Getting Started with Paper Circuits

Electronics and Paper

Adding electronics to paper crafts is a fun way to take any project to the next level. A design can really shine when you incorporate lights, and by adding a switch, you can change how someone interacts with the project. The possibilities are endless, and learning the basics couldn't be easier.

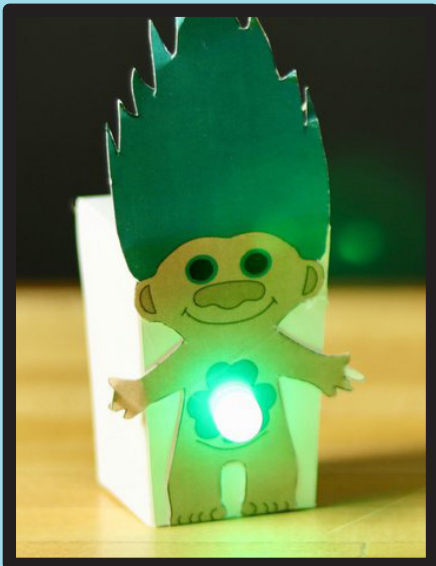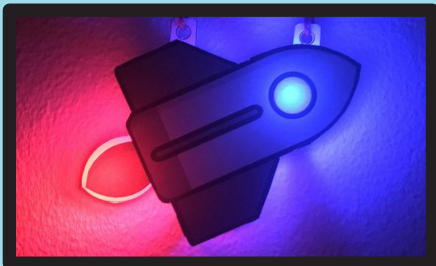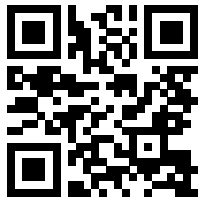In this *Getting Started with Paper Circuits eBook,* we'll tell you what materials to use, explain how simple circuits work, and provide templates and examples that you can build right away. We'll recommend projects that will help you practice your skills. You can also follow along with the *Getting Started with Paper Circuits* video available at:
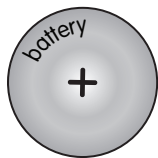
https://youtu.be/BxOqugaH1ZE

What makes a circuit a circuit?

Every circuit has 3 or 4 main components:

If you need paper circuits parts or supplies, pick up the Paper Circuits Kit from BrownDogGadgets.com

Power:
Every circuit needs a power source. For paper circuits, a coin-cell battery is perfect because it's small and flat. We use CR2032 batteries, but any 3V coin cell battery will work.

Wire:
Most circuits use metal wires to connect components. For paper circuits, we use *Maker Tape*, a conductive tape that's made of woven metal fabric with conductive adhesive on the bottom. It's flexible and flat, like paper!
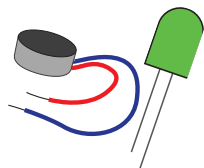
Outputs:
The output of a circuit is what it "does." The circuits in this eBook light up with LEDs (light emitting diodes). Other circuits could vibrate, make sound, or even change color.

Inputs:
Inputs are ways to interact with a circuit like buttons and switches. Yes, you can have a circuit with no input, but a string of lights is way better with a switch! Inputs add interactivity and control.

Tricks of the Trade

Here are a few universal techniques that will help you build the paper circuits in this eBook:

Maker Tape comes in 2 sizes: 1/4 inch and 1/8 inch.

We use 1/4 inch tape for paper circuits because components like LEDs are easier to attach with wider tape.

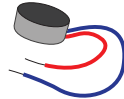1/8 inch tape is great for working in a brick-based environment.

Positive and Negative

LEDs have one positive leg and one negative leg. The long leg is positive, and the short leg is negative.
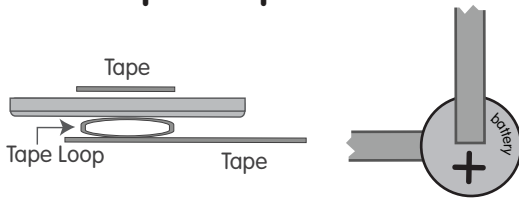
Positive
Negative

In the case of wires, red is typically positive, and black, dark blue, or white is typically negative.

Attaching the Battery

The Tape Loop Method
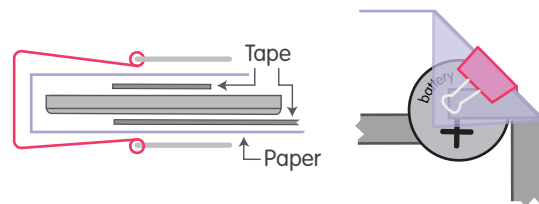
Tape

Tape Loop   Tape

Make a small tape loop underneath the battery to stick it down to the tape.

Pro: All you need is Maker Tape, and you can place the battery anywhere on the page.

Con: Peeling the tape back to remove or change the battery can be difficult.

The Binder Clip Method

Tape

Paper

Fold the corner of the paper around the battery and the Maker Tape, then use a binder clip to keep it in place.

Pro: It's easier to remove/replace the battery.

Con: It's bulky, and you need to place the battery at the edge of the paper.

Hiding the Circuit

Once you get the hang of building circuits on paper, hide the circuit on the back of the paper instead. To do this, poke holes where the LEDs go and thread the legs through from the other side.

It will make the light, sound, or motion seem like magic!

Paper

Tape   Tape
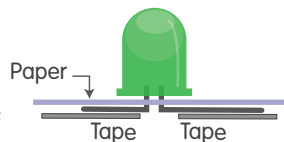
Print on Cardstock

The electronic components are heavy compared to paper, so using a thicker stock of paper like cardstock is recommended - especially when you are just starting out.
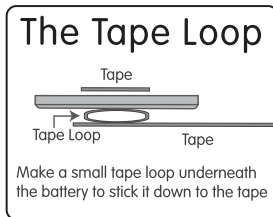
(...but printer paper will work in a pinch!)

❶ The Simplest Circuit

Make a circuit with a single LED.

❶ Bend the LED legs flat, and place them on the paper where shown, with the negative (shorter) leg facing up. (Tip: Place a bend in the longer leg to remember that it's positive!)

❷ Place Maker Tape along the top line and over the negative LED leg, stopping at the spot where the battery goes.

❸ Add a loop of Maker Tape on top of the line of tape, then place the battery on top of it with the positive side of the battery facing up.

The Tape Loop

Tape

Tape Loop   Tape

Make a small tape loop underneath the battery to stick it down to the tape

❹ Place Maker Tape over the battery and down along the line.

❺ Place Maker Tape across the bottom line and over the positive LED leg. The LED should light up!
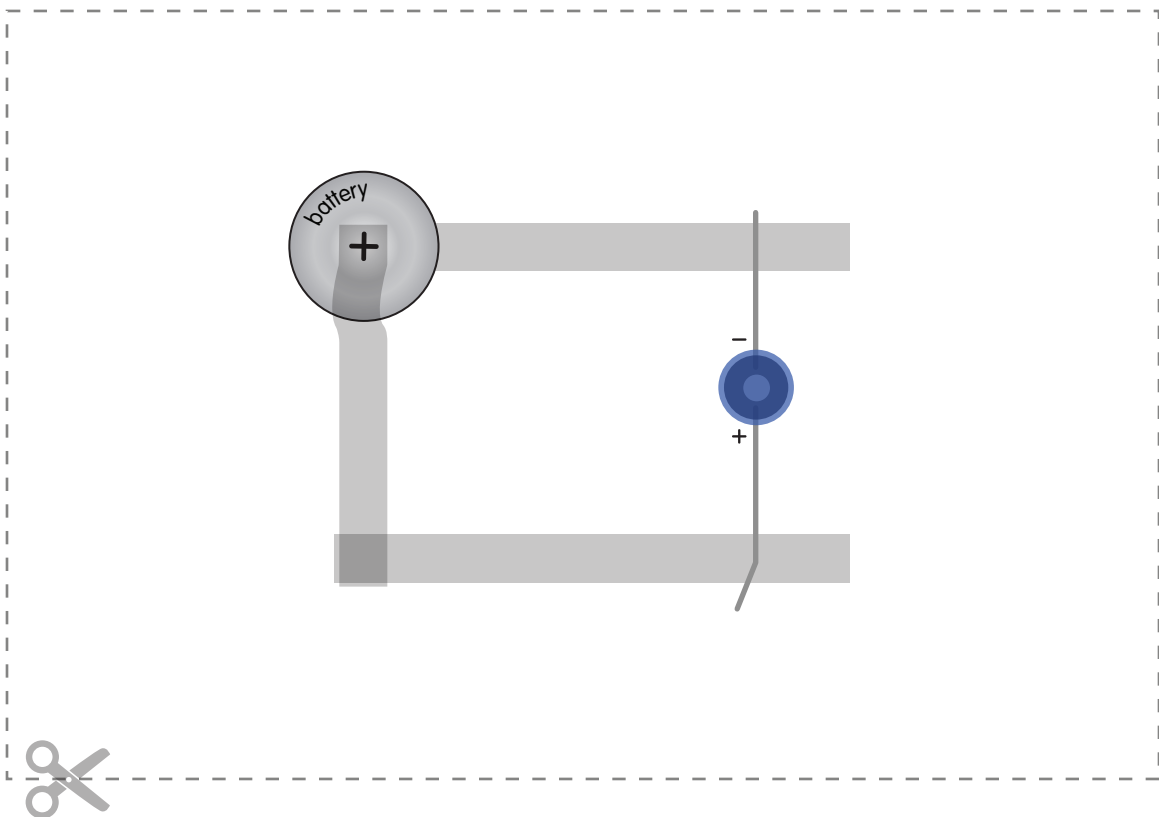
❷ Double Trouble

Make a circuit with 2 LEDs.

❶ Bend each of the LEDs' legs flat, and place them on the paper where shown, with the negative (shorter) legs facing up.

❷ Place Maker Tape along the top line and over the negative LED legs, stopping at the spot where the battery goes.

❸ Add a loop of Maker Tape on top of the line of tape, then place the battery on top of it with the positive side of the battery facing up.
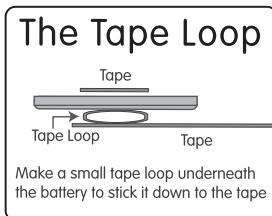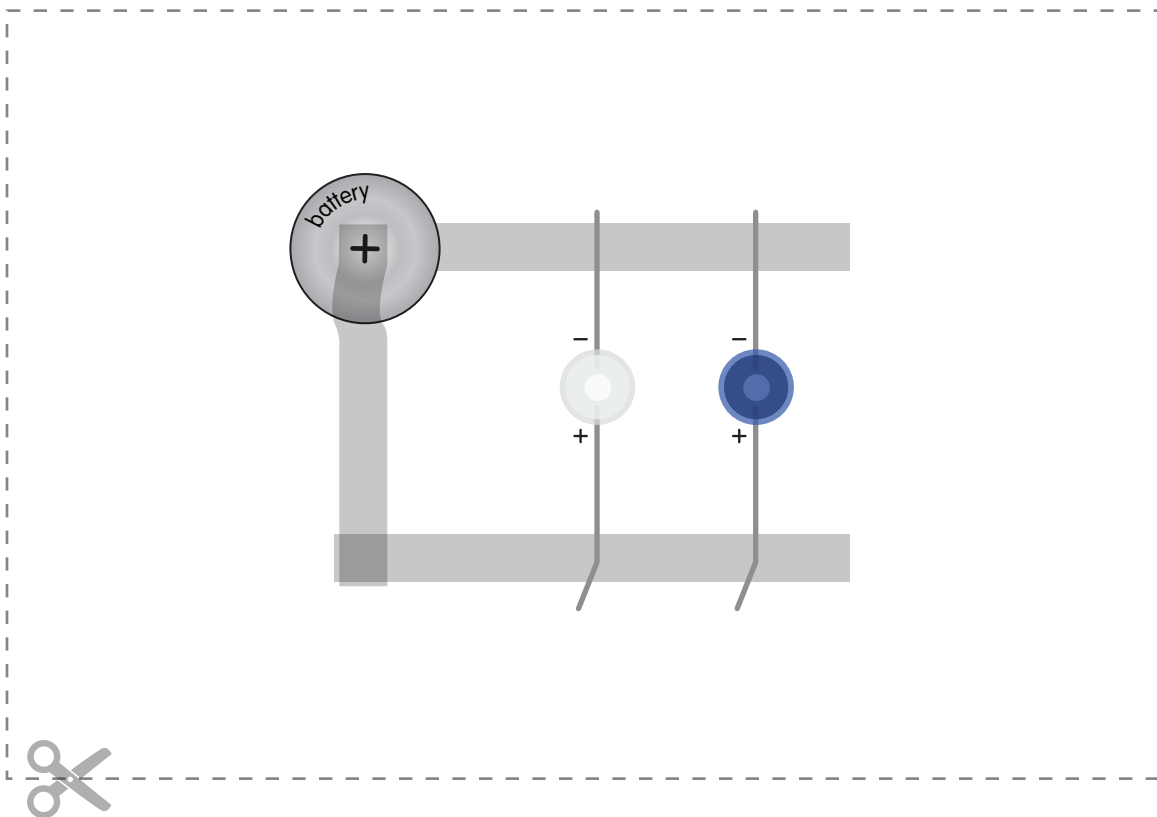
The Tape Loop

Tape

Tape Loop

Tape

Make a small tape loop underneath the battery to stick it down to the tape

❹ Place Maker Tape over the battery and down along the line.

❺ Place Maker Tape across the bottom line and over the positive LED legs. Both of the LEDs should light up!

❸ Adding a Switch

Make a circuit with a simple switch.

❶ Bend each of the LEDs' legs flat, and place them on the paper where shown, with the negative (shorter) legs facing up.

❷ Place Maker Tape along the top line and over the negative LED legs, stopping at the spot where the battery goes.

❸ Add a loop of Maker Tape on top of the line of tape, then place the battery on top of it with the positive side of the battery facing up.
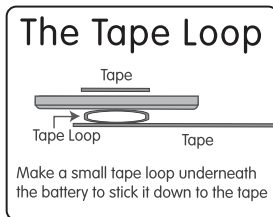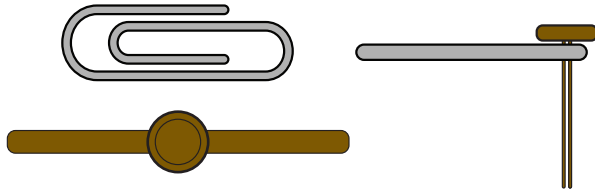
The Tape Loop

Tape

Tape Loop   Tape

Make a small tape loop underneath the battery to stick it down to the tape

❹ Place Maker Tape over the battery and down along the line, stopping where shown.

❺ Place Maker Tape across the bottom line and over the positive LED legs.

❻ Place a piece of maker tape over the line near the fold line as shown.

❼ Cut out the circuit along the dotted lines, including the lines on the left near the fold line.

❽ Fold the flap at the fold line, and use it to bridge the gap between the two pieces of Maker Tape in the circuit. When the switch is closed, the LEDs should light up!
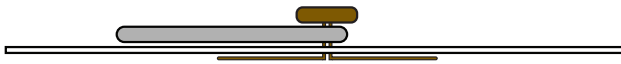

fold
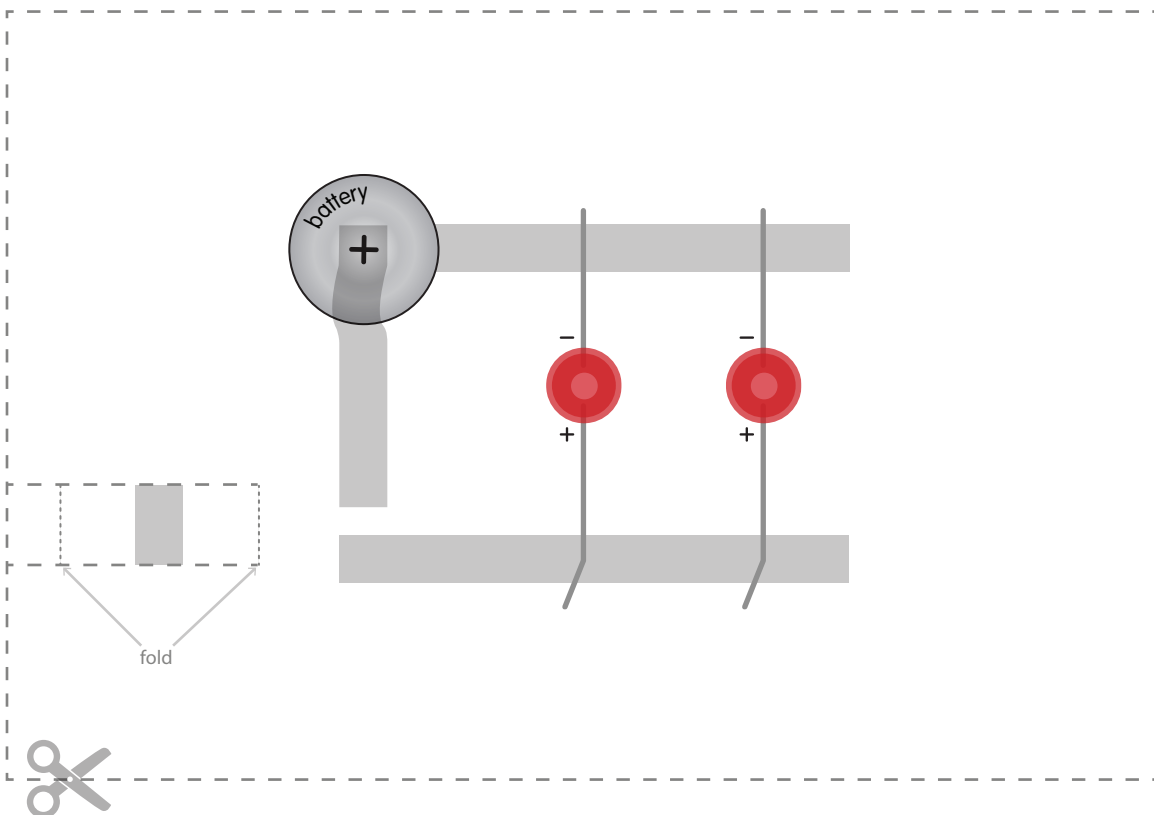
❹ Paper Clip Switch

Use a brass fastener and a metal paper clip to make a switch that connects only one of two LEDs at at time, or turns the circuit off.

❶ Thread the brass fastener through the paperclip and push it through the paper where shown. Bend the legs flat on the back.

❷ Bend each of the LEDs' legs flat, and place them on the paper where shown.

❸ Place Maker Tape along the lines using the tape loop method for the battery and making sure the Maker Tape runs over the brass fastener. This will allow the current to flow through the paper clip and also allow the paper clip to move freely.

❹ You can now move the paper clip to touch one or the other piece of Maker Tape to choose which LED you want to turn on. Or, leave it in the middle to turn the entire circuit off.
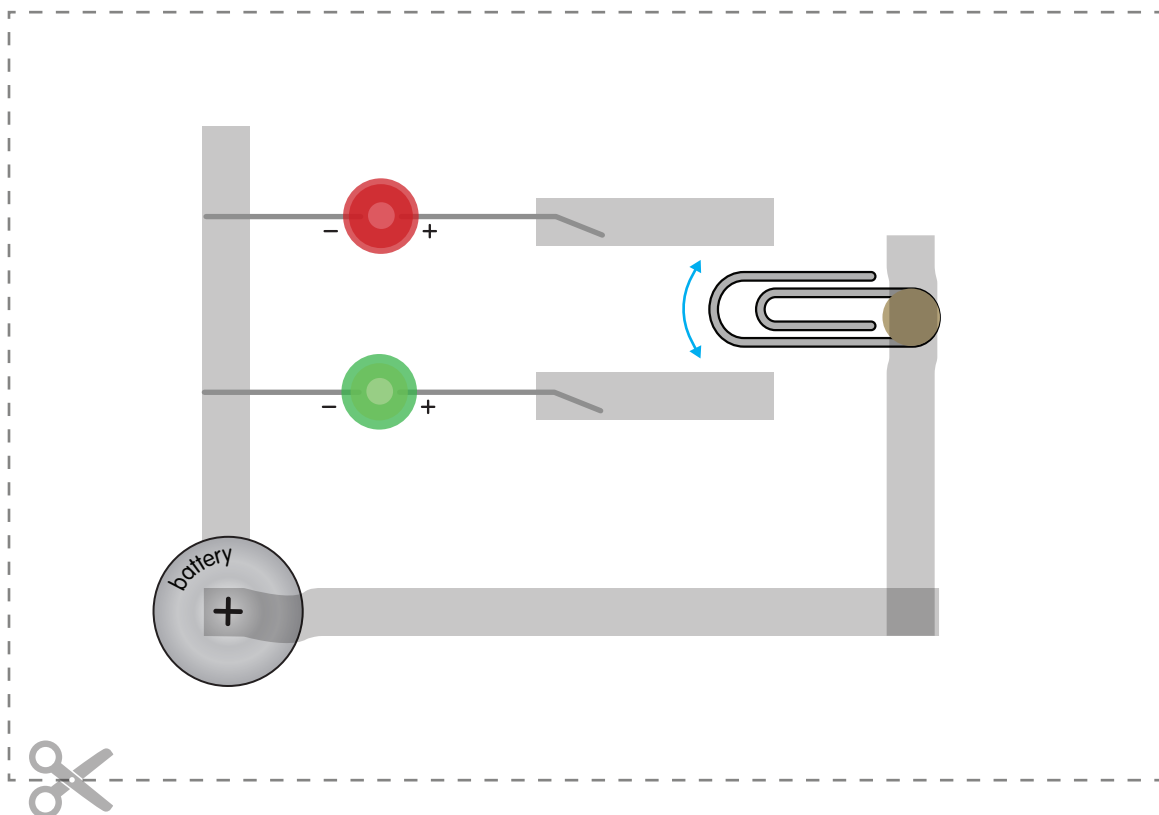
❺ Changing It Up

The skills that you just learned can be applied to many types of projects. For example, instead of an LED, you could use a vibration motor so that when the circuit is closed, it will vibrate!

Experiment with making your own circuits that combine multiple inputs and outputs.

battery

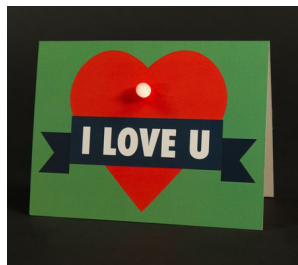+

fold
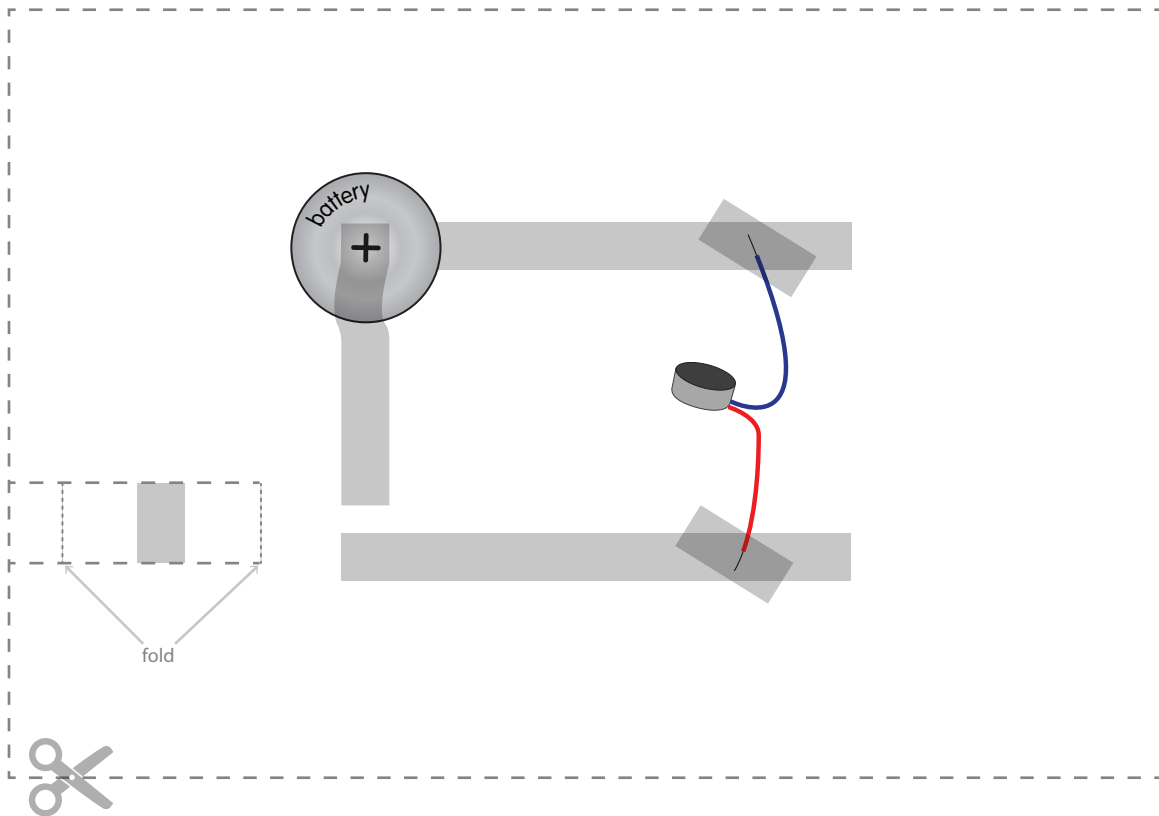
❻ More Projects & Inspiration

Other Materials
You can use Maker Tape on more than just paper. In fact, any flat surface will do!

This makes it a great material to design circuits on top of felt or other craft materials, like the LED bracelet below. With the same paper circuit techniques, you can build all kinds of projects! The possibilities are endless.

If you need paper circuits parts or supplies, pick up the Paper Circuits Kit from BrownDogGadgets.com
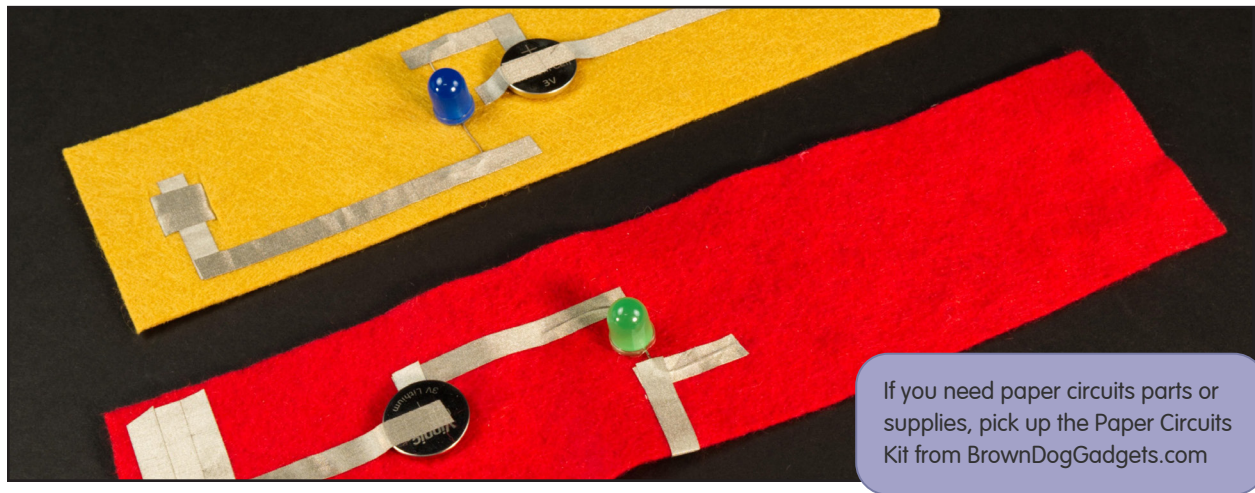
Light-Up Cards (Maker Tape, LEDs, Batteries, and Paper)

Light-Up Heart

Laser Cat

Birthday Candles

Light-Up Tree

Robots and Wearables (Maker Tape, LEDs, Motors, Batteries, Paper, Felt)

Tree Bracelet

Motor Robot Buddy

Motor Robot Vacuum

Monster Bracelet

These are just some of the projects to try next! Check out all of our free project templates and guides available to download at www.BrownDogGadgets.com

Learn, Create, and Inspire–Even on a Budget

Creating a project from scratch can be difficult for the casual builder. Finding the right directions, the right parts, and the right tools—all at the right price—can be a major hurdle.

At Brown Dog Gadgets, we've created kits and projects for creators of all ages and budgets. Follow our step-by-step project directions and learn more with our classroom resources or find individual parts to dream up your own creations. No matter how or what you create, our products can help you learn the basics of electronics, circuitry, and solar energy.

Find additional eBooks, crafting guides, videos, directions, and educational resources at BrownDogGadgets.com. Contact us for educational discounts and free professional development classes.

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