

## JUMBO LED FLASHER | JAMECO PART NO. 2216606



**Experience Level: Beginner | Time Required: 20 minutes**

Two jumbo 10mm LEDs flash in an alternating frequency that you can adjust with two potentiometers. You can also substitute the LEDs for another color.

### Required tools and parts:

- Soldering iron & solder
- Wire cutters
- 9V battery

### Kit Includes:

Part No	Qty	Description
690865	2	1k $\Omega$ resistor (R1, R2)
691104	2	10k $\Omega$ resistor (R3, R4)
254044	2	500k $\Omega$ potentiometer (R5, R6)
254801	2	BC547 transistor (Q1, Q2)
2152155	2	Red diffused jumbo 10mm LEDs (D1, D2)
29891	2	10 $\mu$ F, 50V electrolytic capacitor (C1, C2)
109154	1	9V battery snaps
2215401	1	Flasher PCB

### Step 1 - Install resistors

**R1, R2 = 1k  $\Omega$**  (brown-black-red)

**R3, R4 = 10k  $\Omega$**  (brown-black-orange)



The resistors do not have polarity so they can be installed in either direction. Bend both leads down and insert so they are flush with the board according to the color code and location above. On the other side, bend the leads at an angle so the resistor remains in place. Solder and clip the excess wire.

### Step 2 - Install potentiometers

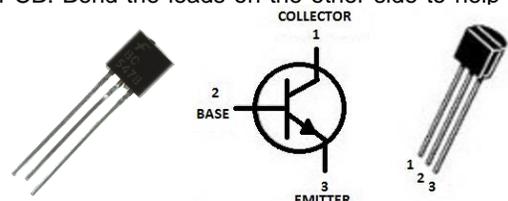
**R5, R6 = 500k  $\Omega$**



Install the potentiometers according to the silkscreen and hole pattern on the PCB. Bend the leads on the other side to help hold the component in place while you solder the leads. Trim the excess.

### Step 3 - Install transistors

**Q1, Q2 = BC547 (TO-92 package)** Pin 1: Collector, Pin 2: Base, Pin 3: Emitter



Install the transistors according to the silkscreen pattern on the PCB. The half-circle must match the half-circle on the PCB. Bend the leads on the other side to hold the component in place while you solder the leads. Trim the excess.

#### Step 4 - Install capacitors

**C1, C2 = 10 $\mu$ F capacitor**



This capacitor is polarized and can only be installed in one direction. The PCB has a '+' plus sign near the pad for the positive lead. The capacitor has a stripe with the minus sign going down one side to show which lead is negative. Place the component on the PCB in the correct orientation and bend the leads to hold it in place and solder the leads. Trim the excess.

#### Step 5 - Install LEDs

**D1, D2 = Red LED**



The longer lead is the positive and the shorter is the negative lead. The square pad is for the positive lead. Correctly install the LED and bend the leads to hold it in place while you solder it. Trim the excess.

#### Step 6 - Install battery holder



The space marked 'BAT' is for the battery holder. The pad with the dot near it is the pad for the positive lead. Install the red wire to the positive pad and solder the wire. You may need to use tape or a third hand to keep the wire in place. Install the black wire in the other pad and solder.

#### Step 7 - Plug in the battery

Plug in the 9V battery and the LEDs should begin to flash. Use a small screwdriver to adjust the tuning knobs/screws on the potentiometer. Each potentiometer will adjust the flash rate of one LED. As long as both adjustment screws are at the same position, the LED flash should be the same duration.

#### Explanation

When you apply power to the circuit, the transistors will switch on and off causing the LEDs to flash in pulses. Let's assume when you first power up the circuit with the 9 volt battery, C1 has already charged up with 7 volts through the 1k  $\Omega$  resistor at R1. Capacitor C2 is charging through the 500k  $\Omega$  potentiometer at R6 and when the voltage reaches 0.7 volts, transistor Q1 turns on. The Q1 collector and the positive lead from C1 are pulled down to 0 volts which forces the negative lead of C1 to -7 volts which turns off transistor Q2.

Capacitor C1 is still connected to the positive 9 volts through the 1k  $\Omega$  resistor at R1 and it makes the capacitor C1 charge in the opposite direction. The voltage on the negative side of C1 (and base of transistor Q2) starts to move from -7 volts toward the +9 volts. When the voltage reaches 0.7 volts, transistor Q2 turns on and the voltage stored in capacitor C2 turns the transistor Q1 off.

Capacitor C2 now charges in the opposite direction through the 10k  $\Omega$  resistor at R4. The voltage on the negative side of C2 (and base of transistor Q1) now starts to rise toward the +9 volts but triggers Q1 when it reaches 0.7 volts. The circuit will now repeat being back where it started.

The capacitor and potentiometer values are what determine the flash rate and the potentiometer varies the time the other transistor is off.

