

## Crazy Circuits

### LEGO™ compatible modular electronics

Crazy Circuits is a non-soldering electronic learning platform that allows people to create circuits from almost any material they can imagine. Crazy Circuits are designed to pop onto LEGO™ bricks, enabling your creations to light up, move, and make noise. Use Crazy Circuits to construct paper crafts with conductive tape, use conductive thread for sewing, sculpt with conductive dough, and create art with conductive inks and paints. You can even upload Arduino sketches to the Crazy Circuits Touch Board. No matter what you make, Crazy Circuits brings it all together.



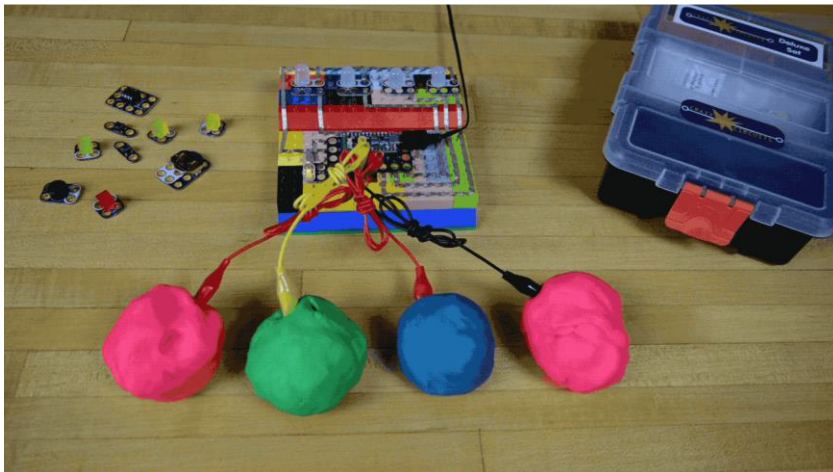
*Crazy Circuits works on LEGO™, paper, fabric, and tons of other materials.*

# What does it do?

We designed Crazy Circuits to interface with all kinds of systems and materials that are already in your home, classroom, or makerspace. Start with simple circuits comprised of a battery and LED, then add switches, buttons, and programming boards to integrate sound, motion, and interactive elements. The real fun comes when you combine Crazy Circuits with your own creativity. Make a light up t-shirt, a singing greeting card, or a treat dispensing robot; the only limit is your own imagination.



At the heart of our most exciting projects is the Crazy Circuits Touch Board. The Touch Board is built around a Teensy LC microcontroller and features capacitive touch inputs. Any conductive material, from a cup of water to a potato can be turned into a touch sensor, no grounding necessary. We've made light up T-shirts, a conductive paint piano, a music visualizer, and we've got lots more ideas on the way. We can't wait to see what you create!



# Who is it for?

Crazy Circuits is a great tool for anyone trying to get into circuit design and basic programming. From a kid making paper crafts, to an engineer building LEGO™ robots, Crazy Circuits has something for everyone. If you promise not to swallow anything, Crazy Circuits is for you!

## Features and Functions

### Endless Compatibility

There's no need to reinvent the wheel. That's why Crazy Circuits is designed to be compatible with all kinds of systems and materials that you already have on the shelf. If you've got a LEGO™ collection, you're already most of the way to an ambulance with flashing lights or a rocket with glowing engines.



Our programming boards are Arduino based so even novices have an easy time getting started. All you need is a computer (Mac, PC, or Linux) with a USB port. You can copy our code, edit it, write your own, or borrow from the hundreds of Arduino projects already shared online.

The Crazy Circuits Touch Board can also be used as a USB keyboard. This functionality is great for creating game controllers or buttons that launch apps or execute keyboard shortcuts such as "copy" and "paste" commands.



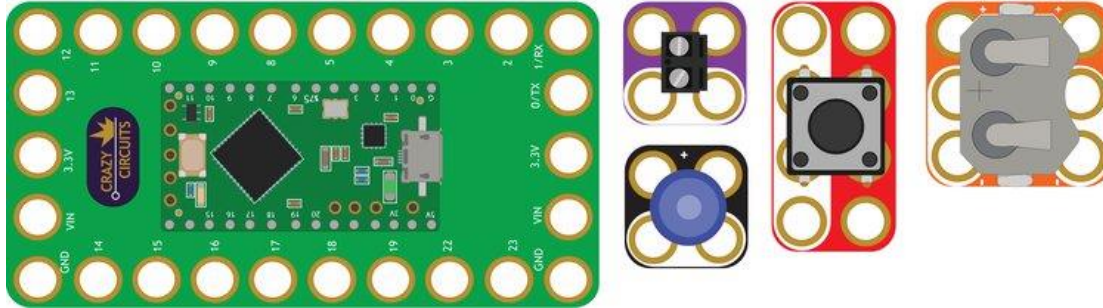
Crazy Circuits is compatible with any conductive material you care to connect to. Some of our favorites include our nylon conductive tape, Squishy Circuits™ dough, Bare Conductive Electric Paint, and conductive thread, but you can use anything you like. Paper clips, aluminum foil, and even pipe cleaners make great wires and touch pads for Crazy Circuits.

## Color Coordination

Despite Josh's inability to differentiate red and green, each type of Crazy Circuits Chip is a different color depending on what it does.

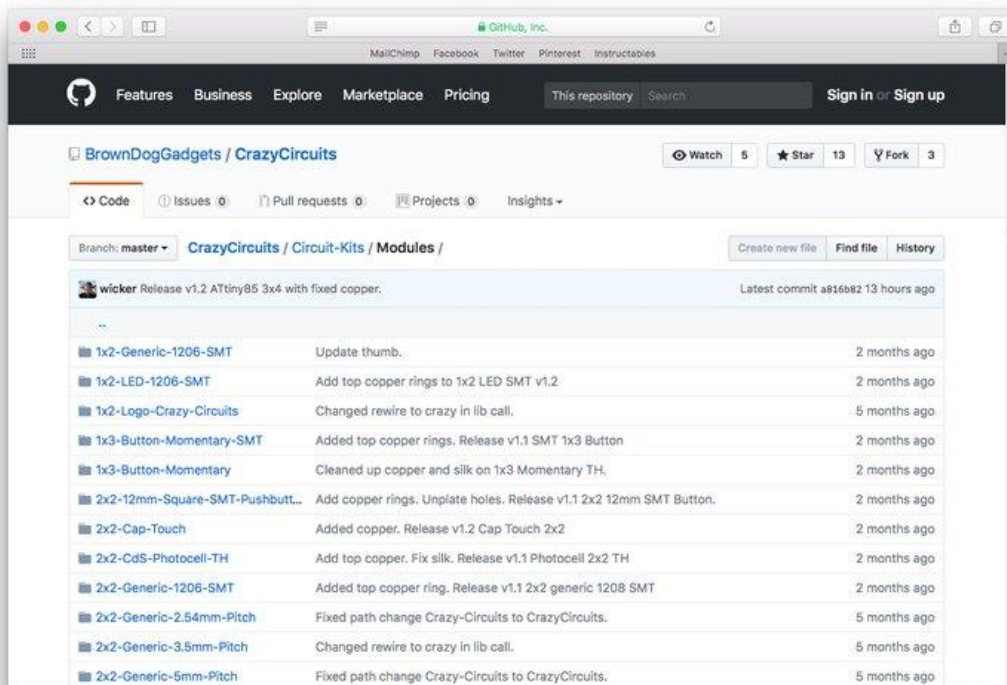
Color	Function	Example
Black	Output	LEDs and piezo speakers
Red	Input	buttons and switches
Orange	Power	battery holders
Green	Integrated Circuits	Touch Board, Robotics Board, Blink/Fade Board
Purple	Connectors	terminal blocks and pin headers





## Open Source

Crazy Circuits is available for free as open source hardware and software. Our [GitHub repository](#) contains information for dozens of parts, complete with gerbr files and DigiKey part numbers. If you want to make or order your own Crazy Circuits, you can, even the parts we aren't manufacturing yet.



We want to support the same maker communities that give us ideas and inspiration for our own projects. We will always provide our code, instructions, and other project files for free on the [GitHub](#). This includes everything from Arduino code for the Bare Conductive Paint Piano to the laser cutting files for the wooden NES Controller. Follow us on social media and check back often for new projects!

# Create Your Own

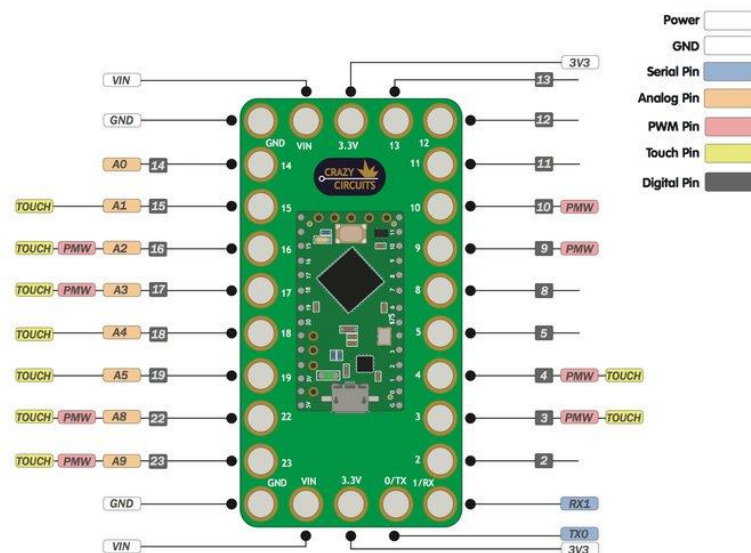
In the [Development](#) section of our GitHub repository you will find guidelines for creating new Crazy Circuits parts, as well a KiCAD library and template. These are intended to help you make any component you want into a Crazy Circuits Chip.

## Technical Specs

The guiding factor in Crazy Circuits' design is their compatibility with LEGO™ bricks. Through prototyping we determined that a hole diameter of 4.98mm works best with the 4.80mm LEGO™ studs. This size allows for slight variations in manufacturing due to the somewhat loose fit, and gives a tight connection when used with our conductive nylon tape. Crazy Circuits are Lead Free/ROHS Compliant.

### *Crazy Circuits Touch Board*

The Touch Board measures 5x10 "LEGO™ studs" or about 4x8 cm. At the center sits a TeensyLC microcontroller, which allows the Touch Board to function as a USB Keyboard and enables capacitive touch sensing, without the need for a grounding wire.



- 20 Input/Output pins
- 20 Digital Pins
- 11 Touch Pins
- 8 Analog Pins
- 8 PWM Pins
- Two each of Ground, VIN, and 3.3V pins

## *Nylon Conductive Tape*

Most conductive tapes on the market are composed of copper or aluminum foil ribbon with an adhesive backing. While inexpensive, these materials tear easily and made a mess when we attempted to remove them from LEGO™ bricks. To solve this issue we have sourced a nylon based tape manufactured with nickel and copper resulting in a very strong, and highly conductive tape.



- Extra strength nylon tape with nickel and copper
- $\frac{1}{8}$  or  $\frac{1}{4}$  inch width
- 1 Ohm resistance per foot
- Tear resistant
- 5 meter rolls

## *Conductive Thread*

- Steel nylon thread
- Five Meter Rolls
- 15 Ohms resistance per foot
- 5 meter rolls

# Comparisons

	Crazy Circuits	Circuit Stickers	Makey Makey	Little Bits	SAM Labs
Features					
Input/Output Pins	24	6	18	6	N/A
Reusable Parts	Yes	No	Yes	Yes	Yes
Capacitive Touch	Yes	No	No	No	No
Compatible With...					
LEGO(TM)	Yes	No	No	Yes	No
Conductive Tape	Yes	Yes	Yes	No	No
Conductive Paint	Yes	Yes	Yes	No	No
Conductive Thread	Yes	Yes	Yes	No	No
Arduino	Yes	Yes	Yes	Yes	No

## Made in the USA

Producing custom parts designed to fit onto LEGO™ bricks requires a high level of quality and precision. To ensure that Crazy Circuits boards meet these standards, we're having them made right here in America.

## Risks & Challenges

We have done our best to reduce risks to our backers.



### *Funding:*

We ran a successful Kickstarter earlier this year and raised sufficient funds to manufacture the parts we need. Our initial goal was to develop a subscription box model for Crazy Circuits, but our backers were most interested in the Crazy Circuits Touch Board. We created this campaign with the many specialized Touch Board kits as a response to that feedback. We are very excited to get Crazy Circuits out into the world and see what people do with it!

### *Manufacturing:*

Over the past year we have built numerous prototypes on all the Crazy Circuits Chips and we are pleased with the results. Manufacturing Crazy Circuits in the United States, just a few hours drive from our office, helps us mitigate potential errors due to miscommunication and makes it easy and affordable for us to conduct quality control. We have already placed orders for our circuit boards and for electronic parts, and some items have already arrived at our warehouse. We are on schedule to deliver to our Kickstarter backers in September, and we plan to fulfil our Crowd Supply orders the same month.

## About the Team

The Brown Dog Gadgets team is lead by Joshua Zimmerman, a former teacher turned small business owner. In the hunt for quality science activities for his classroom, Josh began creating his own projects to fit his budget. Posting these early projects to sites like Instructables uncovered a niche for simple, inexpensive projects in both the home and education markets. Josh left his teaching job in 2013 to run Brown Dog Gadgets full time. In the last few years the business has grown to include an expanded product line, five employees, several specialized contractors, and two office dogs.

## Pledge Levels

This table details exactly what comes in the box when you order at each pledge level.

	<b>Touch Board</b>	<b>Squishy Circuits™ Kit</b>	<b>Conductive Paint Kit</b>	<b>NES Controller Kit</b>	<b>Sewing Kit</b>	<b>Deluxe Kit</b>	<b>Makerspace Kit</b>
Crazy Circuits Chips							

	<b>Touch Board</b>	<b>Squishy Circuits™ Kit</b>	<b>Conductive Paint Kit</b>	<b>NES Controller Kit</b>	<b>Sewing Kit</b>	<b>Deluxe Kit</b>	<b>Makerspace Kit</b>
Touch Board	1	1	1	1	1	1	5
Momentary Pushbutton Switch				6		3	5
Jumbo Momentary Pushbutton Switch						3	5
Three Pin Slide Switch					1	2	5
Coin Cell Battery Holder					1	3	5
10mm Jumbo LED		5	5	1	5	10	20
Surface Mount LED					5	5	20
Brick LED						5	15
RGB LED						1	5
Piezoelectric Speaker		1	1	1	1	1	1
Screw Terminal					1	2	10
Blink/Fade Board						1	5

	<b>Touch Board</b>	<b>Squishy Circuits™ Kit</b>	<b>Conductive Paint Kit</b>	<b>NES Controller Kit</b>	<b>Sewing Kit</b>	<b>Deluxe Kit</b>	<b>Makerspace Kit</b>
Robotics Board							3
Other Parts							
Alligator Clip 5 Pack	1	1	1				2
Conductive Tape Roll		1	1	1		1	10
Conductive Thread Bobbin					1	1	5
LEGO™ Baseplate		1	1	1		1	10
CR2032 Battery 5 Pack					1	1	10
USB Cable	1	1	1	1	1	1	8
Squishy Circuits™ 6 Pack		1					
Bare Conductive Paint			1				
Wood Controller Enclosure				1			
2AAA Battery Holder w/						1	5

	<b>Touch Board</b>	<b>Squishy Circuits™ Kit</b>	<b>Conductive Paint Kit</b>	<b>NES Controller Kit</b>	<b>Sewing Kit</b>	<b>Deluxe Kit</b>	<b>Makerspace Kit</b>
Switch							
3AAA Battery Holder w/ Switch					1		
Standard Servo							3
Continuous Rotation Servo							6