

Tap Operated Switch Project

With this project you will build a circuit based around the 555 timer/oscillator integrated circuit (IC), which alternately turns a light emitting diode (LED) on and off in response to a tap or knock on a piezo electric transducer.

Parts Included:

Resistors - value identified by stripe colour code.

470 Ohms (470R) – Yellow/Violet/Brown/Gold

100,000 Ohms (100k) – Brown/Black/Yellow/Gold

10,000,000 Ohms (10M) – Brown/Black/Blue/Gold

Capacitor - Identified by the value printed on the casing.

10 micro-Farad (10uF) 16V.

Important: This is a polarised electrolytic capacitor and must be connected the right way round to operate correctly. The longer lead indicates the positive side and a white stripe on the casing points to the negative side.

LED - 5mm red.

As with the capacitor, the LED must also be connected the right way round to operate. The longer lead indicates the positive (anode) side and is shown as the bent lead in the assembly image below.

IC - 555 timer/oscillator.

This is an 8-pin integrated circuit. The pins are numbered from 1 to 8 in an anti-clockwise direction starting in the top left corner. Look for a notch in the casing at the top edge and/or a dimple close to pin 1. Pin 1 is bottom left in the assembly graphic below.

Transistor - identified by the reference printed on the body.

This is a 3-terminal amplifying component that must be connected the correct way round. Look for the flat side of the body to orientate it as in the assembly graphic below.

Piezo Transducer.

A piezo transducer can convert a mechanical force into an electrical signal and vice-versa. As such it can be used to detect knocks, as in this project, or produce sounds when a signal of an appropriate frequency is applied to it. Connection is made via the red and black leads.

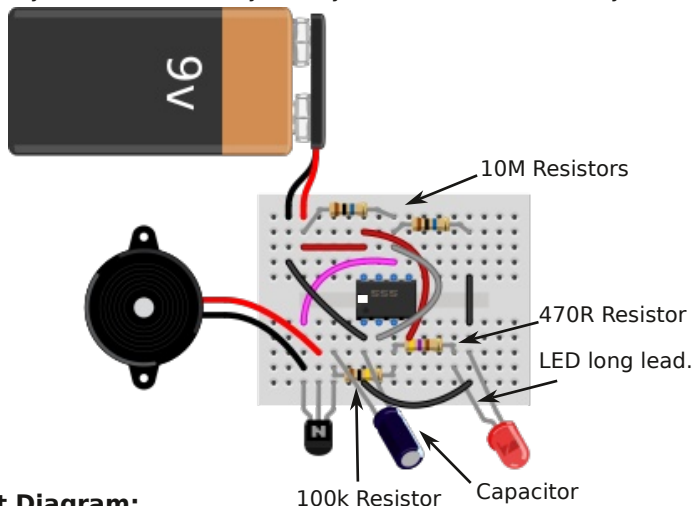
Mini Breadboard

This is where you assemble your circuit. The holes in the breadboard are connected inside in columns either side of the central channel, as shown in the image (right). This means that any component lead or wire occupying holes in that column become electrically joined.

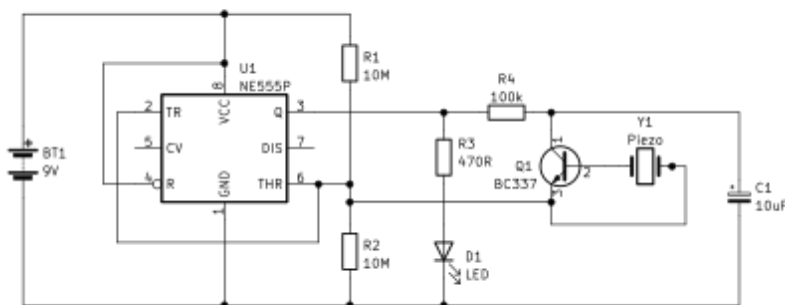
Jumper wires and a battery clip are also included.

Assembly:

Assemble the circuit on the breadboard by plugging the components into the appropriate holes according to the diagram below. Jumper wires are shown in red and black (the supplied colours may vary). Be sure to get the LED, capacitor and IC the right way round. Only connect the battery when you have double checked your work.



Circuit Diagram:



If everything has been assembled correctly the led should alternately light, then go out in response to sharp taps on the piezo transducer - leave a couple of seconds between each tap.

Troubleshooting: If the circuit does not work straight away, disconnect the battery immediately. The cause of any failure will, almost certainly be due to getting components or wires in the wrong position. Check that the polarised components are the right way round and that all leads are pushed fully into the breadboard.

Circuit Description:

The operation relies on two properties of the 555 IC.

1. When the voltage on pin 2 (trigger) drops below 1/3 of the supply voltage, pin 3 (output) switches ON.
2. When the voltage on pin 6 (threshold) rises above 2/3 of the supply voltage, pin 3 switches OFF.

Pins 2 and 6 are connected together and held at 1/2 the supply voltage by resistors R1 & R2.

If the output is ON, a tap on the piezo will activate the transistor raising the voltage on pin 6, turning OFF the output.

If the output is OFF, a tap on the piezo will then apply a negative voltage, which is detected by pin 2 and the output turns ON.