

Christmas Decoration Project

This project flashes 18 LEDs at three different rates and you can use these to create a Christmas decoration of your choice. The circuit is kept simple (and cheap!) by using the 4060B chip which is a counter and oscillator (clock) in one package. The circuit requires a 9V supply, such as a PP3 battery. It will not work with lower voltages and a higher voltage will destroy the LEDs.

The preset variable resistor can be used to adjust the oscillator frequency and this determines the flash rate of the LEDs. The chip limits the current to and from its outputs so the LEDs can be safely connected without resistors in series to limit the current. The stripboard part of the circuit is easy to build but the wiring for the LEDs needs care so detailed instructions are provided below.

You can design your own decoration or download our Christmas Tree template to print out and glue onto thick card, hardboard etc. The template has two tree outlines on one sheet of A4 paper.

Warning!

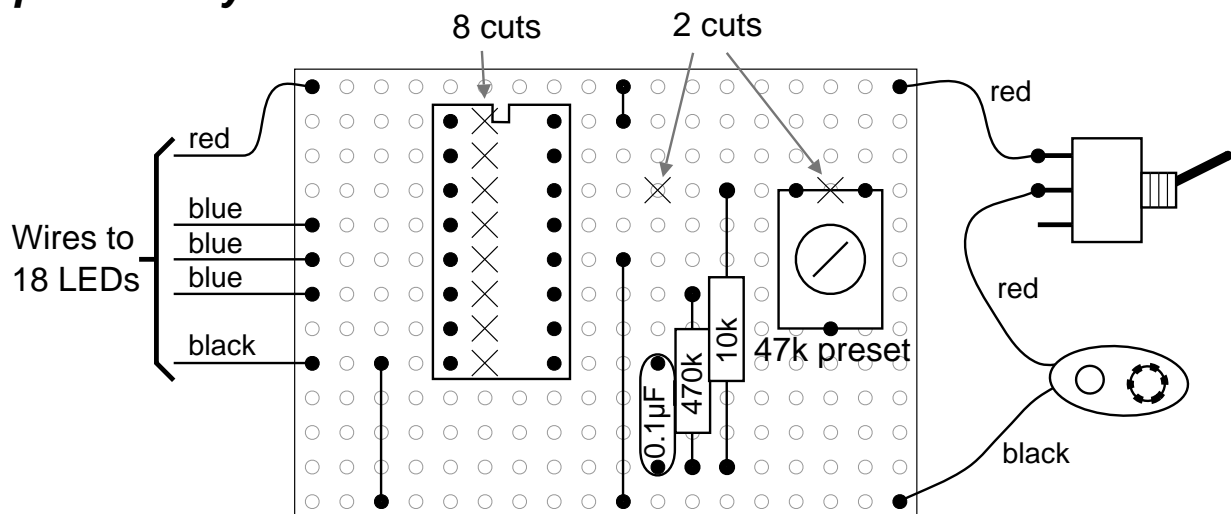
Using a battery (or power supply) with a voltage higher than 9V will destroy the LEDs.

You can see from the circuit diagram (below) that 6 LEDs are connected in series between the +9V supply and 0V. Each LED requires about 2V across it to light, so using a voltage of about 12V (= 6 × 2V) or more will make the LEDs conduct directly, regardless of the 4060B chip. With no series resistor to limit the current this will destroy the LEDs.

Parts Required

- resistors: 10k, 470k
- preset: 47k (this could be 100k if necessary)
- capacitor: 0.1µF
- 4060B IC
- 16-pin DIL socket for IC
- LEDs × 18, 5mm diameter, any mix of colours: red, orange, amber, yellow or green
- on/off switch
- battery clip for 9V PP3
- stripboard 13 rows × 18 holes

Stripboard Layout



Building the Circuit

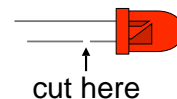
- Begin by soldering the components onto the stripboard as shown in the diagram above. Do **not** insert the 4060B chip at this stage. continued ...

Arranging the LEDs:

- Cut out a suitable shape from stiff card (or similar material), such as our Christmas Tree template. Paint or colour the card at this stage if necessary.
- Plan the layout of the 18 LEDs (suggested positions are marked on our template).
- Drill 5mm holes for the LEDs - put the card on a piece of scrap wood to do this without damaging the card or the table.
- Push LEDs into the holes, they should be a fairly tight fit and glue should not be necessary.
- Label the LEDs D1 - D18 at random on the back of the card.

Wiring of the LEDs:

Use stranded wire for all the connections to the LEDs and solder all wires near to the LED body so the leads can be trimmed short later on. The wire colours are suggested to avoid confusion but you can use other colours if you wish, the electricity won't mind! For example you could use red and black as suggested but substitute yellow and white for the blue and green suggested.



- 1 Cut all the LED short leads to be very short to make identification easier:
- 2 Connect **RED** wire to link up all the LONG leads of D1, D2 and D3.
Solder wires near to the LED body so the long lead can be trimmed short later on.
- 3 Connect **BLACK** wire to link up all the SHORT leads of D16, D17 and D18.
- 4 Use 3 pieces of **BLUE** wire to connect:
 - D7 short - D10 long
 - D8 short - D11 long
 - D9 short - D12 long
- 5 Use 12 pieces of **GREEN** wire to connect:
 - D1 short - D4 long
 - D3 short - D6 long
 - D11 short - D14 long
 - D4 short - D7 long
 - D6 short - D9 long
 - D14 short - D17 long
 - D2 short - D5 long
 - D10 short - D13 long
 - D12 short - D15 long
 - D5 short - D8 long
 - D13 short - D16 long
 - D15 short - D18 long
- 6 Connect the **RED** wire from the circuit board to the **RED** wiring on the decoration (connect it to any convenient point).
- 7 Connect the **BLACK** wire from the circuit board to the **BLACK** wiring on the decoration (connect it to any convenient point).
- 8 Connect the 3 **BLUE** wires from the circuit board to each of the 3 **BLUE** wires on the decoration, they may be connected in any order.
- 9 Carefully check all wiring, trim the long LED leads, plug the 4060B into its holder.
- 10 Connect a 9V battery and switch on, then use a small screwdriver to adjust the 47k preset variable resistor to give a suitable flash rate for the LEDs.

Circuit diagram

