

The 555 Timer

First introduced by the Signetics Corporation as the SE555/NE555 about 1971.

Pin connections and functions: (See schematic below for basic circuits)

- Pin 1 (Ground) - The ground (or common) pin is the most-negative supply potential of the device, which is normally connected to circuit common when operated from positive supply voltages.
- Pin 2 (Trigger) - This pin is the input which causes the output to go high and begin the timing cycle. Triggering occurs when the trigger input moves from a voltage above $\frac{2}{3}$ of the supply voltage to a voltage below $\frac{1}{3}$ of the supply. For example using a 12 volt supply, the trigger input voltage must start from above 8 volts and move down to a voltage below 4 volts to begin the timing cycle. The action is level sensitive and the trigger voltage may move very slowly. To avoid retriggering, the trigger voltage must return to a voltage above $\frac{1}{3}$ of the supply before the end of the timing cycle in the monostable mode. Trigger input current is about 0.5 microamps.
- Pin 3 (Output) - The output pin of the 555 moves to a high level of 1.7 volts less than the supply voltage when the timing cycle begins. The output returns to a low level near 0 at the end of the cycle. Maximum current from the output at either low or high levels is approximately 200 mA.
- Pin 4 (Reset): - A low logic level on this pin resets the timer and returns the output to a low state. It is normally connected to the + supply line if not used.
- Pin 5 (Control) - This pin allows changing the triggering and threshold voltages by applying an external voltage. When the timer is operating in the astable or oscillating mode, this input could be used to alter or frequency modulate the output. If not in use, it is recommended installing a small capacitor from pin 5 to ground to avoid possible false or erratic triggering from noise effects.

Pin 6 (Threshold) - Pin 6 is used to reset the latch and cause the output to go low.

voltage

supply.

similar to the

Reset occurs when the voltage on this pin moves from a

below 1/3 of the supply to a voltage above 2/3 of the

The action is level sensitive and can move slowly

trigger voltage.

Pin 7 (Discharge) - This pin is an open collector output which is in phase with the

capability.

main output on pin 3 and has similar current sinking

Pin 8 (V +) timer IC.

- This is the positive supply voltage terminal of the 555

to +16

Supply-voltage operating range is +4.5 volts (minimum)

volts (maximum).

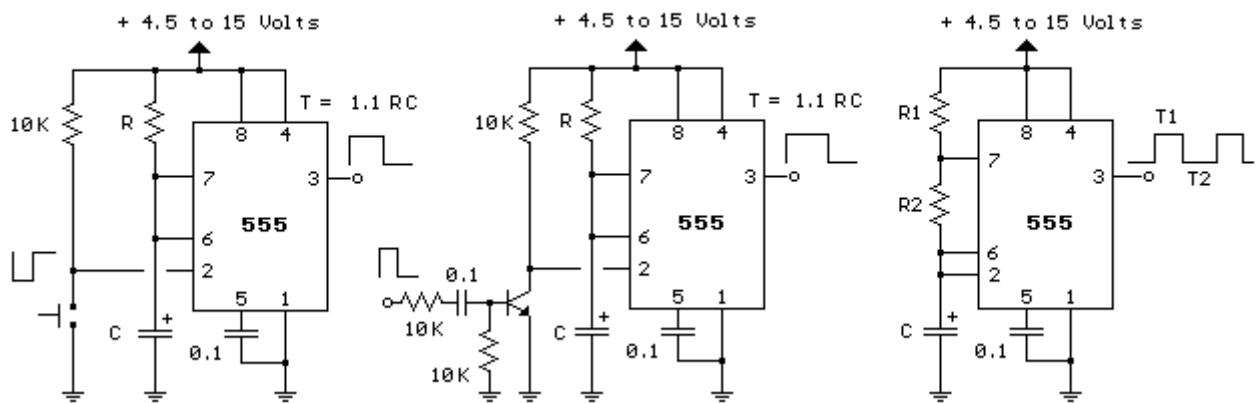
The pin connections for the 556 which is a dual 555 timer (2 in one package) are shown in table below. For example, the two outputs for the two timers of the 556 are on pins 5 and 9 which correspond to the output pin 3 of the 555.

	555	556 timer #1	timer #2
Ground	1	7	7
Trigger	2	6	8
Output	3	5	9
Reset	4	4	10
Control	5	3	11
Threshold	6	2	12
Discharge	7	1	13
+ Power Vcc	8	14	14

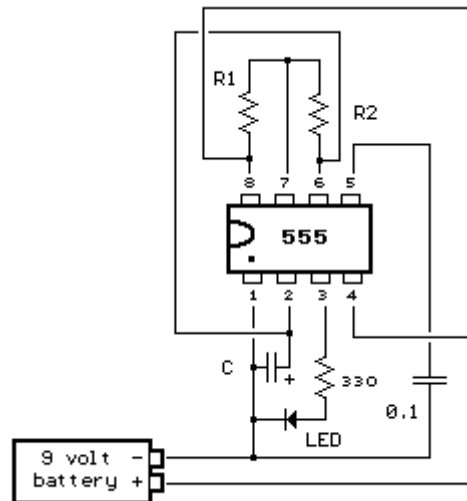
The schematics below show the two basic circuits for the 555 timer.

Monostable or "One-shot"

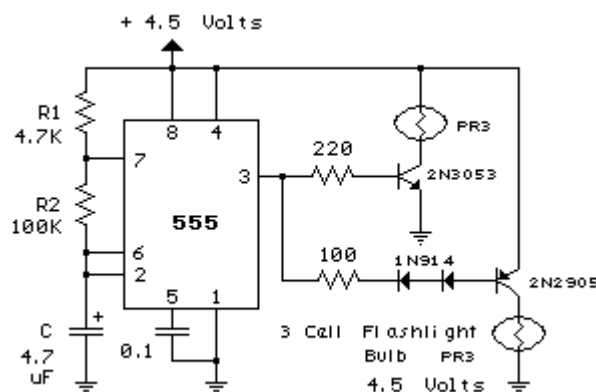
Astable or oscillator.



Below is a pictorial view of the 555 timer wired as a LED flasher and powered with a 9 volt battery. The LED will turn on during time T1 and off during time T2.



The 555 circuit below is a flashing bicycle light powered with three C or D cells (4.5 volts). The two flashlight lamps will alternately flash at a approximate 1.5 second cycle rate. Using a 4.7K resistor for R1 and a 100K resistor for R2 and a 4.7uF capacitor, the time intervals for the two lamps are 341 milliseconds (T1, upper lamp) and 326 milliseconds (T2 lower lamp). The lamps are driven by transistors to provide additional current beyond the 200 mA limit of the 555 timer. A 2N2905 PNP and a 2N3053 NPN could be used for lamps requiring 500 mA or less. For additional current, a TIP29 NPN and TIP30 PNP could be used up to 1 amp. A PR3 is a 4.5 volt, 500 mA flashlight bulb. Two diodes are placed in series with the PNP transistor base so that the lower lamp turns off when the 555 output goes high during the T1 time interval. The high output level of the 555 timer is 1.7 volts less than the supply voltage. Adding the two diodes increases the forward voltage required for the PNP transistor to about 2.1 volts so that the 1.7 volt difference from supply to the output is not enough to turn on the transistor. You can also use an LED in place of the two diodes as shown in the lower schematic.



40 LED Bicycle Light

The 555 circuit below is a flashing bicycle light powered with four C,D or AA cells (6 volts). Two sets of 20 LEDs will alternately flash at approximately 4.7 cycles per second using RC values shown (4.7K for R1, 150K for R2 and a 1uF capacitor). Time intervals for the two lamps are about 107 milliseconds (T1, upper LEDs) and 104 milliseconds (T2 lower LEDs). Two transistors are used to provide additional current beyond the 200 mA limit of the 555 timer. A single LED is placed in series with the base of the PNP transistor so that the lower 20 LEDs turn off when the 555 output goes high during the T1 time interval. The high output level of the 555 timer is 1.7 volts less than the supply voltage. Adding the LED increases the forward voltage required for the PNP transistor to about 2.7 volts so that the 1.7 volt difference from supply to the output is insufficient to turn on the transistor. Each LED is supplied with about 20 mA of current for a total of 220 mA. The circuit should work with additional LEDs up to about 40 for each group, or 81 total. The circuit will also work with fewer LEDs so it could be assembled and tested with just 5 LEDs (two groups of two plus one) before adding the others.

