discrete components. The circuit is functionally the same as the integrated LM3909 but has a minor variations in values of the components used.

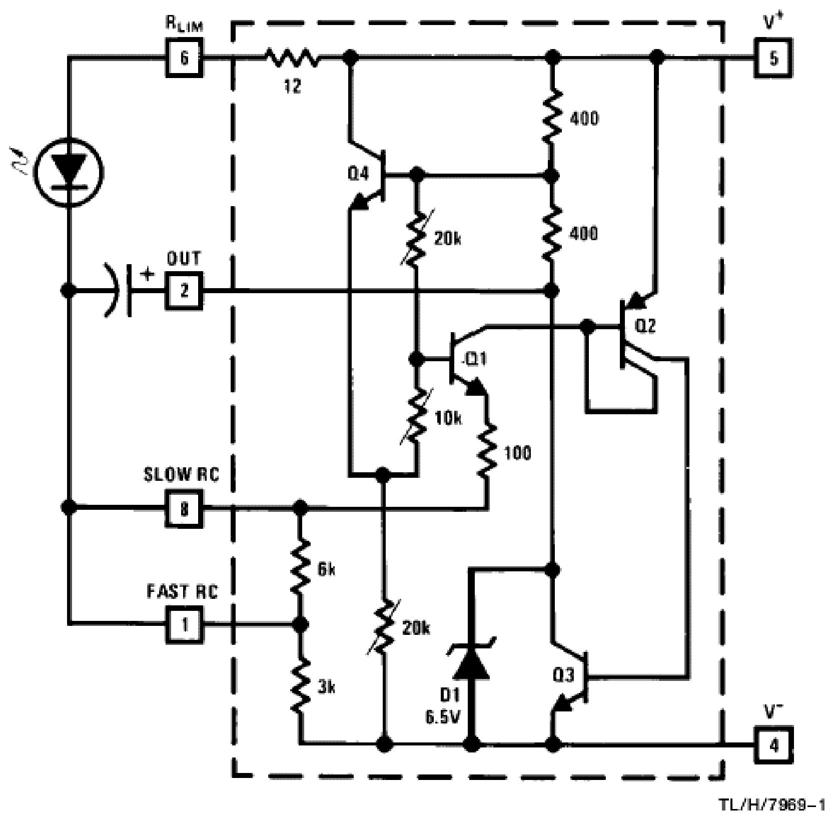
The LM3909 can still found but is fairly expensive, one possible source is Futurlec. The LM3909 is also available through some surplus electronics sources but usually only in quantities of hundreds or thousands of pieces.

Naturally the circuit will not be as compact as the integrated circuit but it does offer the ability to adjust individual component values and can be less expensive than the integrated circuit itself.

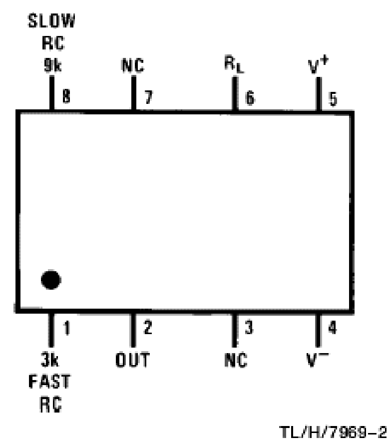
LM3909 Data sheet - National Semiconductor (.pdf)

Datasheet Circuit Of The LM3909 IC

Typical 1.5V Flasher



Dual-In-Line Package



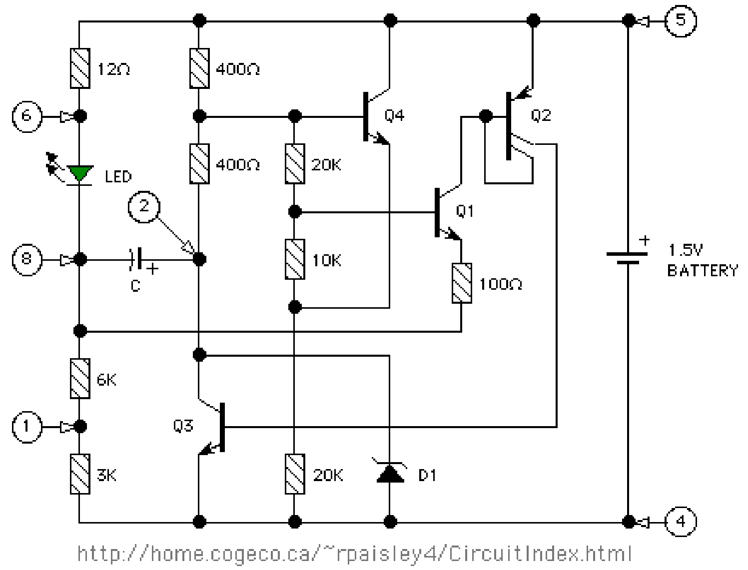
Top View

Order Number LM3909N
See NS Package Number N08E

Redrawn Internal Circuit Of The LM3909 IC

SCHEMATIC DIAGRAM FOR THE INTEGRATED LM3909 OSCILLATOR

3909 DIY 08 SCH IC
08 March, 2008



- C AND THE RESISTORS AT TERMINAL '1' SET THE FLASH RATE
- LED = EXTERNAL LED

(1)—▷ EQUIVALENT LM3909 PIN LOCATIONS

Discrete Component Replacement Circuit For The LM3909 IC

The following schematic is of the discrete component replacement for the LM3909.

SCHEMATIC #1 FOR A DISCRETE COMPONENT LM3909 OSCILLATOR

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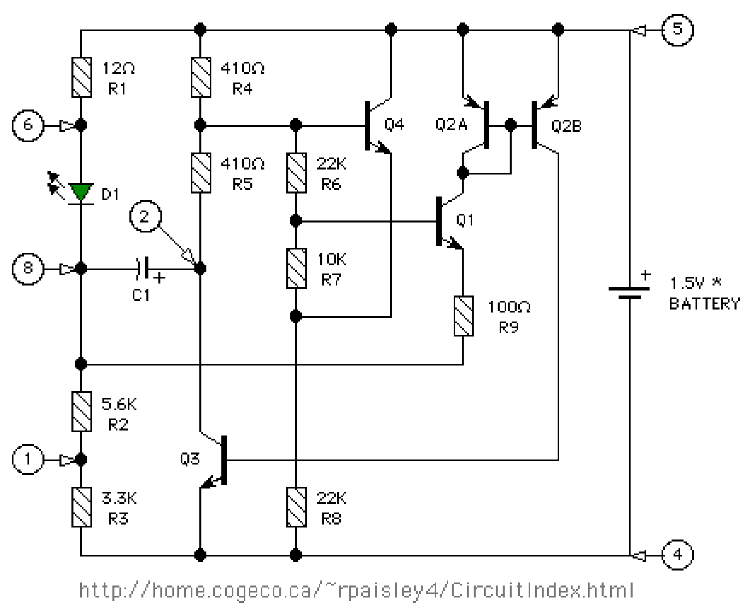

* THIS CIRCUIT IS FOR 1.5 TO 3 VOLT OPERATION ONLY

(1)—▷ EQUIVALENT LM3909 PIN LOCATIONS

Q1, 3, 4 = 2N3904 Q2A/B = 2N3906

C1 / R2 / R3 = SET THE FLASH RATE

D1 = EXTERNAL LED

Discrete Component LM3909 Circuit Notes

- The operation of the discrete circuit is the same as the integrated version. For more information on the LM3909 itself, refer to the datasheet in the link above.
- The values of the components were chosen from standard values to match as closely as possible those in the integrated circuit.
- The 2N3904 and 2N3906 transistors used in the circuit could be replaced by any small signal or switching type of transistor.
- Transistors Q2A and Q2B are used as a current mirror, a type of current regulator. Using discrete transistors for this application is not precise but will be acceptable in this circuit.
- The values of the resistors in the circuit can be adjusted to change various parameters of the circuit. (There is plenty of room to experiment with this circuit.)
- LED, D1 is the output device of the circuit and flashes at the rate determined by the oscillator. For a 1.5 volt power source, the forward voltage of the LED should be 2 volts or less.
- Resistor R1 - Higher resistance causes a longer but less intense flash.
- Capacitor C - Controls the basic flash rate of the circuit. Larger capacitors will have a slower flash rate but the intensity of the LED will appear to be greater as the pulse is longer. (The circuit above operated at a frequency of approximately one hertz with a capacitor value of 150 microfarads.)
- Resistors R2 and R3 - Also control the flash rate. The larger the resistance the slower flash rate. (Resistors R2 and R3 can be combined into one resistor.)
- Resistor R4 and R5 - Can be increased; causing the circuit to draw less current and slowing the flash rate slightly. These resistors should be equal in value. (The circuit showed no ill effects when R4 and R5 were increased to 820 ohms.)
- The integrated circuit contains a Zener diode (D1) which has been omitted from the discrete version as it appears to serve no function when the circuit is operated from 1.5 or 3 volts.

NOTE: This circuit has not been tested in any other mode other than that shown in the above schematic. There is no apparent reason that it shouldn't work in the other circuits shown on the LM3909 data sheet if the zener diode D1 is replaced.

A Slightly Different Version Of The Discrete Circuit

In this circuit, the current mirror formed by Q2A and Q2B has been replaced by one transistor and a resistor.

The value of resistor R10 was based on measurments taken from the current mirror portion of the circuit operating at 1.5 volts. The 330 ohm value allowed capacitor C1 to discharge fully.

The only savings with this circuit is the cost of a transistor versus that of a resistor.

SCHEMATIC #2 FOR A DISCRETE COMPONENT LM3909 OSCILLATOR

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3909 DIY 08 SCH Discrete B

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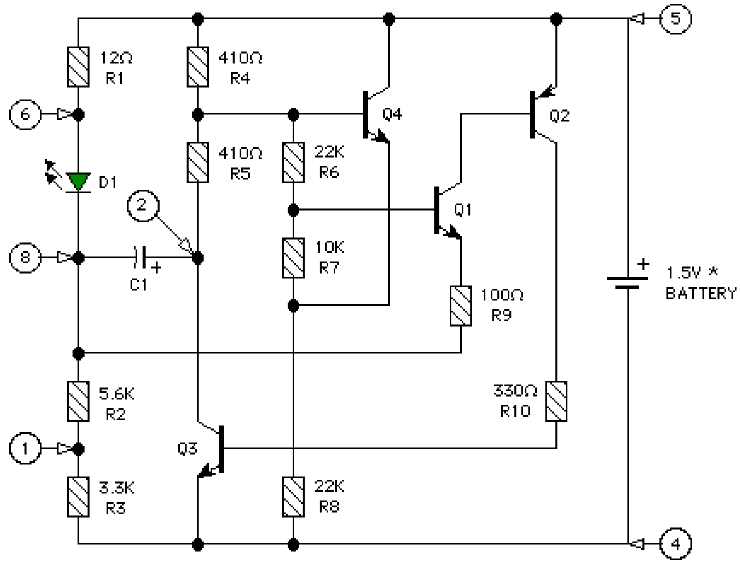


http://home.cogeco.ca/~rpaisley4/CircuitIndex.html

* THIS CIRCUIT IS FOR 1.5 TO 3 VOLT OPERATION ONLY

(1)—▷ EQUIVALENT LM3909 PIN LOCATIONS

Q1, 3, 4 = 2N3904 Q2 = 2N3906

C1 / R2 / R3 = SET THE FLASH RATE

R10 IS BASED ON MEASUREMENTS FROM THE ORIGINAL CIRCUIT

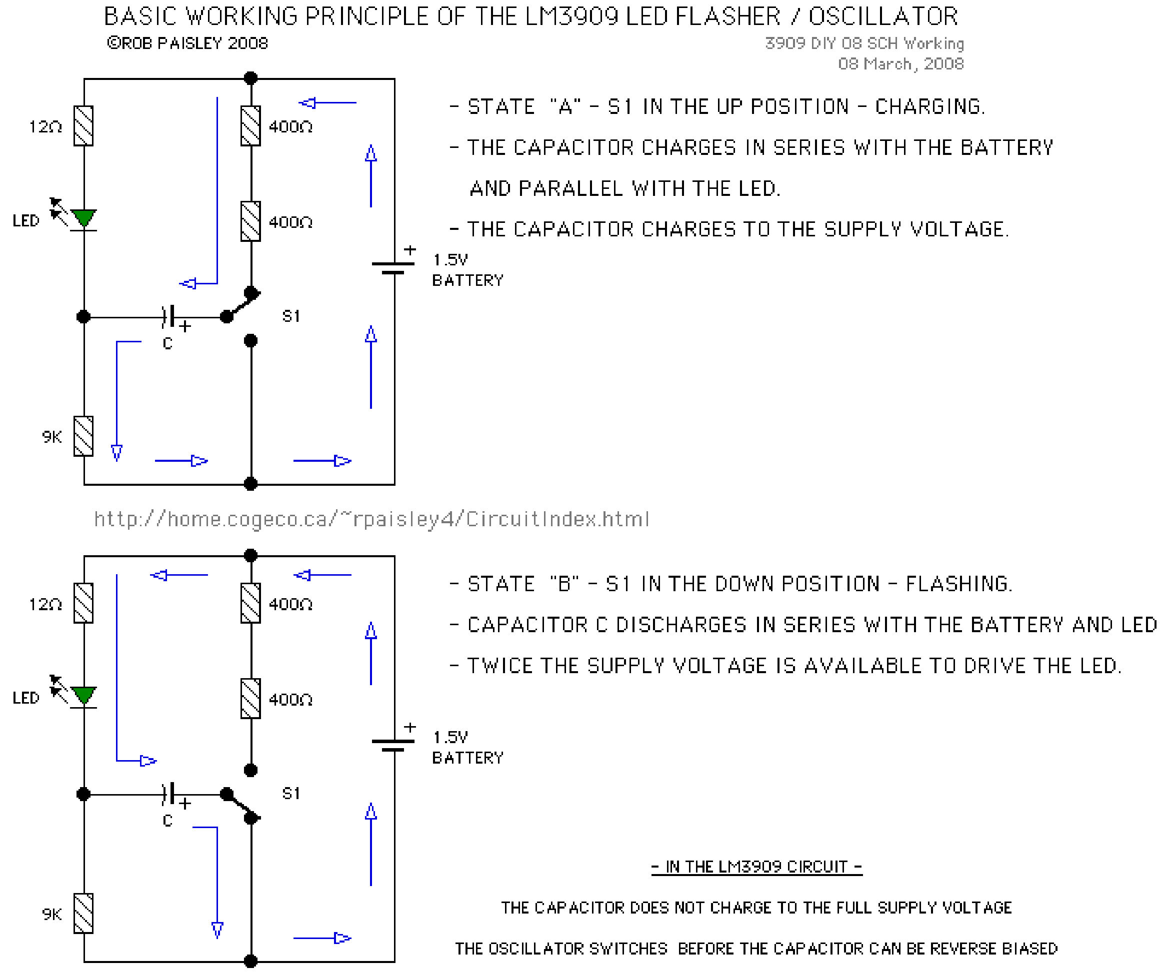
D1 = EXTERNAL LED

LM3909 Working Principle

The following diagram illustrates the basic working principle of the LM3909 oscillator.

The circuit acts as a 'voltage doubler'. Capacitor C1 from the battery and is then put in series with the battery to boost the voltage.

This allows a 1.5 volt source to provide more than the 2 volts required by the LED.



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Please Read Before Using These Circuit Ideas

The explanations for the circuits on these pages cannot hope to cover every situation on every layout. For this reason be prepared to do some experimenting to get the results you want. This is especially true of circuits such as the "Across Track Infrared Detection" circuits and any other circuit that relies on other than direct electronic inputs, such as switches.

If you use any of these circuit ideas, ask your parts supplier for a copy of the manufacturers data sheets for any components that you have not used before. These sheets contain a wealth of data and circuit design information that no electronic or print article could approach and will save time and perhaps damage to the components themselves. These data sheets can often be found on the web site of the device manufacturers.

Although the circuits are functional the pages are not meant to be full descriptions of each circuit but rather as guides for adapting them for use by others. If you have any questions or comments please send them to the email address on the Circuit Index page.

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08 March, 2008