

Sticker Circuits

TCIPG

TRUSTWORTHY CYBER INFRASTRUCTURE FOR THE POWER GRID

Investigate possible circuit combinations using copper tape and the clear sheets. Use the templates for your first circuits and then explore by adding more LEDs and copper tape traces.

How many LEDs can you light? Can you make a light-up card or art project?

Getting Started: Place a clear sheet over the template and press copper tape on the circuit traces. Be sure to leave breaks in the tape for the LED, switch, and battery.

Make A Switch

Switches in circuits allow the circuits to be open or closed. The switch will connect, and close one part of a circuit to another. You can make a simple switch using copper tape.

Leave a small gap in the circuit where you want to put your switch.

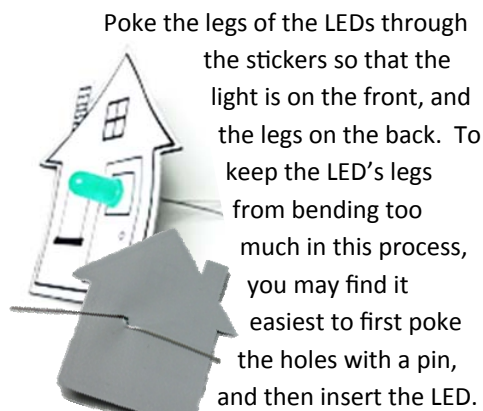
One side of the copper tape near the gap should be long enough to touch the other side plus an extra inch.



Fold the long piece of tape under itself, covering up the adhesive for a half inch.

Test your switch – when you push it down, it should touch the other side of the circuit without sticking to it.

How to add LEDs to a Sticker



Poke the legs of the LEDs through the stickers so that the light is on the front, and the legs on the back. To keep the LED's legs from bending too much in this process, you may find it easiest to first poke the holes with a pin, and then insert the LED.

MATERIALS

- 2 coin batteries (CR2032)
- Building stickers
- LED's (Some of each color)
 - red
 - green
 - yellow
 - blue
 - flashing RGB
- Copper tape
- Clear sheets
- Circuit templates

Using the Copper Tape

When tracing the circuit templates with tape, or creating your own circuit, be sure that the tape overlaps at each corner. Press the pieces firmly with your fingernail to ensure the best connection.



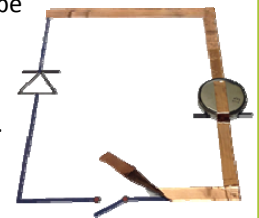
How to Put a Coin Cell Battery in the Circuit

To put a battery into a circuit, both sides of the battery need to be a part of the conducting path. To do this, follow these steps:

- Create a break in the circuit.
- Place the battery on the copper tape right before the break.
- Extend the copper tape from the other side of the break so that it touches the top of the battery.

Now both sides of the battery are in the circuit!

You can add a piece of transparent tape to reinforce the battery's connection and to keep it securely in place.



Troubleshooting Your Circuit:

LEDs blink or don't stay lit

This is a connection issue! Firmly press down any corners where two pieces of tape meet. Double check that your battery is secured and that any switches in the circuit are closed. Add some transparent tape to your battery or to a switch to help keep it secure. Also be sure that your stickers are pressed to your page snugly, and that the legs of your LEDs are touching the copper tape.

LEDs won't light

The most likely cause is that the LED is in the circuit in the wrong direction. Try reversing the direction of the LED in the circuit. If this still doesn't work, check the connections as described in the paragraph above.

Tips and Techniques

LEDs

Light emitting diodes (LEDs) create light when electrons are pushed through two different semiconductor materials. The two materials are layered together so that the electrons can only flow in one direction. The moving electrons release photons that we see as colored light. The color of the LED light depends on the type of semiconductor. Some colors require more power than others.

LEDs do not create heat so they are more efficient light sources and last longer than traditional light bulbs. LED lighting is becoming more common. They are used to light up supermarket freezer sections, streetlights and traffic lights, automobile taillights, and have been installed to light the giant signs in Time Square in New York City.

Notice that one leg of the LED is longer than the other. The long leg is the positive lead, or called the anode. The shorter leg is the negative lead, or the cathode. Since current flows through a LED in one direction only, knowing which side is positive and which is negative helps you correctly place the LED in a circuit.

