Q

.(/)

PROJECTS

Kid's Basics: Flickering Flame
Light Up the House Without Burning it Down!!

DANIEL KOCH

Issue 23, June 2019

SHARE: f   🐦   G+

(http(https://plus.google.com/share?
text=Kid%27s%Basic%2Fdiyodemag+Flam%url=https%2F%2F%2Fdiyodemag.com%2Fprojects%2Fkids_basics_flickering_flam

This circuit will flicker an LED like a flame, and with some other LEDs and some craftiness, you can have a pretty realistic fire scene.

Kid's Basics: Electronic Flickering Flame Camp Fire Diorama

▶

In Issue 019 of Kids Basics (https://diyodemag.com/projects/kids_basics_using_the_555_timer_ic) we used the 555 Timer IC to flash some emergency LED lights. We then

For this project, we've stayed with our friend   mer IC   d a;   we're u   g tw   n. This   ever, v   lifferent components to give slower times, producing visible effects through the LED. Y   an th   uild   inte   cam   e d'   na t   ve s   you   et c   ve and make your own setting.

ELECTRONICS AND CONSTRUCTI

We will split the build into two parts. First, w   l buil   e ele   onics t   ble th   Ds tc   ker.   n we   sho   to construct your own campfire diorama scene using sticks and stones.

* Quantity shown as used in the circuit, may   be a'   ble   acks.

** Ceramic capacitors. MKT not available fr..... .... supplier.

\# 270Ω not available in this pack. 330Ω will be acceptable instead.   (/).
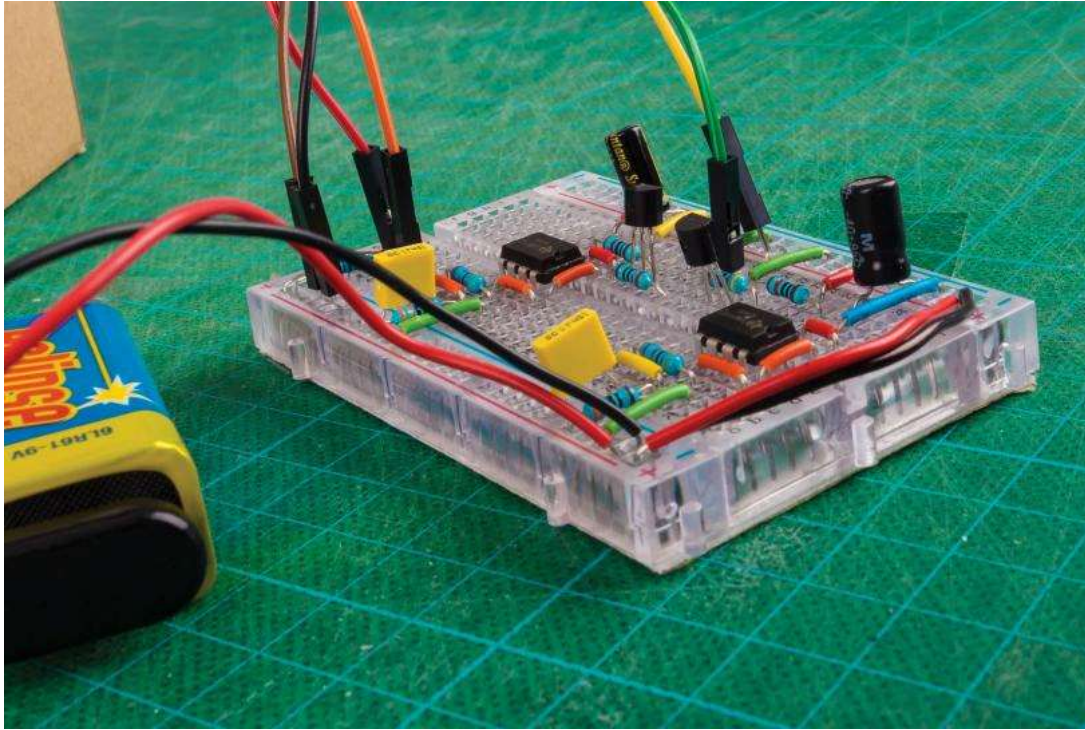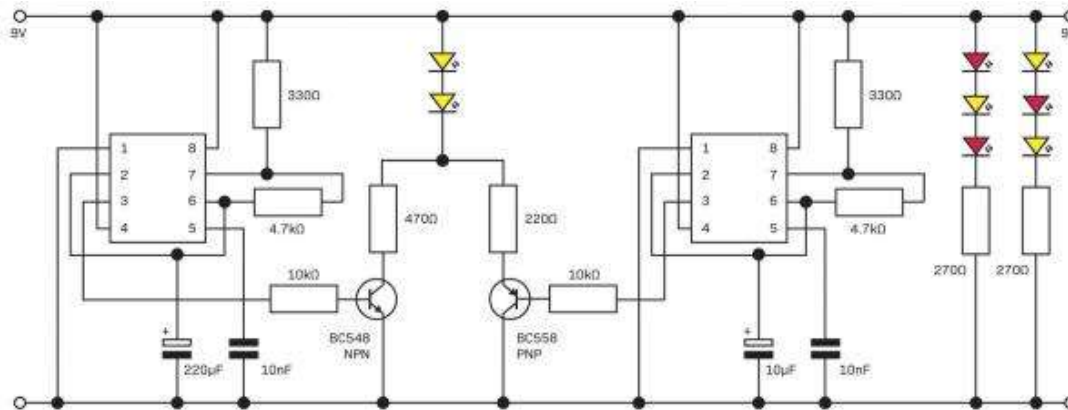
(/_images/5cedffacc672e083280861f2)

THE BUILD:

We're assuming very little (or zero) electronics knowledge, and so will try to walk through everything carefully, in order to ensure your success. There is no soldering or programming required - we've kept it as simple as possible.

If this is your first project, you may also like to read "Breadboard Basics" in Issue 15 (https://diyodemag.com/education/fundamentals_breadboarding_basics), to familiarise yourself with the breadboard before getting started.
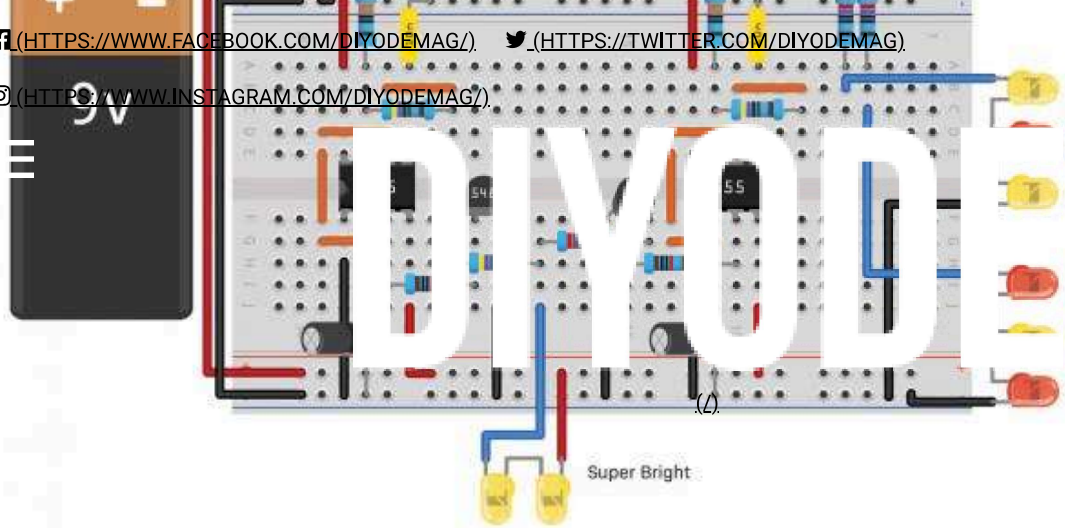
(/_images/5cedffacc672e083280861f5)
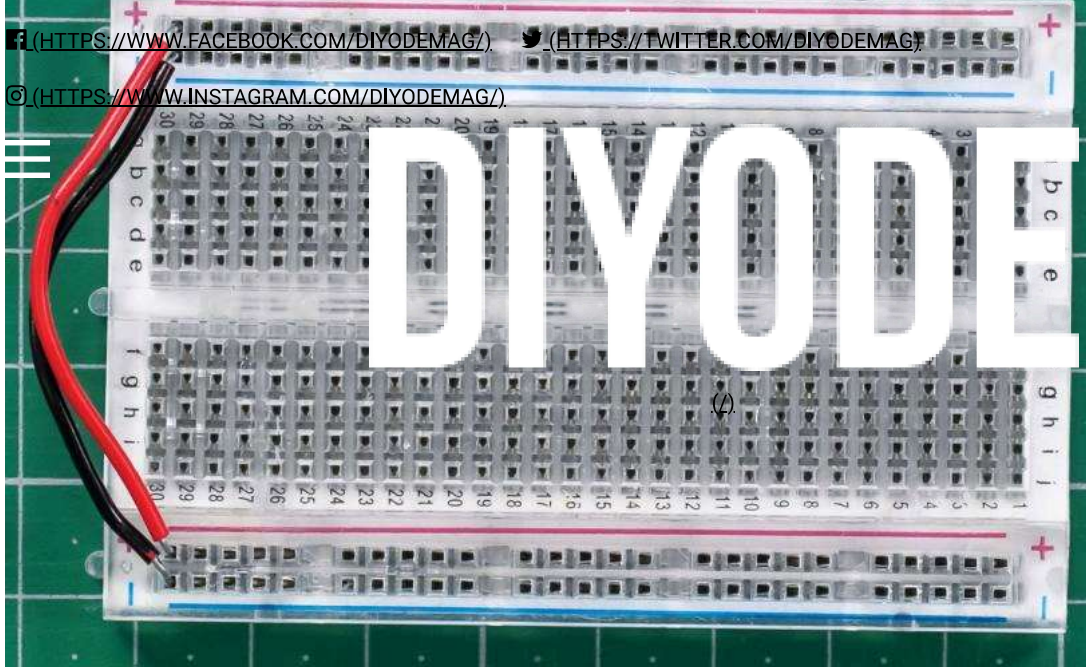
(/_images/5cedffacc672e083280861f7)

STEP 1:
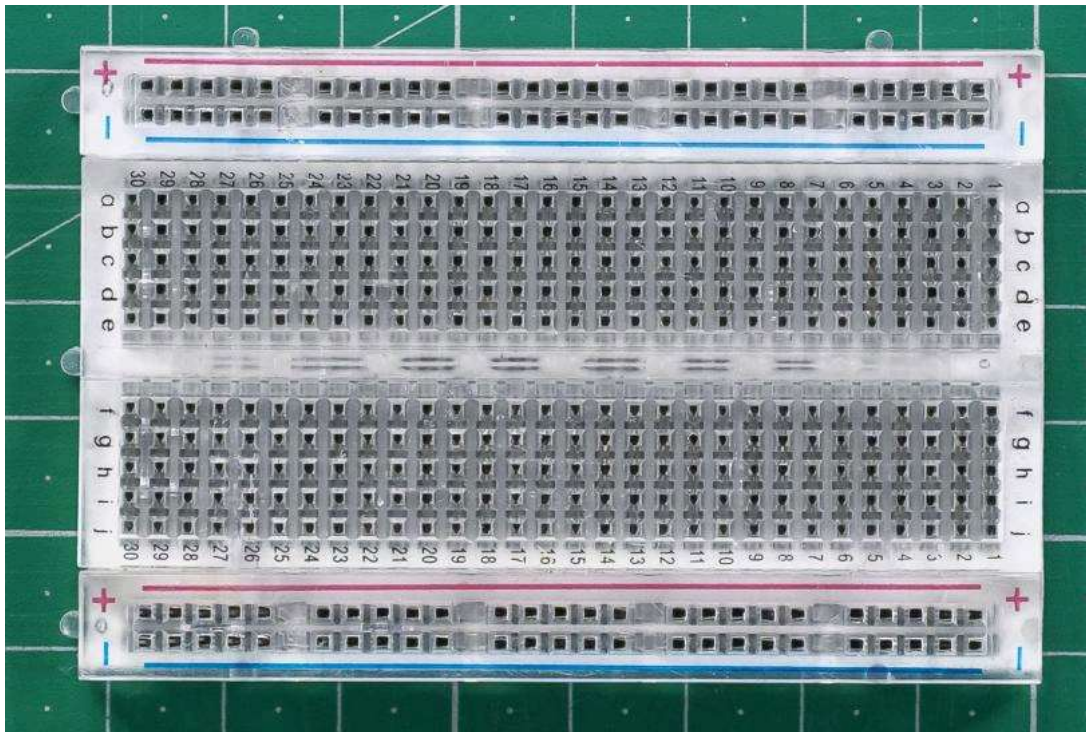
(/_images/5cedffacc672e083280861f9)

Put the breadboard on the table in front of you with the blue (-) negative power rail closest to you.

(/_images/5cedffacc672e083280861fc)

Insert the two wire links on the left that join the set of power rails at the top with the ones at the bottom. Be very careful that (+) goes to (+) and (-) goes to (-).

STEP 3:
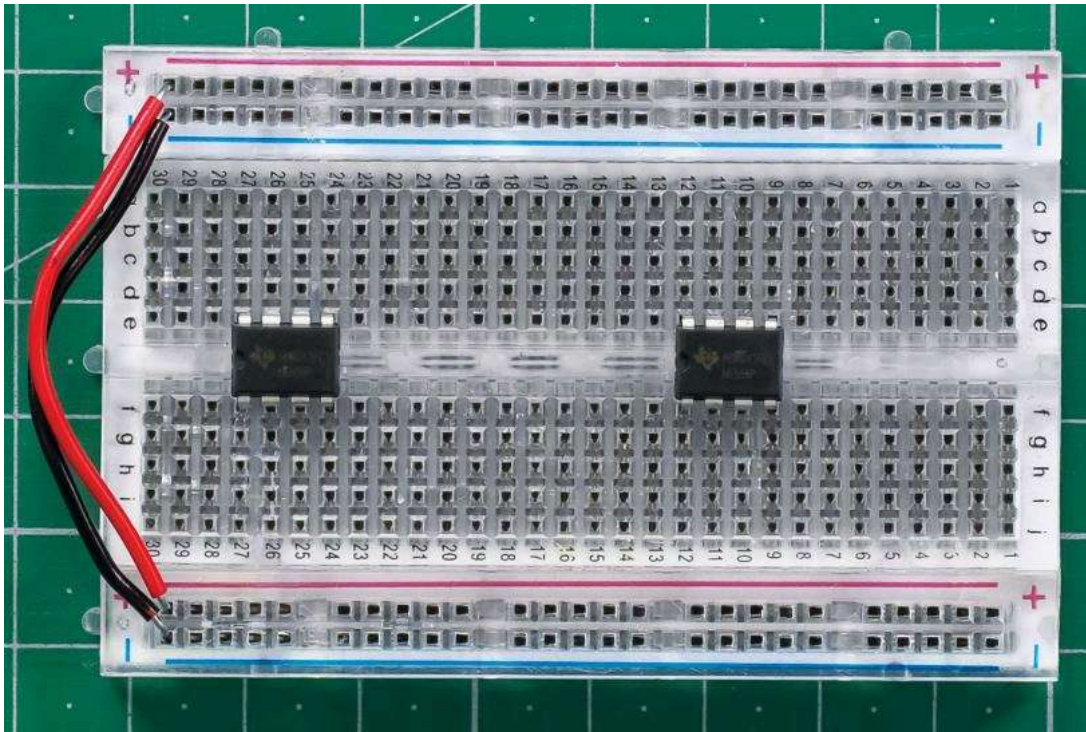
(/_images/5cedffacc672e083280861ff)

Gently insert the two 555 timer ICs, making sure the notches face left. Some versions have a dot instead that should go at the bottom left.
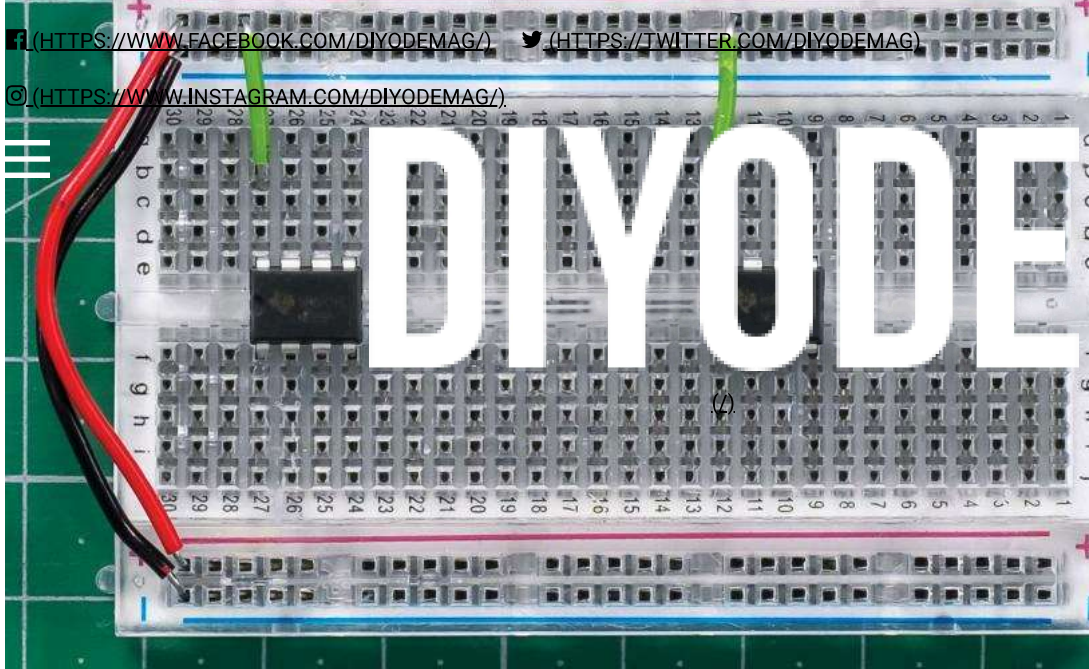
(/_images/5cedffacc672e08328086202)

Insert two wire links shown here, one each from the upper (+) rail (red) to pin 8 of each IC.

STEP 5:
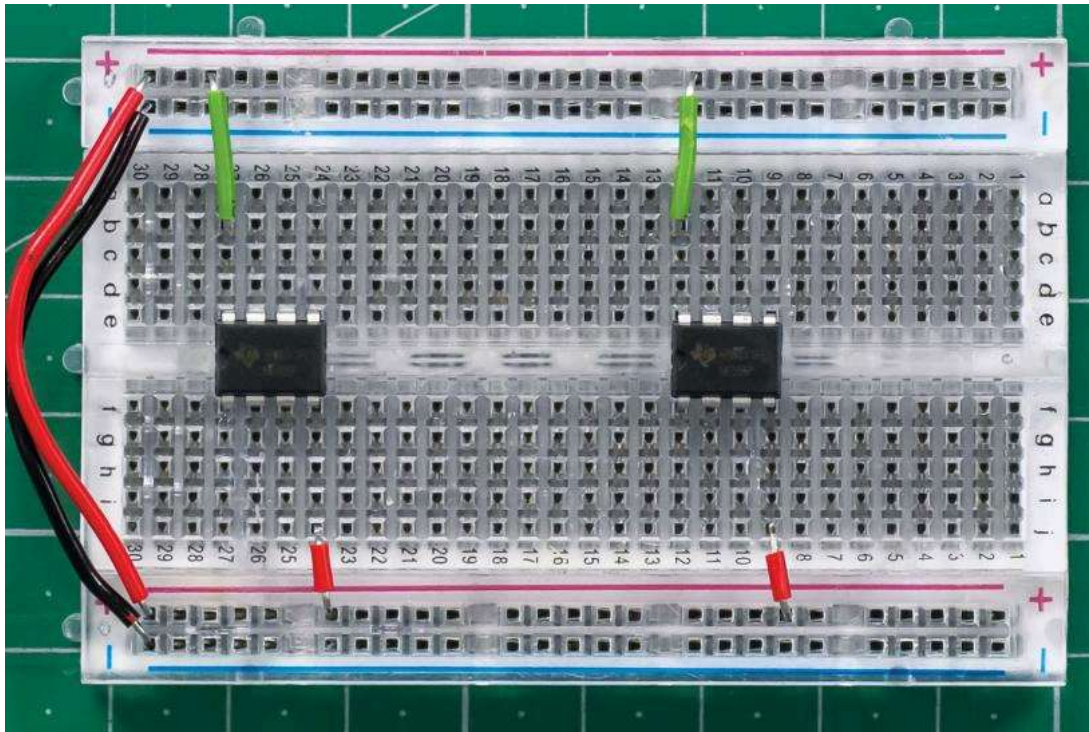
(/_images/5cedffacc672e08328086205)

Insert the wire links shown here, one each from the lower (+) rail (red) to pin 4 of each IC.
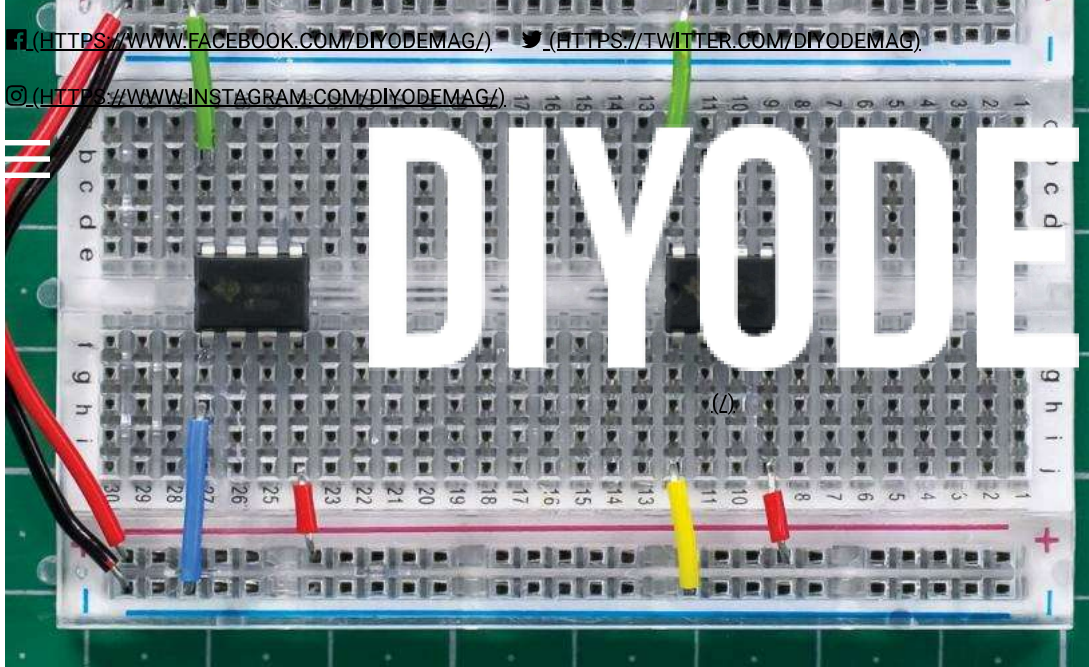
(/_images/5cedffb4c672e0f104085db4)

Insert the two wire links shown here, one each from the lower (-) rail (blue) to pin 1 of each IC.

STEP 7:
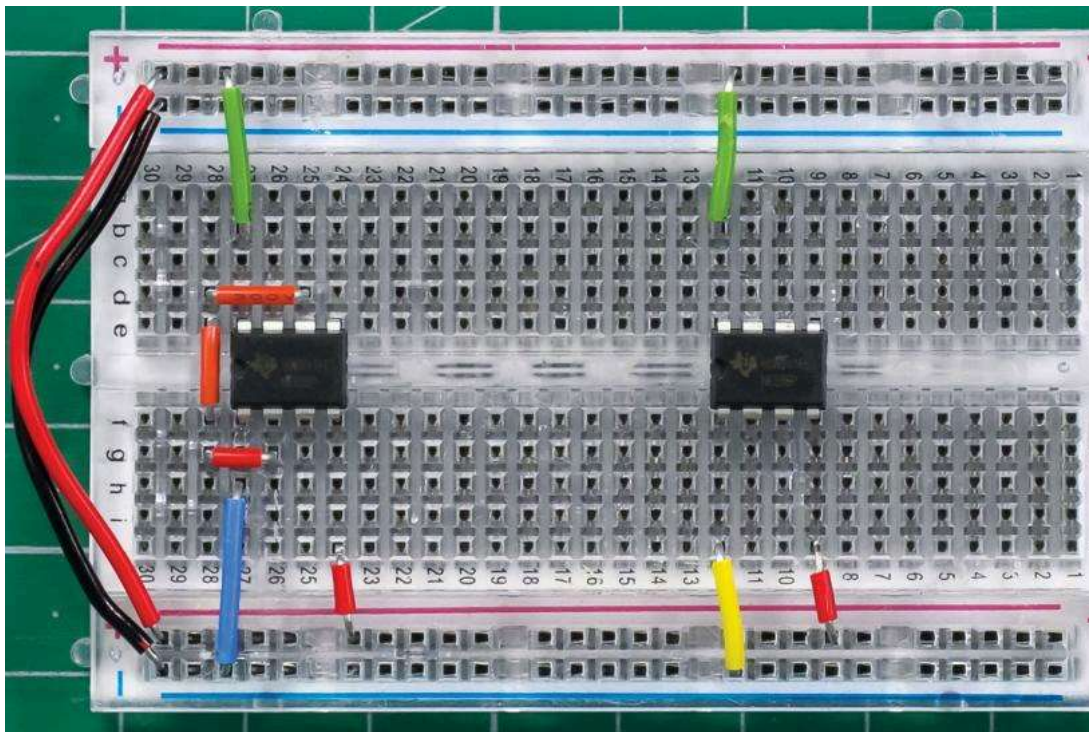
(/_images/5cedffb4c672e0f104085db7)

Insert the three wire links shown here that join pin 2 to pin 6 on the left-hand IC.

(2)
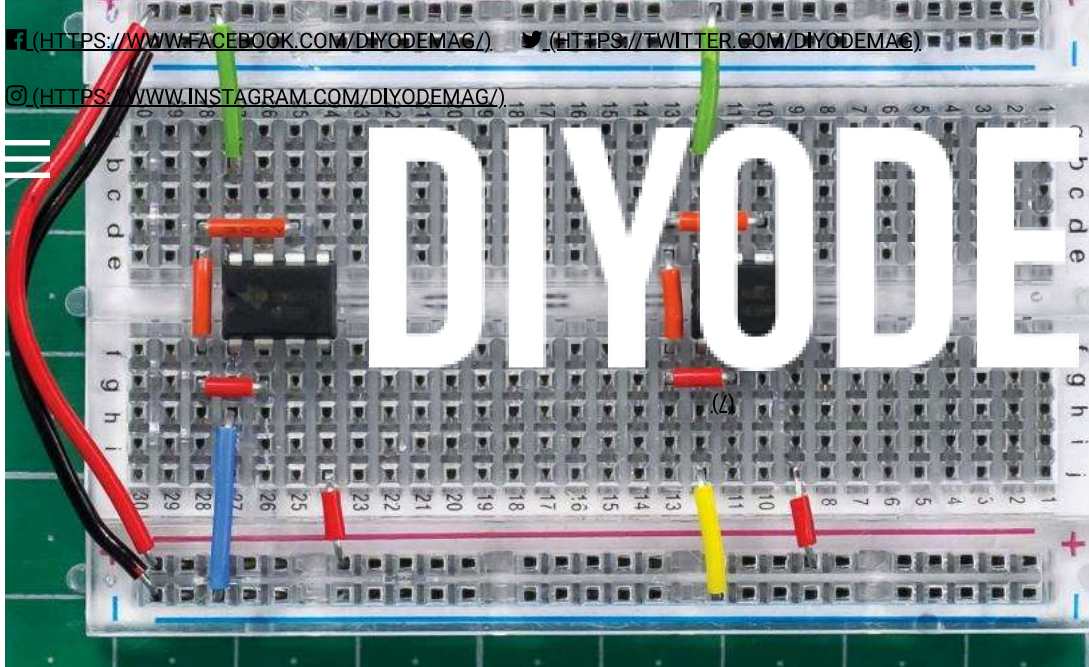
(/_images/5cedffb4c672e0f104085dba)

Insert the three wire links shown here that join pin 2 to pin 6 on the right-hand IC.

STEP 9:
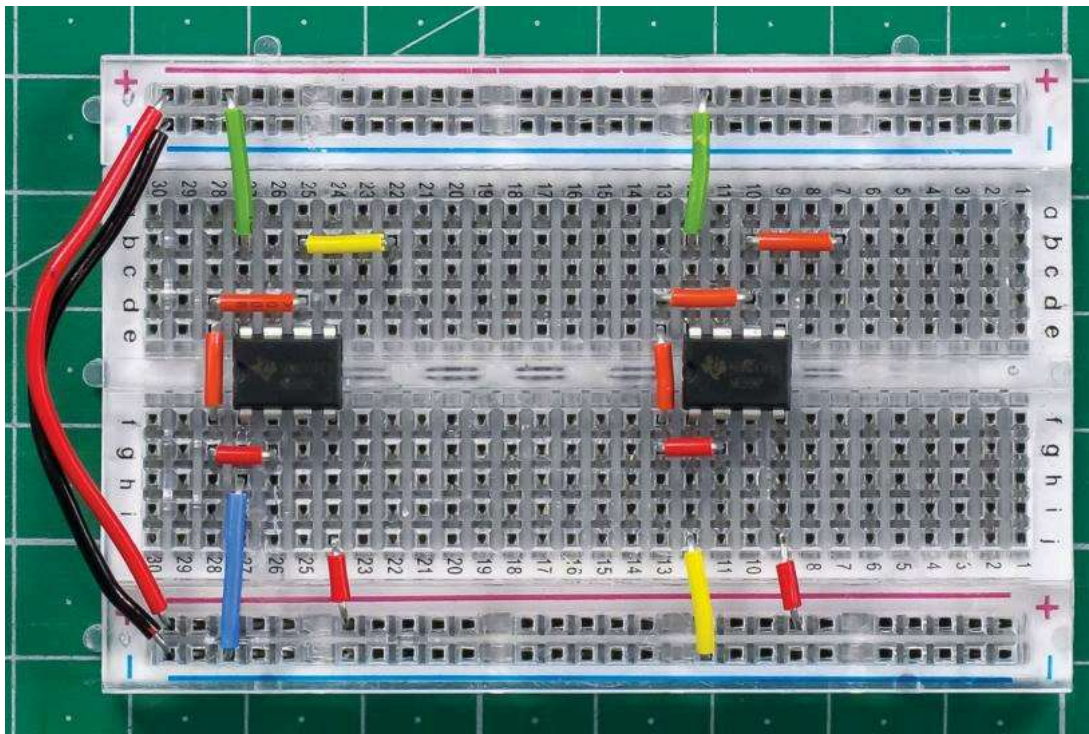
(/_images/5cedffb4c672e0f104085dbd)

Insert the two wire links shown here, between pin 6 of each IC and a spot to the right of each IC. The two links are identical, just repeated for each IC.
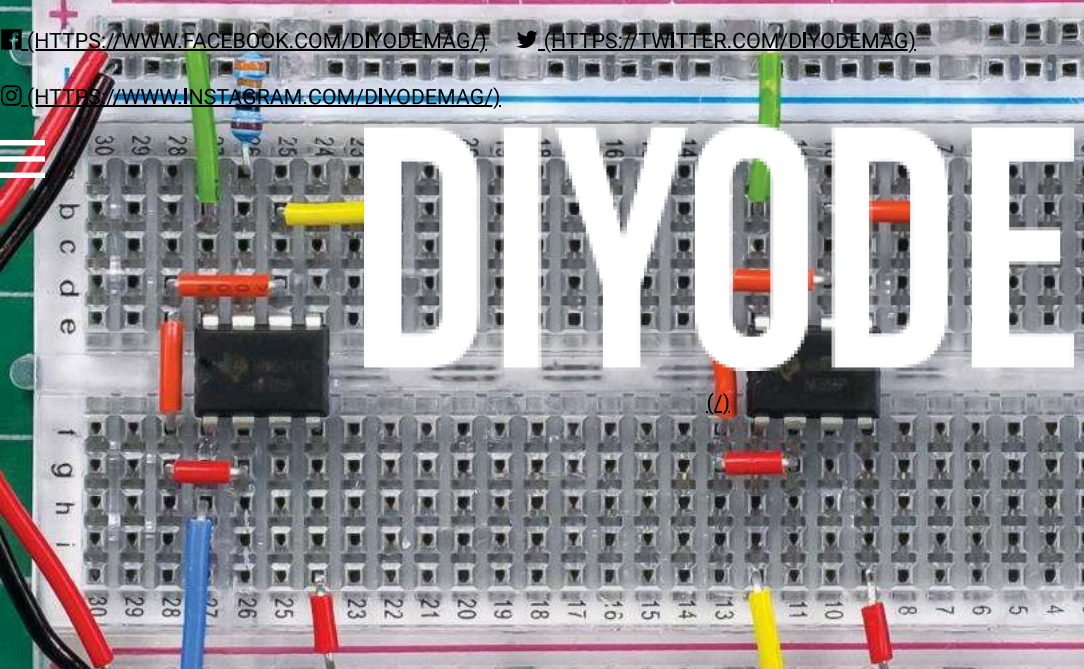
(/_images/5cedffb4c672e0f104085dc0)

Insert a 330Ω (orange-orange-brown or orange-orange-black-black) resistor between the upper (+) rail (red) and pin 7 of the left-hand IC.

Note: We have trimmed the leads of some of our components and bent the leads so that they fit neatly onto the board. This helps us in photography, but it will help you in checking, avoiding mistakes, stopping components touching each other, and making changes more easily.

STEP 11:
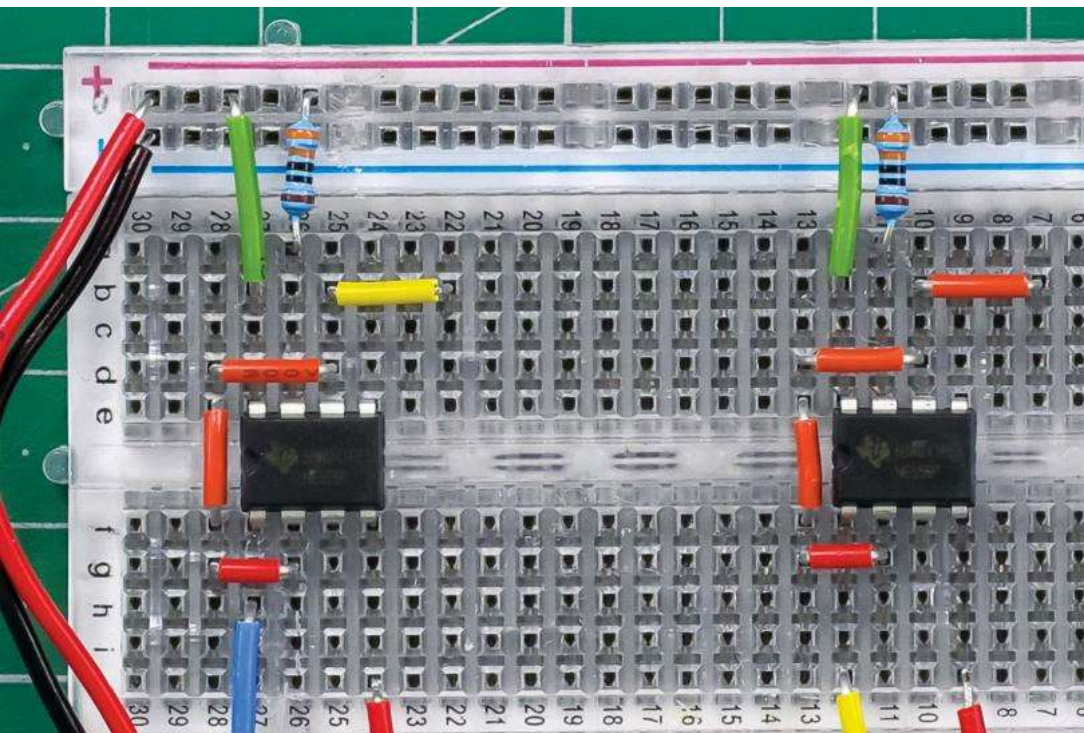
(/_images/5cedffb4c672e0f104085dc3)

Insert a 330Ω (orange-orange-brown or orange-orange-black-black) resistor between the upper (+) rail (red) and pin 7 of the right-hand IC.
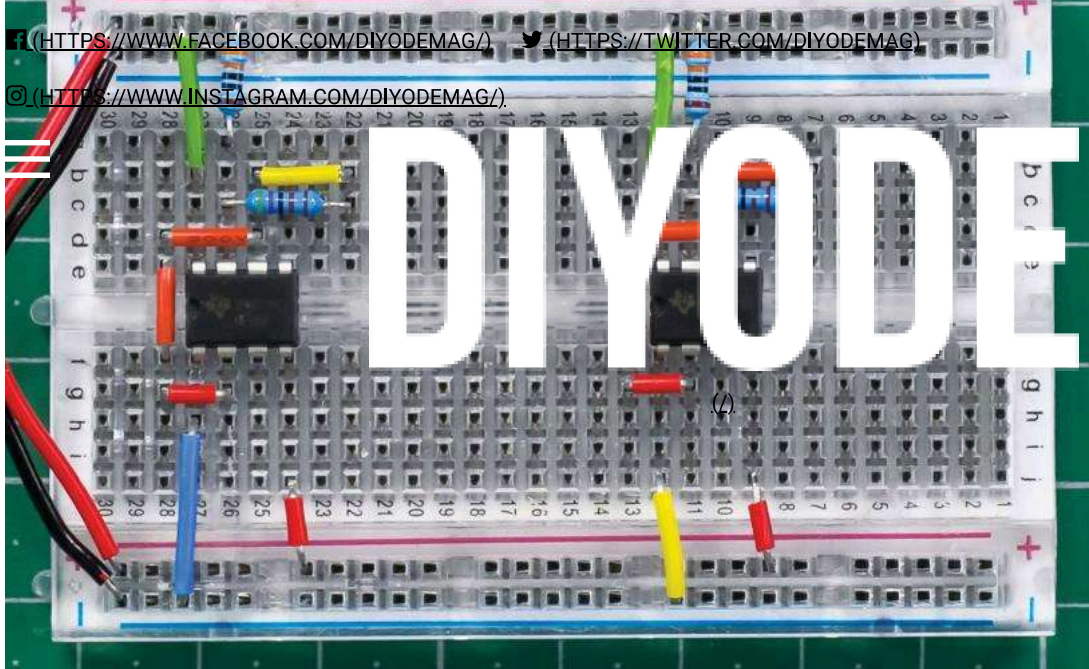
(/_images/5cedffb4c672e0f104085dc6)

Insert a 4.7kΩ (yellow-purple-red or yellow-purple-black-brown) resistor between pin 7 of the left-hand IC and the end of the wire link from step 9, then do exactly the same for the right-hand IC.

STEP 13:
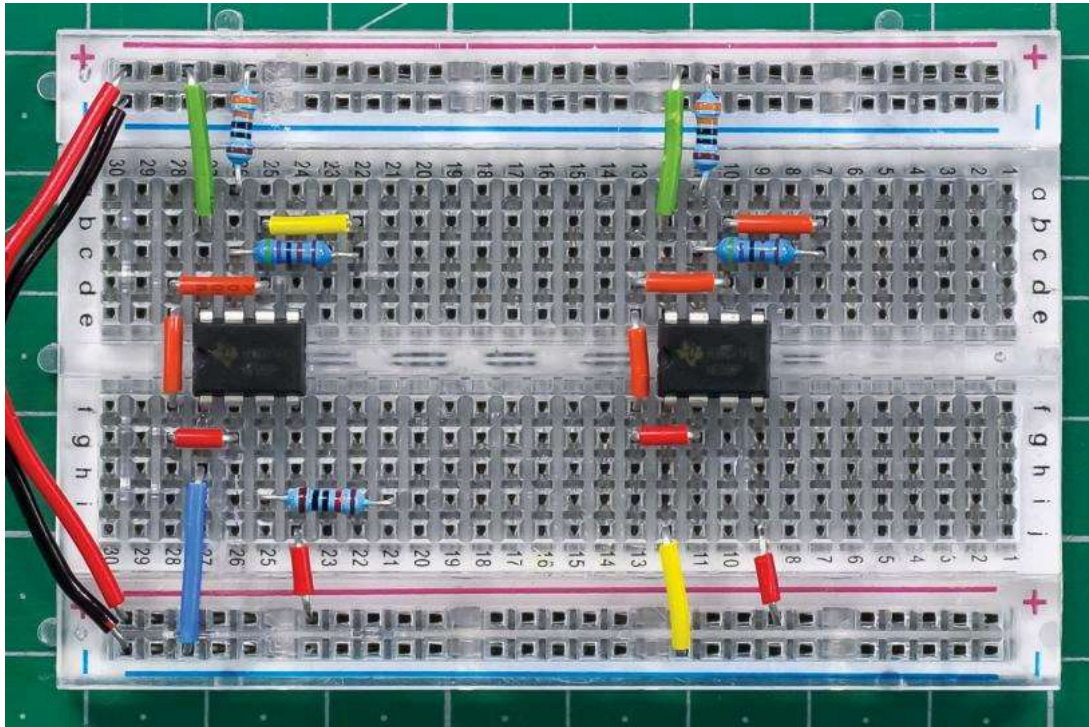
(/_images/5cedffb4c672e0f104085dc9)

Insert a 10kΩ (brown-black-orange or brown-black-black-red) resistor between pin 3 of the left-hand IC and a spot three holes to the right of the IC as shown.
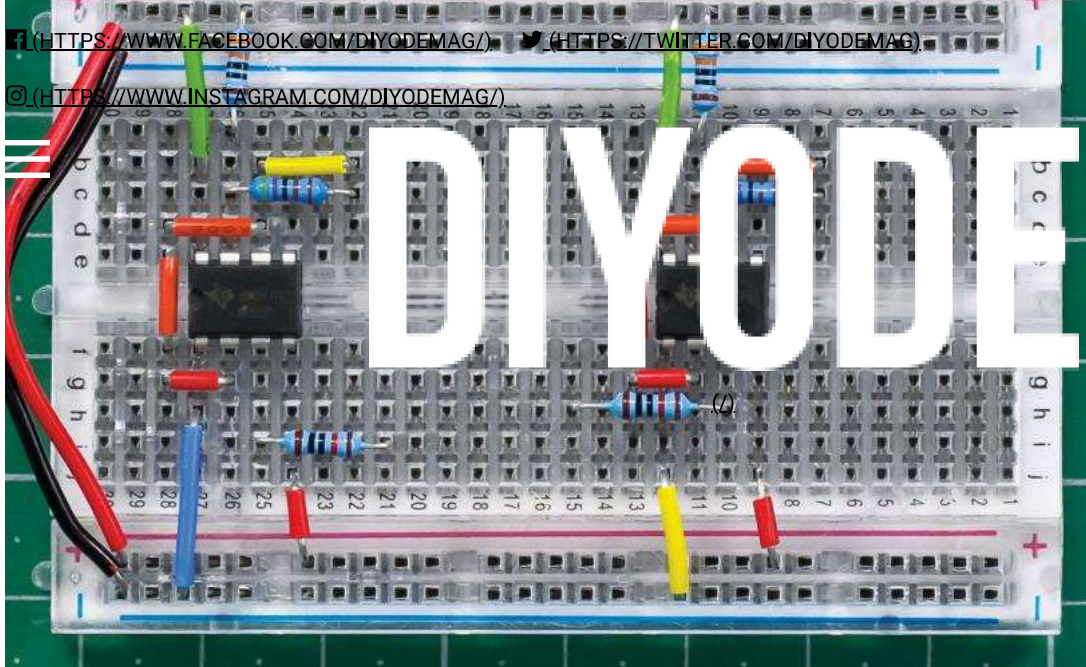
(/_images/5cedffbcc672e06673085dcb)

Insert a 10kΩ (brown-black-orange or brown-black-black-red) resistor between pin 3 of the right-hand IC and a spot three holes to the left of the IC as shown.

STEP 15:

(/_images/5cedffbcc672e06673085dce)

Insert the two 270Ω (red-violet-brown or red-violet-black-black) resistors between the upper (+) rail (red) and the spots shown.

.(/).

[(/_images/5cedffbcc672e06673085dd1)](/_images/5cedffbcc672e06673085dd1)

Insert the BC548 transistor with its flat face toward you, as shown. The middle leg lines up with the end of the resistor you placed in step 13.

STEP 17:

[(/_images/5cedffbcc672e06673085dd4)](/_images/5cedffbcc672e06673085dd4)

Insert the BC558 transistor with its flat side facing towards you, as shown. The middle leg lines up with the end of the resistor from step 14.

DIYODE

(/).

(/_images/5cedffbcc672e06673085dd7)

Insert a wire link between the right-hand leg of the BC548 as installed on the board and the lower (-) rail (blue).

STEP 19:

(/_images/5cedffbcc672e06673085dda)

Insert a wire link between the left-hand leg of the BC558 as installed on the board and the lower (-) rail (blue).

DIYODE

(/)

(/_images/5cedffc5c672e0f975086067)

Insert the 470Ω (yellow-purple-brown or yellow-purple-black-black) resistor between the left-hand leg of the BC548 and the spot between the two transistors.

STEP 21:

(/_images/5cedffc5c672e0f97508606a)

Insert the 220Ω (red-red-brown or red-red-black-black) resistor between the right-hand leg of the BC558 and the spot between the two transistors, in line with the resistor placed in step 20.

DIYODE

.(/).

(/_images/5cedffc5c672e0f97508606d)

Insert a 10nF (marked 103, 10n or 0.01μ, followed by a capital letter and other numbers) MKT capacitor between the upper (-) rail (blue) and pin 5 of each IC. Note that you are doing the same thing twice, once for each IC.

STEP 23:

(/_images/5cedffc5c672e0f975086070)

Insert the 220μF electrolytic capacitor between the lower (-) rail (blue) and pin 2 of the left-hand IC. Note that the negative side of the capacitor is shown with a stripe, and must go to the (-) rail (blue).

(/_images/5cedffc5c672e0f975086073)

Insert the 10µF electrolytic capacitor between the lower (-) rail (blue) and pin 2 of the right-hand IC. Note that the negative side of the capacitor is shown with a stripe, and must go to the (-) rail (blue).

STEP 25:
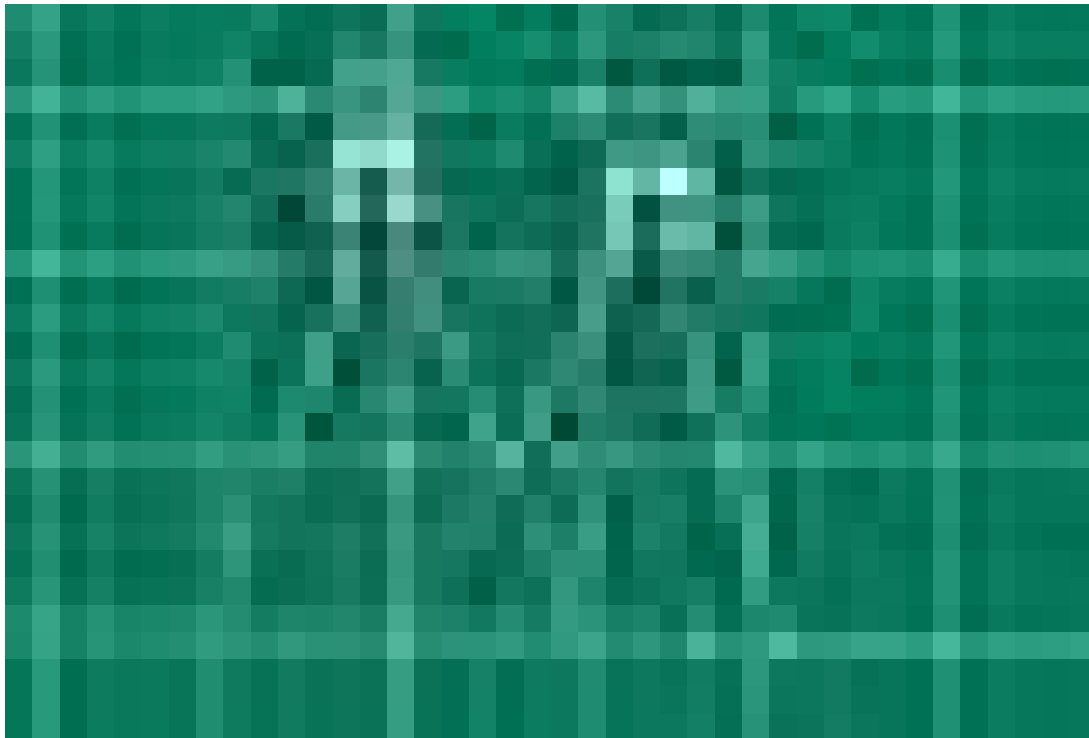
(/_images/5cedffc5c672e0f975086076)

Now we have some off-board electronics to do. Take the two super-bright yellow LEDs and place them on the table so that their legs are arranged as shown. Note that one long leg connects to one short leg. The flat edge on the LED rim also indicates the negative leg.

.(/)

(/_images/5cedffcdc672e0d817085fce)

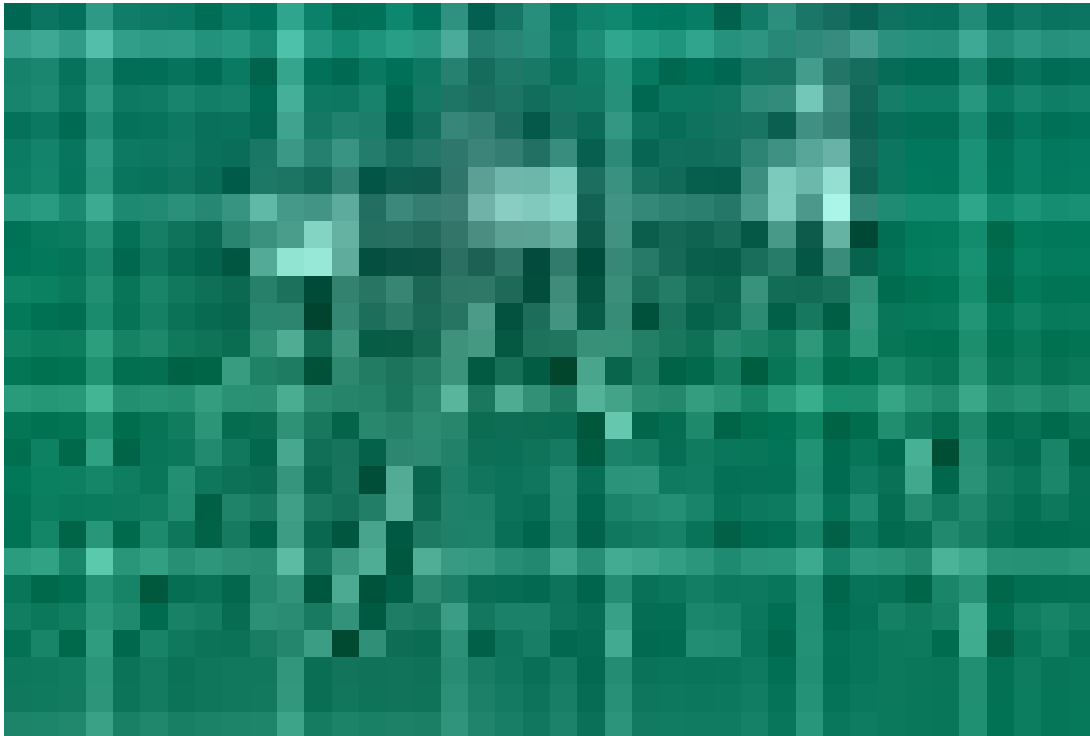Pinch the LED legs above where they join, and use pliers to twist the legs tightly together as shown. Get an adult to help if you need to.

STEP 27:

(/_images/5cedffcdc672e0d817085fd0)

Lay two of the lower brightness yellow LEDs and one red one on the table, in a yellow-red-yellow pattern. Place the legs as in step 25, except that there is an extra LED.

DIYODE

(/)

(/_images/5cedffcdc672e0d817085fd3)
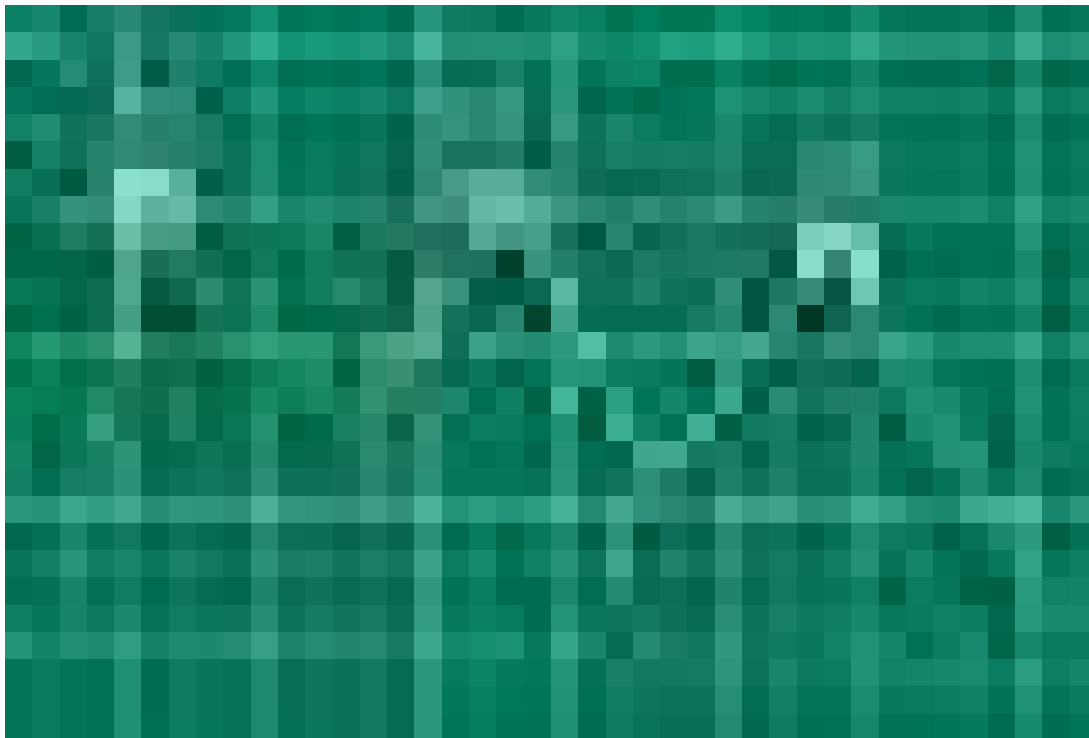
Twist the long leg of the first LED to the short leg of the next one, as in step 26. You should end up with a line of three LEDs as shown.

STEP 29:

(/_images/5cedffcdc672e0d817085fd6)

Lay the other two red LEDs and the last yellow LED in a red-yellow-red arrangement. Twist the legs as in step 28.

DIYODE

.(/).

(/_images/5cedffcdc672e0d817085fd9)

Strip six different colours off the chain of pin-to-pin jumpers. Choose three light and three dark colours. Do the same for the socket-to-socket chain, in the same colours.

STEP 31:

(/_images/5cedffcdc672e0d817085fdc)

Push one pin end into a socket end for each pair of the same colour to make long plug to socket leads as shown, and tape each join with sticky tape.

DIYODE

(/)

(/_images/5cedffcdc672e0d817085fde)

Take one light-coloured lead and insert the pin end into the lower (+) rail (red).

STEP 33:

(/_images/5cedffd7c672e0cc3d085dc7)

Take one dark-coloured lead and insert the pin end into the point where the 470Ω and 220Ω resistors meet.

DIYODE

.(/).

(/_images/5cedffd7c672e0cc3d085dcc)
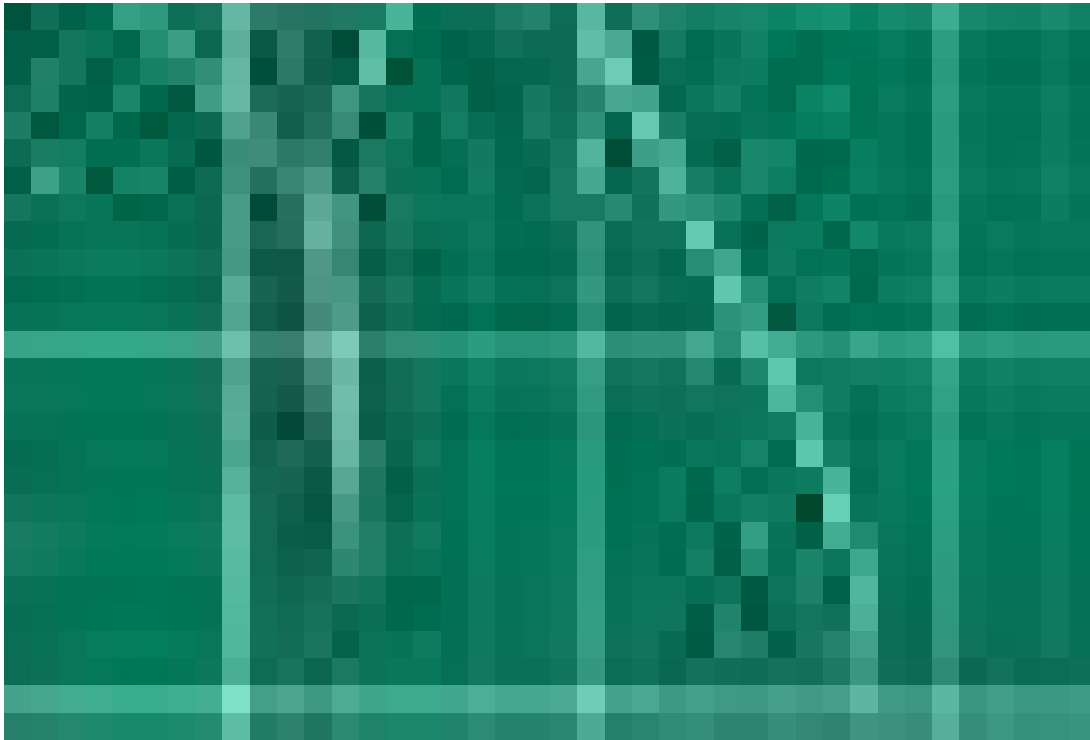
(/_images/5cedffd7c672e0cc3d085dca)

Take the two super-bright LEDs and insert the short lead into the socket of the dark-coloured lead. Insert the long leg into the light-coloured lead as shown.

Note: If at any time the LED legs are not a secure fit in the sockets, fold the end of the leg over as shown and press tightly with pliers. Be gentle when you try again as it will likely only fit one way now, and you may have to rotate the socket ¼ of a turn each time you try until it fits.

DIYODE

[(/)](/)
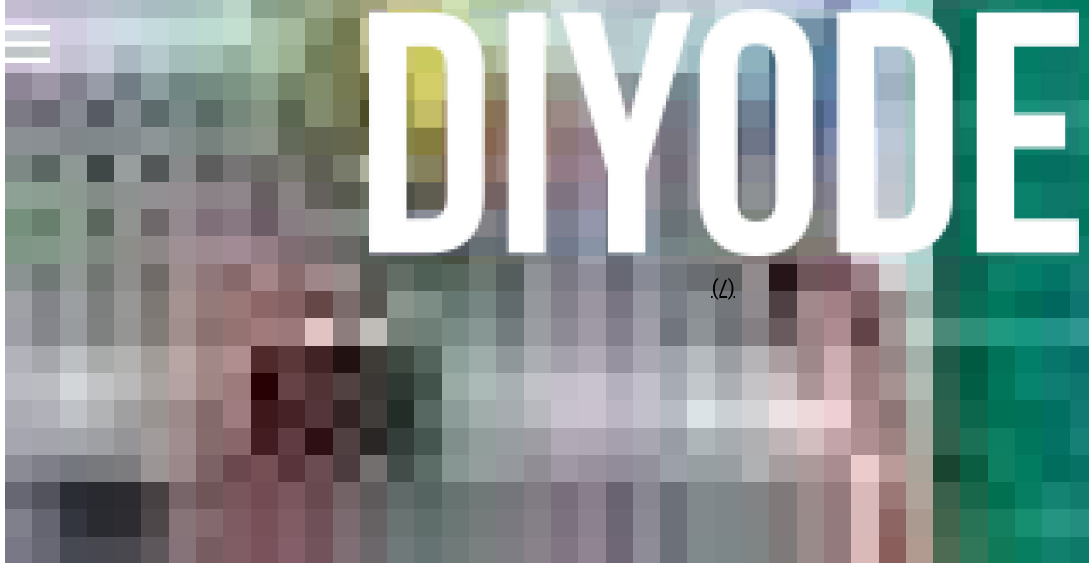
[(/_images/5cedffd7c672e0cc3d085dce)](/_images/5cedffd7c672e0cc3d085dce)

Take two light-coloured leads and insert them into the breadboard at the ends of the 270Ω resistors as shown.

STEP 36:

[(/_images/5cedffd7c672e0cc3d085dd1)](/_images/5cedffd7c672e0cc3d085dd1)

Take two dark-coloured leads and insert them into the lower (-) rail (blue).

(/_images/5cedffd7c672e0cc3d085dd4)

STEP 37:
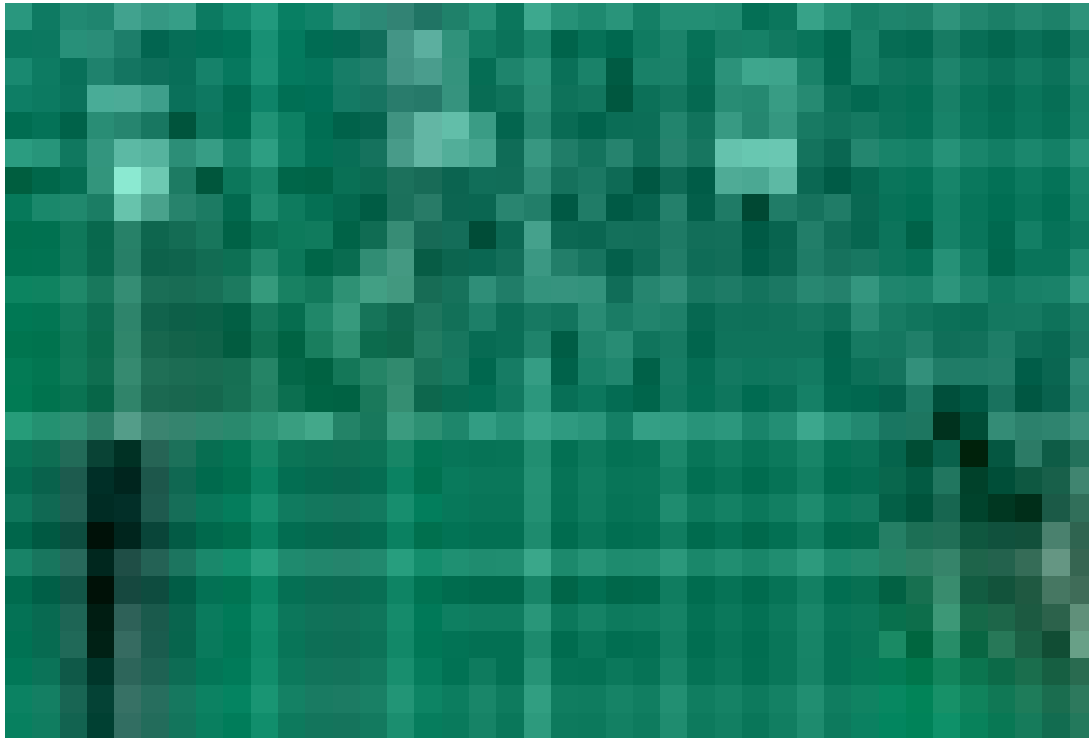
(/_images/5cedffd7c672e0cc3d085dd7)

Take one of the strings of three LEDs and insert the long leg into one of the light-coloured leads from step 35. Insert the short leg into a dark-coloured lead.

DIYODE

(/)

(/_images/5cedffdfc672e0d03d085e11)

Repeat step 37 with the other string of three LEDs, so that they are both plugged in as shown.

STEP 39:

(/_images/5cedffdfc672e0d03d085e14)

Insert the red wire of the battery snap into the upper (+) red rail, and the black wire into the upper (-) rail.

DIYODE

(/)

(/_images/5cedffdfc672e0d03d085e17)

Connect a 9V battery, and check all the LEDs. The two strings of three should be on constantly, and the two much brighter LEDs should be flickering. If not, disconnect the battery and check all connections, working backwards.

WHAT'S GOING ON?

As with the siren circuit in Issue 022 (https://diyodemag.com/projects/kids_basics_siren_effects_for_your_flashing_lights), there are two halves of this circuit, functioning the same way but with different component values to change the timings.

On the left-hand side, the 555 is set up by the 330Ω and 4.7kΩ resistors, along with the 220μF capacitor, to cycle on and off nearly every 1.49 seconds. That's 0.77 seconds for on, and 0.72 seconds for off.

The right-hand side is set up the same, but the 10μF capacitor gives a total time period of 67.5 milliseconds! That means the on and off times are close to 33 milliseconds, or 0.033 seconds! That is just a flicker to the human eye. But that's the point!

The output from the first IC is fed to an NPN transistor. If you remember from last time, the 555 can have current going out (called sourcing) or going in (called sinking) depending on whether the output is on (high) or off (low). The transistor allows us to make sure current is only flowing while the output is 'high', while also allowing more current than the 555 could supply on it's own.

The output from the right-hand IC is also fed through a transistor , but this one is a PNP transistor, which is set up so that it switches on during the 'low' cycle of its driving IC.

These two signals are both fed to the LEDs. The left-hand circuit outputs a slow flash through a transistor with a 470Ω resistor in the line, giving lower than full brightness for the LEDs. The right-hand circuit outputs a fast flash through a transistor with a 220Ω resistor connected to it, giving near full brightness.

The fast flicker effect is sometimes seen to flicker between on and off, and at other times between bright and dim. This is more like a real fire, in which flames vary in their intensity. Have a close look at the pattern. Disconnect the resistor between pin 3 of one IC and the base of the transistor to see the difference. Reconnect it, and try the other.

The two strings of three LEDs are there for effect – in a real fire, there is always some light, and these will be used next to provide the overall 'glow'.

WHERE TO FROM HERE?

You could try different resistor and capacitor values to change the timing cycles. There are calculators on the internet, such as http://www.ohmslawcalculator.com/555-astable-calculator (http://www.ohmslawcalculator.com/555-astable-calculator) which can help you. You could also try adding a resistor-capacitor network to the output of the slower IC to make it 'breathe'. This was done for our siren circuit in Issue 022 (https://diyodemag.com/projects/kids_basics_siren_effects_for_your_flashing_lights). Research 'breathing LEDs' online and see what you come up with. We'll have some more ideas for you once we show you how to build your fire diorama.

.(/).

(/_images/5cedffdfc672e0d03d085e1a)

CONSTRUCTION:
CAMPFIRE DIORAMA

We've designed a fun campfire diorama for you to make. Our campfire is made largely with recycled or collected natural materials. You will need to find some sticks to cut up for your fire. Ours were about 10mm in diameter, but you can choose a size based on the look you want. That will make more sense after you read the instructions and look at the photographs.

You will also need to pick up some clean stones. Any small pebble between 10mm and 30mm or close to this will be fine. Ours were just gravel from a road side, but anything that looks good will do. Also keep your eyes open for a suitable cardboard box.

STEP 1:

(/_images/5cedffdfc672e0d03d085e1d)

Cover the top of your cardboard box with glue from a glue stick.

DIYODE
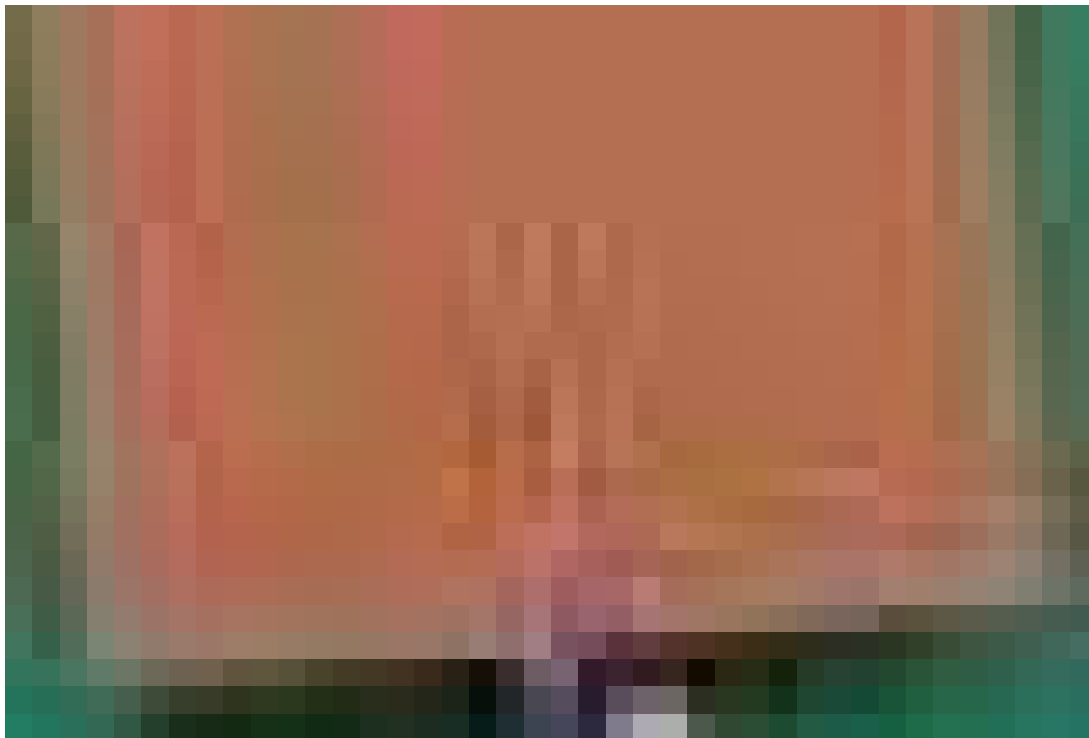
(/).

(/_images/5cedffdfc672e0d03d085e20)

Align a piece of brown coloured paper with one corner of the box and press down all over onto the glue.

STEP 3:

(/_images/5cedffe8c672e0c216085e5f)

At this point, you get to choose whether to trim the edges or glue another side and wrap the paper around. This will vary from box to box. For ours, it was better to trim the edge and cut another piece of paper to cover our sides.
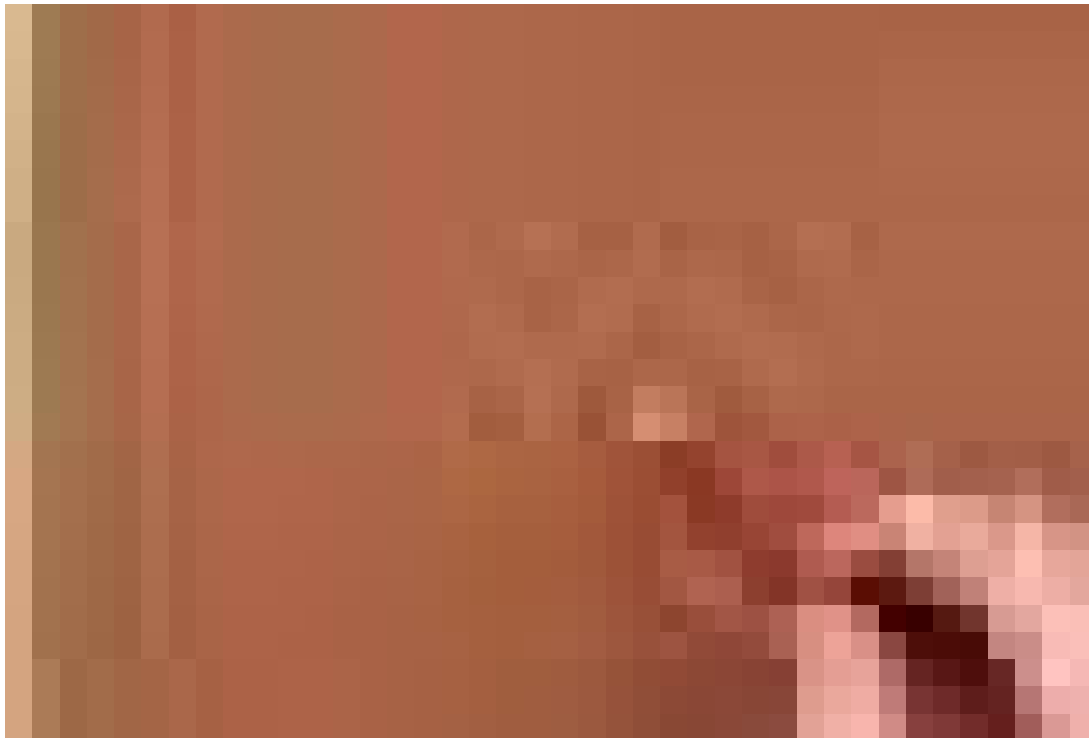
DIYODE

.(/).

(/_images/5cedffe8c672e0c216085e61)

Place both of the strings of three LEDs on top of the box and arrange them onto a rough circle without any leads touching. This will guide your next step so take your time and get it right. They should actually not be neat, as the random effect will help later.

STEP 5:

(/_images/5cedffe8c672e0c216085e64)

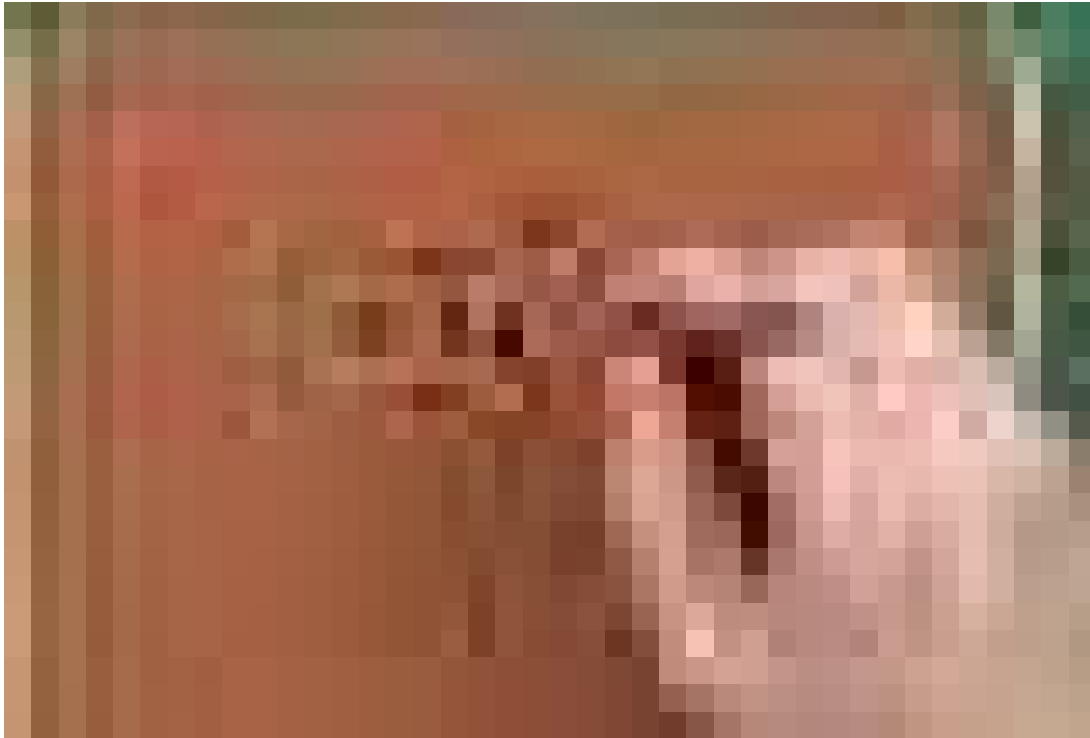Sketch a rough circle around your LEDs as shown, and mark the positions of the LEDs.

(/_images/5cedffe8c672e0c216085e66)

Use a small screwdriver to punch holes in the top of the box where your LEDs will go. Add two extra holes near the centre. Keep your fingers clear, be cautious of the surface under your box, and be careful! It would be best to ask an adult for help.

STEP 7:

(/_images/5cedffe8c672e0c216085e68)

Use the pencil to widen the holes so that the LEDs just push through tightly. The middle two holes need to be a bit bigger, so that the LEDs can go all the way through.

DIYODE

(/)

(/_images/5cedffe8c672e0c216085e6a)

Use a black marker to colour the negative (short) leg of each LED string, the two and both of the threes. This makes reconnecting later much easier. Mark the metal leg, as the ink does not stick to the plastic. After you mark them, disconnect them from the sockets.

STEP 9:
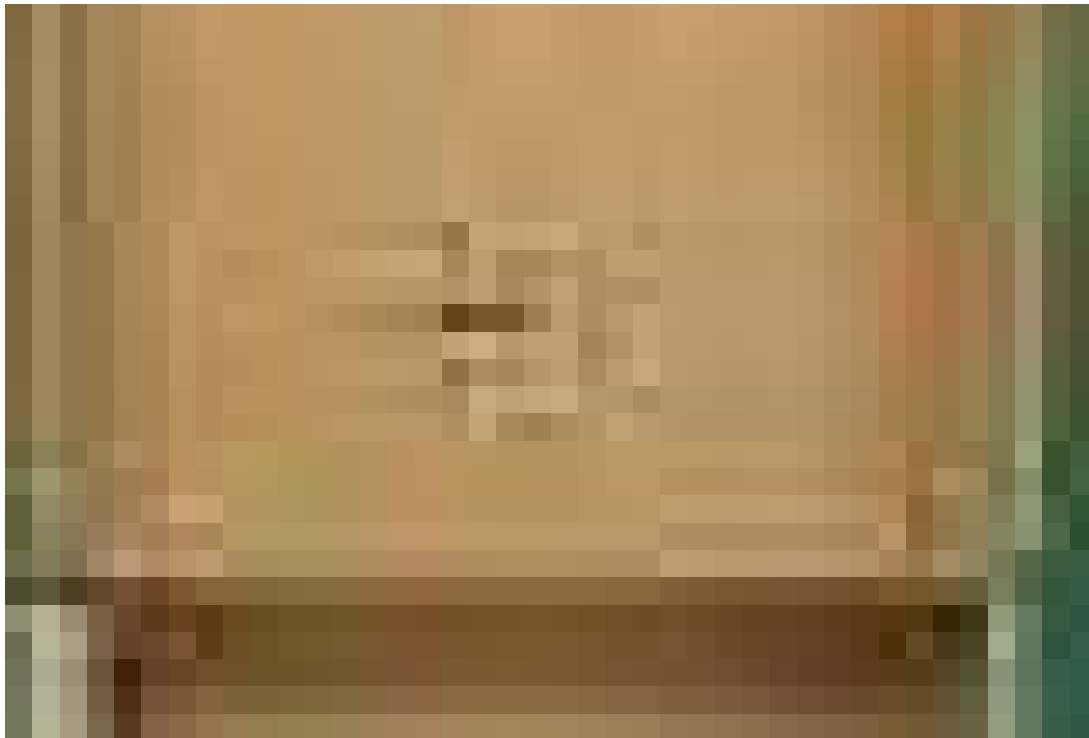
(/_images/5cedffe8c672e0c216085e6c)

Insert one string of three LEDs from underneath the box through the holes from step 7 as shown. Bend the leads outwards away from each other, and use sticky tape to hold everything down.

DIYODE

.(/).

(/_images/5cedfff0c672e06c11085db4)

Repeat for the second set of three LEDs.

STEP 11:

(/_images/5cedfff0c672e06c11085db7)

Insert the set of two super-bright LEDs through the middle holes. Push them as far through as they will go without letting the leads untwist. Fold the remaining lead over in the centre and fix in place with sticky tape.

DIYODE

(/)

(/_images/5cedfff0c672e06c11085dba)

Reconnect the wires to the LEDs. Remember, dark colours to the short legs which you marked earlier, and light colours to the long legs. The two middle LEDs, our super-brights, go to the spot between the two ICs, while the strings of three go to the far side of the board.

STEP 13:

(/_images/5cedfff0c672e06c11085dbd)

Place the breadboard into the box and place the wires so that they fold out of the way when the lid closes. For now, hang the battery snap over the side. It will be put away later.
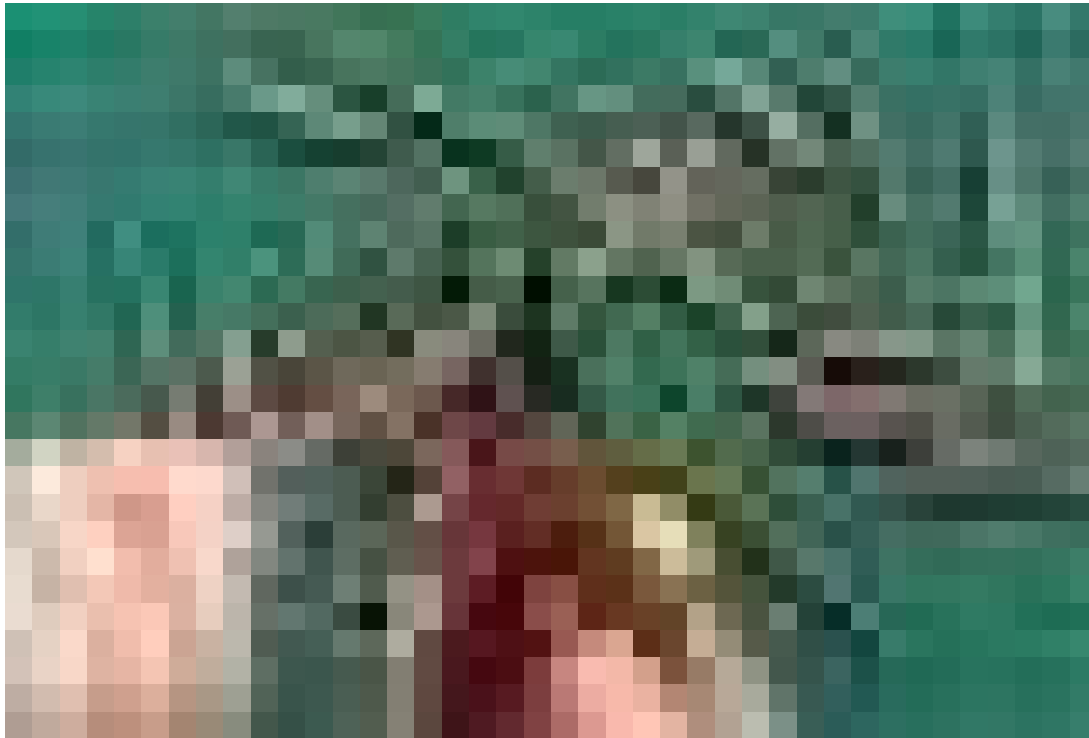
.(/).

(/_images/5cedfff0c672e06c11085dc0)

Close the lid and connect the battery. Do all the lights light up? If they don't, check connections. If they do, disconnect the battery and continue.

STEP 15:

(/_images/5cedfff0c672e06c11085dc3)

Using secateurs, cut lengths of sticks between 4 cm and 6 cm long. Check the photos as a guide but you may build your fire in any way you like. You should get an adult to do the cutting.

DIYODE

.(/)

(/_images/5cedfff0c672e06c11085dc6)

Blacken the ends of most of the sticks with permanent marker, or crayon, or oil pastel. This will help give the charcoal look of a real fire to your model.

STEP 17:

(/_images/5cedfff8c672e0d03d085e22)

Use tacky craft glue to attach a ring of sticks as shown to the base of your fire. Go between the LEDs.

Note: You may have noticed that we used hot melt glue here. This was so we could have one continuous photo shoot. Stick with craft glue for yours. It's safer, and also ends up stronger after it dries.
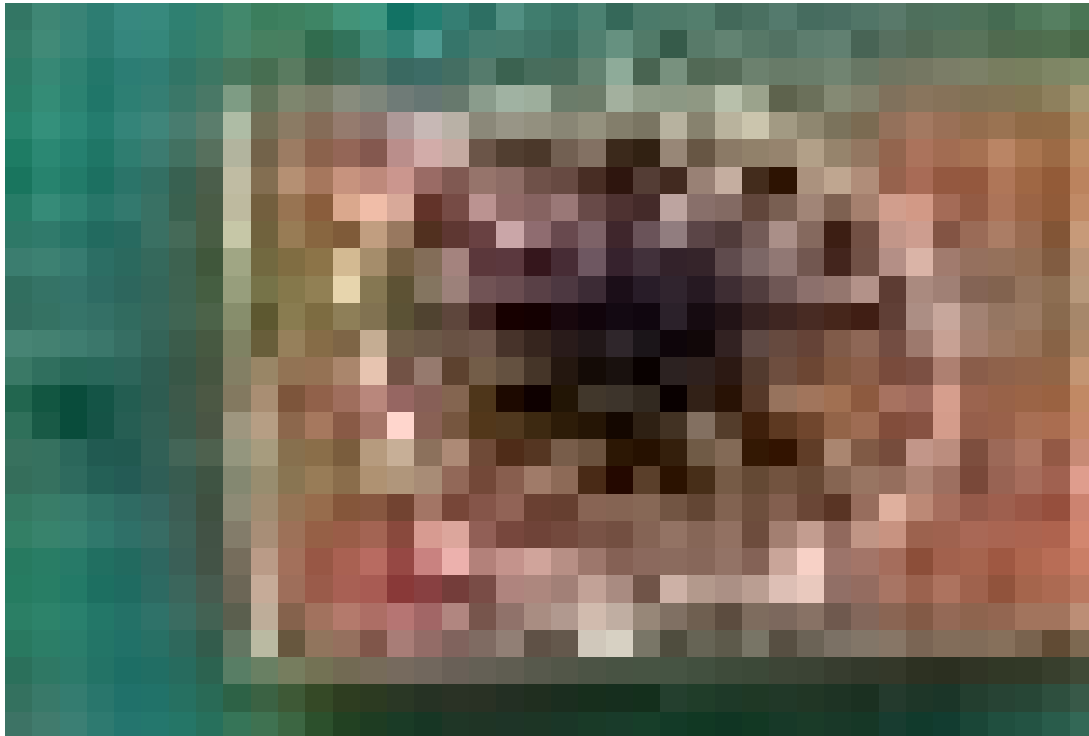
DIYODE

[.(/).](/)

[(/_images/5cedfff8c672e0d03d085e24)](/_images/5cedfff8c672e0d03d085e24)

Glue more sticks on top to build up your fire. Leave lots of space for light to shine out, and for cellophane in later steps.

STEP 19:

[(/_images/5cedfff8c672e0d03d085e26)](/_images/5cedfff8c672e0d03d085e26)

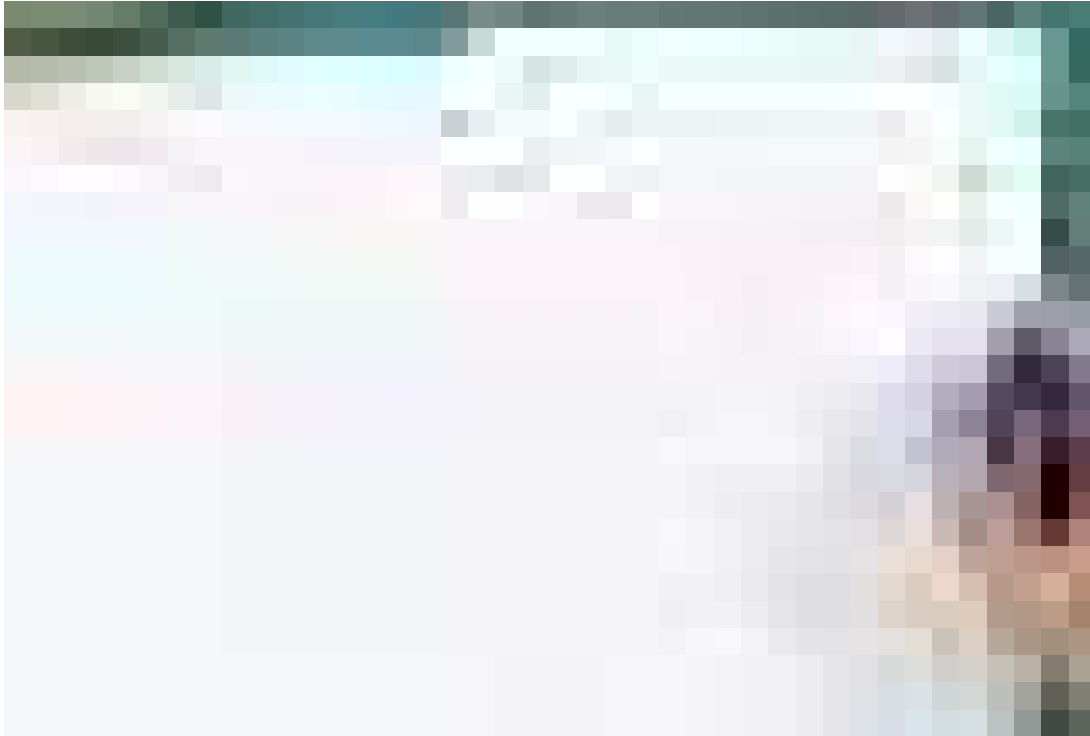Glue a ring of stones around your fire using the tacky craft glue.

(/)

(/_images/5cedfff8c672e0d03d085e29)

To make the marshmallows on a stick, you need to cut two thin strips of paper, about 4mm wide and the whole length of an A4 piece of paper.

STEP 21:

(/_images/5cedfff8c672e0d03d085e2b)

Using scrap paper as a work surface, coat the back of each strip liberally with glue stick glue.

DIYODE

(/)

(/_images/5cedfff8c672e0d03d085e2d)

Cut two lengths of thin twig about 10 cm to 15 cm long.

STEP 23:

(/_images/5cedfff8c672e0d03d085e30)

Take one piece of glued paper strip, and stick the end to one of the twigs.

(/)

(/_images/5cedffffc672e06f11085daa)

Roll the paper strip around the twig, taking care to keep it neat. Rub the end gently but firmly to stick it down, adding more glue if needed.

STEP 25:

(/_images/5cedffffc672e06f11085dac)

Repeat for the other strip and twig.

DIYODE

(/)

(/_images/5cedffffc672e06f11085daf)

Let the whole lot dry overnight. It is very important not to get too excited – the tacky craft glue takes twelve hours to properly set, and you could undo your hard work if you don't wait.

STEP 27:

(/_images/5cedffffc672e06f11085db2)

Cut small pieces of coloured cellophane, some red, some orange, and crumple them up. Gently push them into the recesses at the base of the fire using a toothpick or twig.

DIYODE

(/)

(/_images/5cedffffc672e06f11085db5)

Cut pieces of yellow cellophane and add to the upper recesses of the fire. Some can go on the very top as well, like flames. You can glue any loose pieces with craft glue, which goes on white but dries clear.

STEP 29:

(/_images/5cedffffc672e06f11085db8)

After the last round of glue has dried, connect the battery, gently lift the lid, and place the battery inside the box with the circuit. You now have a self-contained diorama of a campfire!

WHERE TO FROM HERE?

You could add seats around your fire using left over sticks, as we did. You could add a cooking pot, or people out of modelling clay or anything else you can think of.

Additionally, it is not just campfires this circuit can be used for. Looking online, we found candles made from paper tubes with LEDs and cellophane (leave out the strings of three LEDs for this), household fireplaces like an English cottage and grand ones like a country estate, and even a wizard's cauldron with a fire under it. Incidentally, the cauldron also had flickering LEDs in it with green tissue paper at the top. The limits are only set by your imagination!

4 COMMENTS:

Please log in (/login?return=project...Fkids_basics_flickering_flame...) to comment or to subscribe to this thread.

Bernie Kobier 5 years ago   (/)
That's great - thanks for adding the circuit diagram.

In reply
DIYODE Magazine 5 years ago
No worries!

Seluk KAYA 2 years ago
Hi, do you have a printed circuit diagram?

In reply
DIYODE Magazine 2 years ago
STAFF
Hello
Great!
You can order a printed back issue on our website for the magazine this appears in.
Go to https://diyodemag.com/cart and order Issue 23.
Thank you for your support.
Regards
The DIYODE team.