

## Easy Joule Thief Circuit



by How Do You - DIY

A joule thief takes a low DC voltage and boosts it up to a higher voltage. You can even take a battery that other devices will consider to be drained and get a bit more of the energy out of it. You won't get much current from it, but you can get enough to power a 3 volt LED with a battery that's drained to less than a volt. That's why it's referred to as a joule thief. It's almost like stealing energy from a dead battery. By the way, some people call it a zombie circuit for this same reason.

If you're new to building electronics, this is a good circuit for practice. The one I made for this Instructable looks ugly, but it still works. The schematic that I'm following is a basic one that I got from Wikipedia.

([https://en.wikipedia.org/wiki/Joule\\_thief](https://en.wikipedia.org/wiki/Joule_thief)) It uses 4 components plus a battery. You can see some schematic reference pictures in step 10 of this Instructable.

If you would like to see a video version of this instructable, you can check that out here: <https://youtu.be/nBn4JEvv93c>

### Supplies:

#### Tools

- [Wire Cutters](#)
- [Breadboard](#)
- [Soldering Iron](#)
- [Helping Hands](#)

#### Parts

- [Toroid Core](#)
- [Perfboard](#)
- [1k Ohm Resistor](#)
- [2N2222 Transistor](#)
- [LED](#)
- [3/8" Ring Magnets](#)
- [Thumb Tacks](#)

#### Supplies

- [22 Gauge Solid Wire](#)
- [22 Gauge Stranded Wire](#)
- [Epoxy](#)
- [Solder Flux](#)

- Lead-Free Solder
- Lead-Based Solder

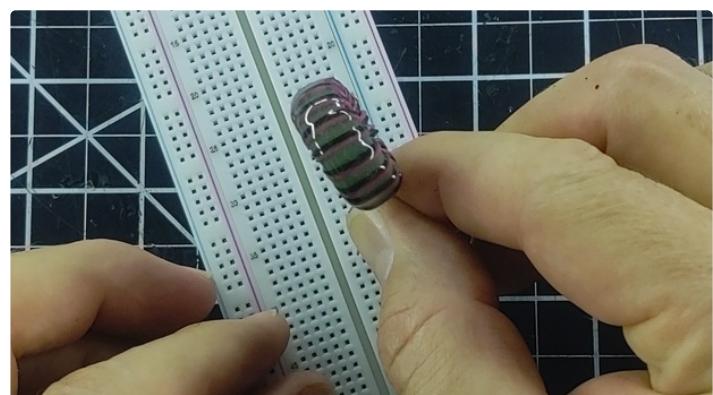
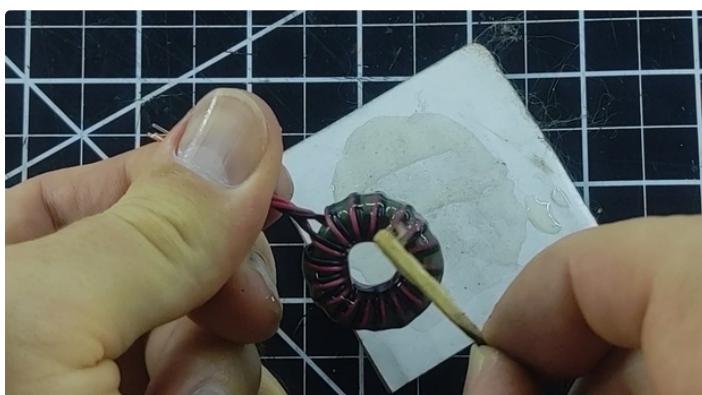
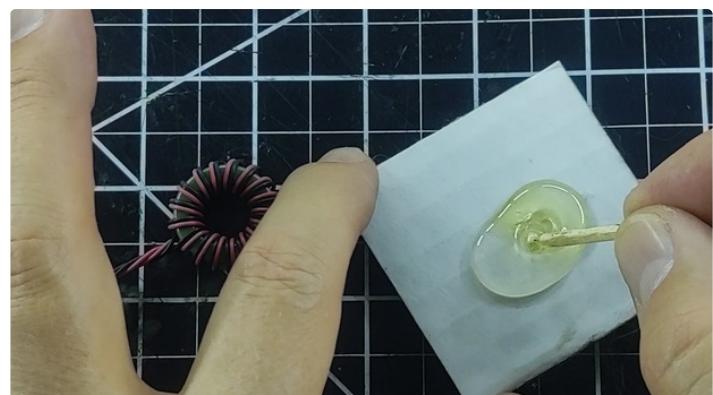
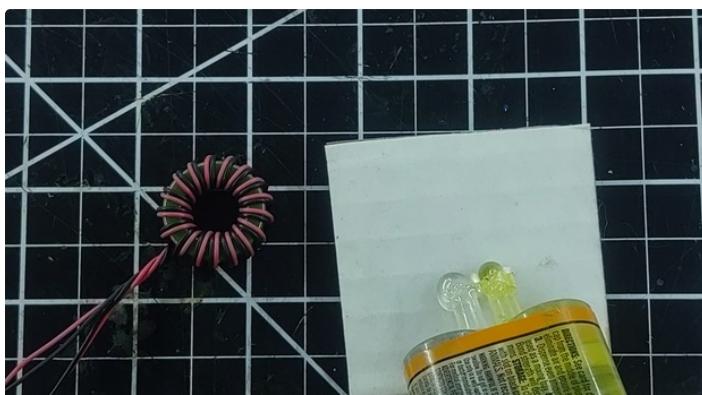
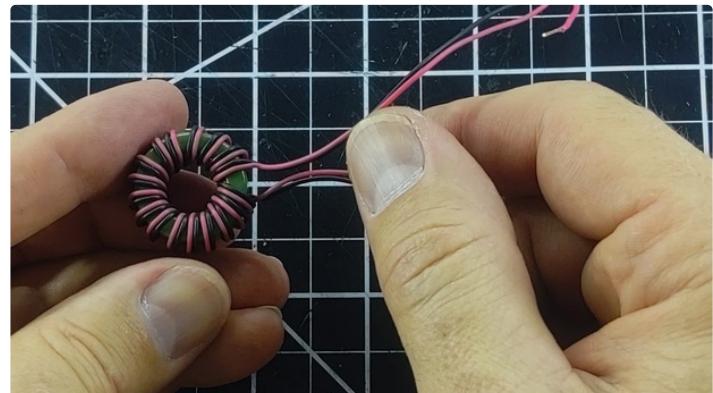
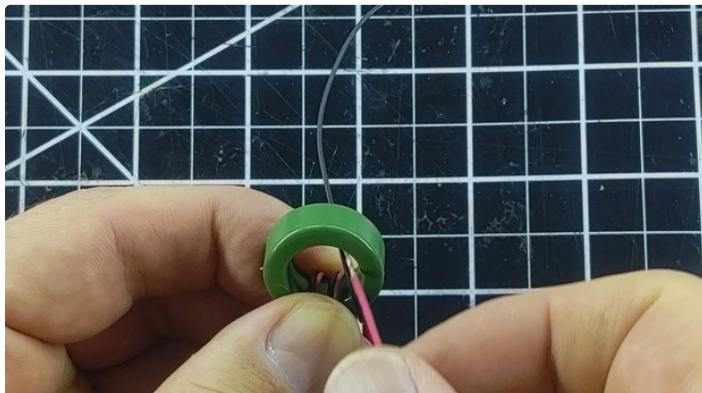
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## Step 1: Build a Toroid Inductor

I start by making a toroid inductor. Using 2 wires, I wrap them around the inductor core until the core is filled. The wires I used are 22 gauge, but they can be even thinner. Wrap them both the same number of times. I used 2 different colors of wires to help me keep track of which is which. (In these pictures I used red and black, but I

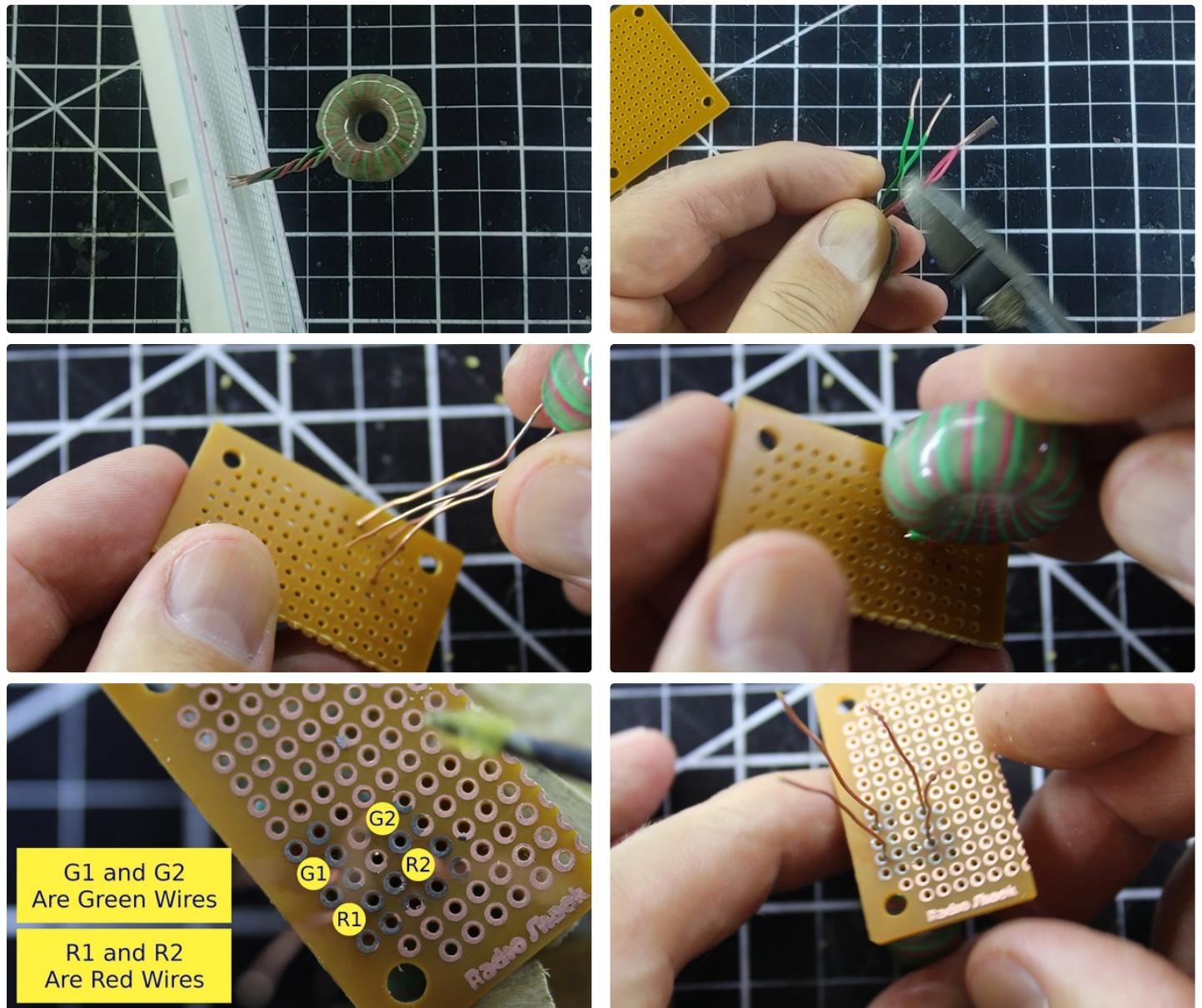
switched to red and green.)

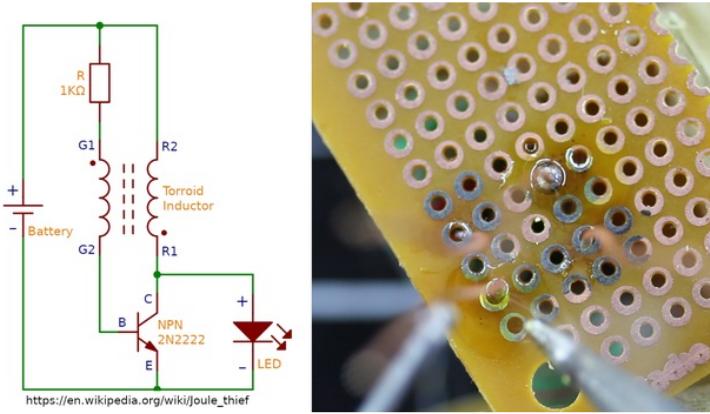
After wrapping them, I mix up some epoxy and coat the toroid with it. This isn't absolutely necessary, but it helps to hold the wires in place on the toroid.



## Step 2: Mount the Toroid Inductor - First Component

When the epoxy sets, I stripped back the wires and soldered the toroid inductor to a perfboard. Keep track of which wires are which. I have the 4 connections labeled in the picture.

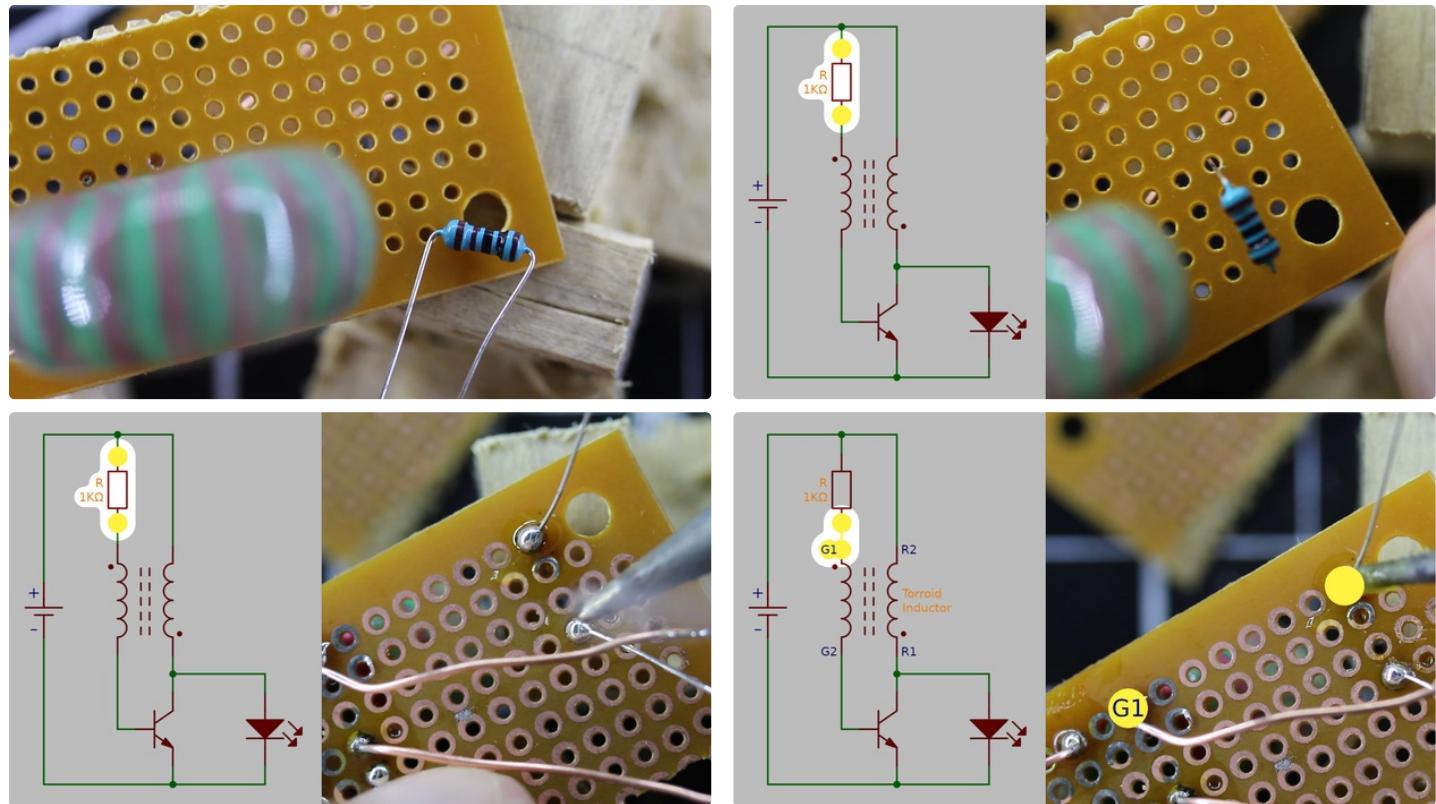


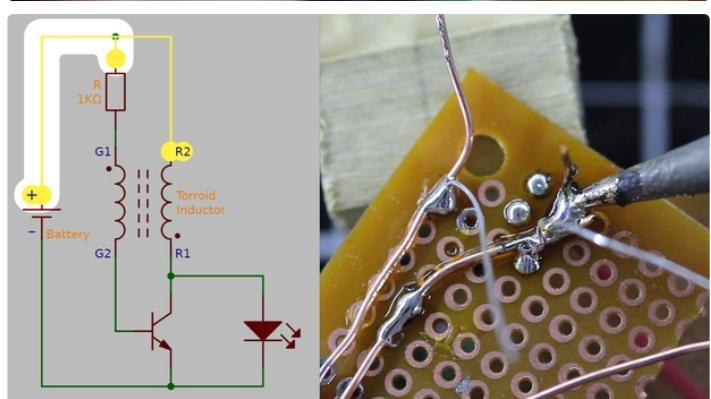
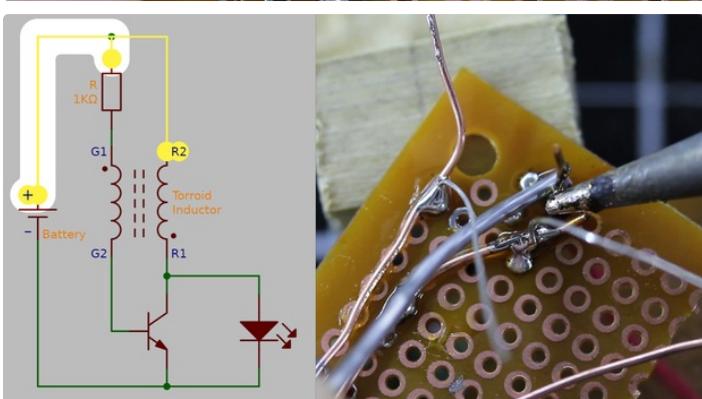
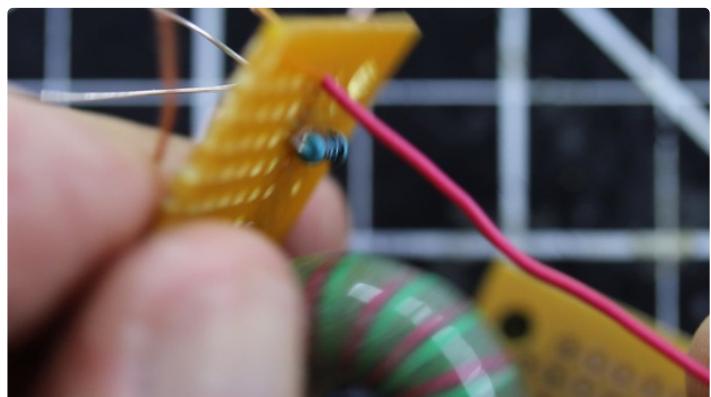
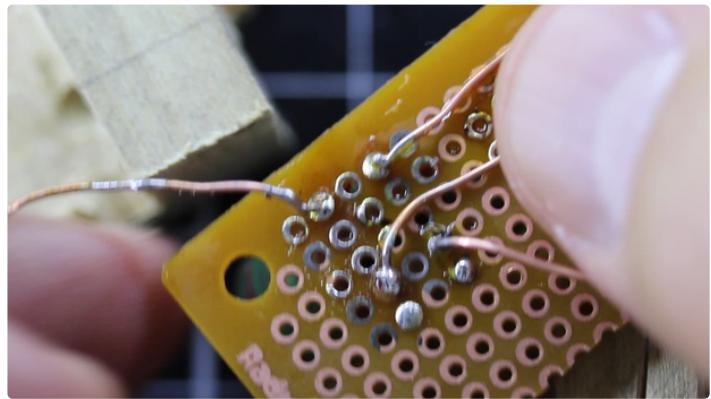
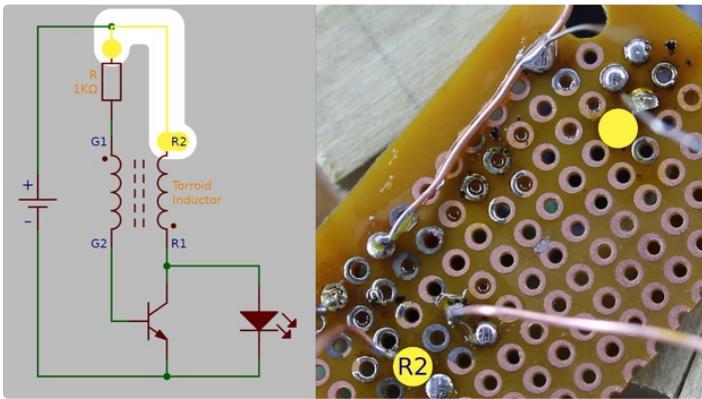
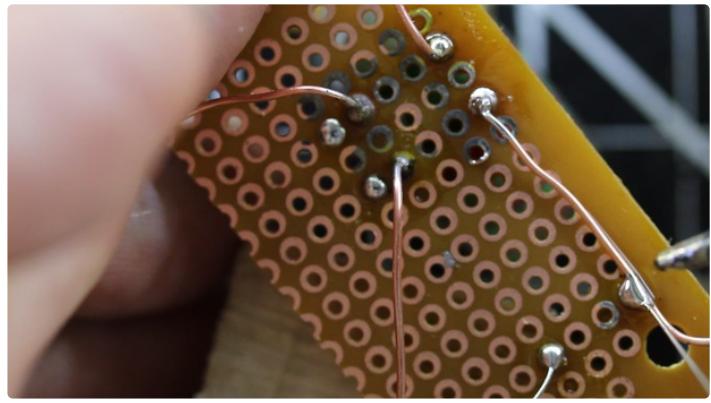
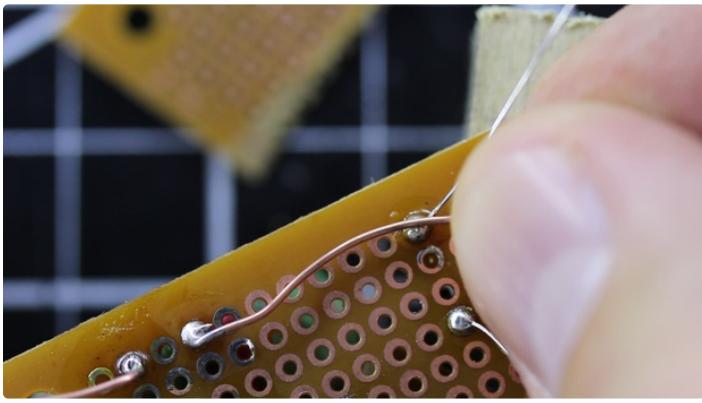


### Step 3: 1K Ohm Resistor - Second Component

The second part that I'm adding is a 1k resistor. Connect G1 from the toroid inductor to one side of the resistor, and it does not matter which side of the resistor we connect it to. The other side of the resistor needs to connect to R2 of the toroid inductor.

Add a (preferably red) wire for the battery positive. It also connects to the resistor at the same point as R2.

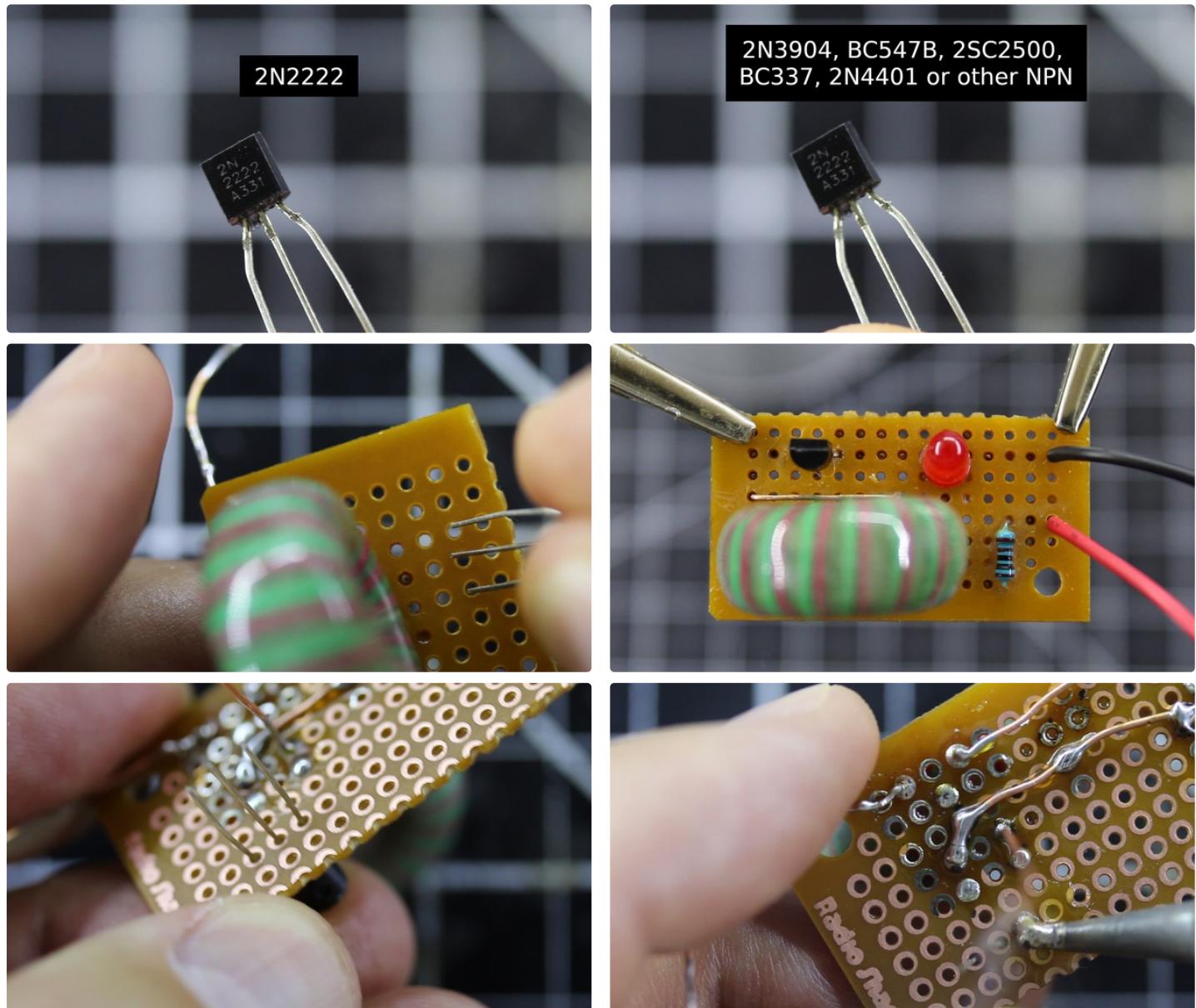




## Step 4: 2N2222 Transistor - Third Component

The 3rd part is a transistor. I used a 2N2222 transistor, but you could instead use a 2N3904, BC547B, 2SC2500, BC337, 2N2222, 2N4401 or other NPN transistor, if that's what you have. Place it on the perfboard with the flat side facing away

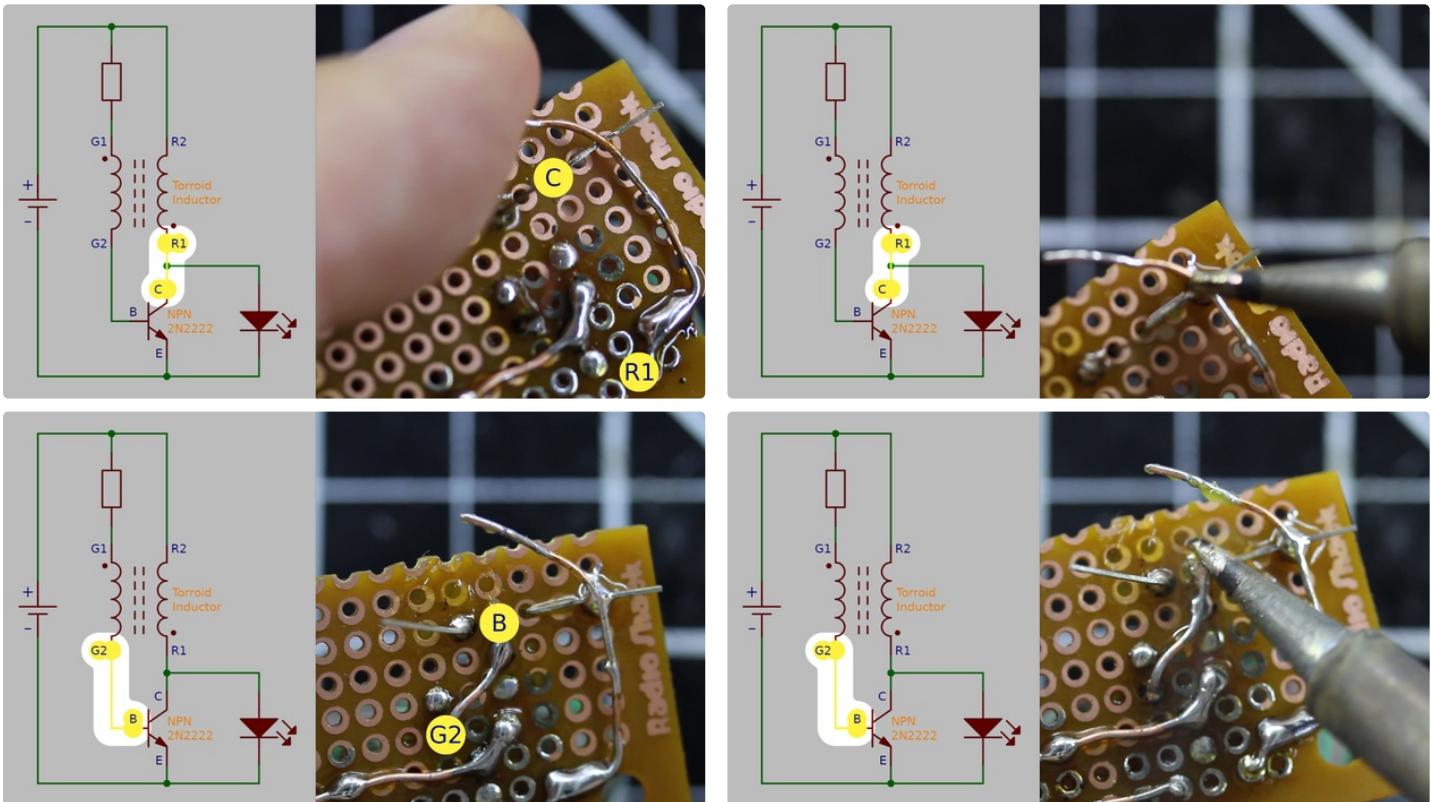
from the toroid. For now I'm just solder one of the leads to hold it to the board.



## Step 5: Transistor Collector and Base

Now it's time to solder R1 of the toroid inductor to it's destination. Route it around to meet up with the collector of the transistor.

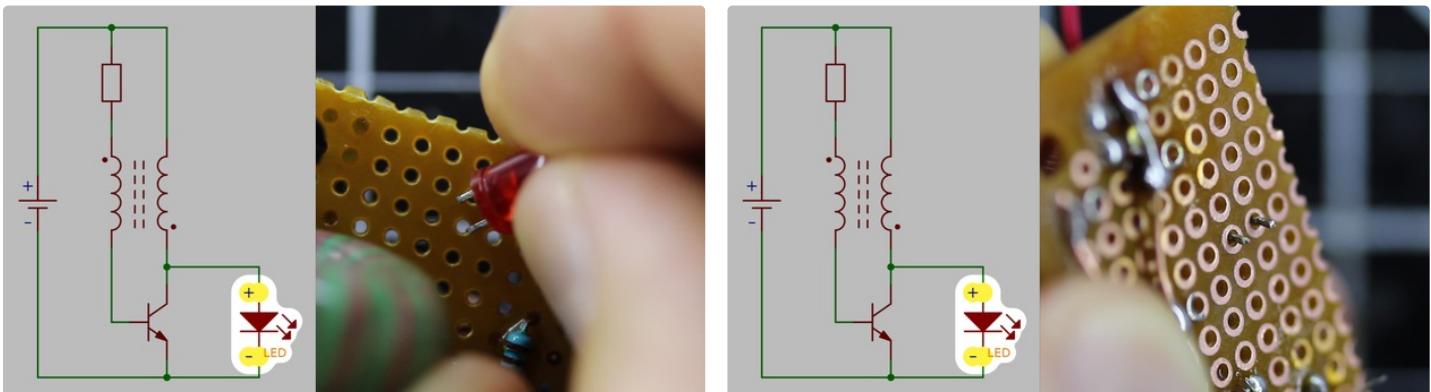
And G2, route that to connect with the base of the transistor. It's the middle pin.

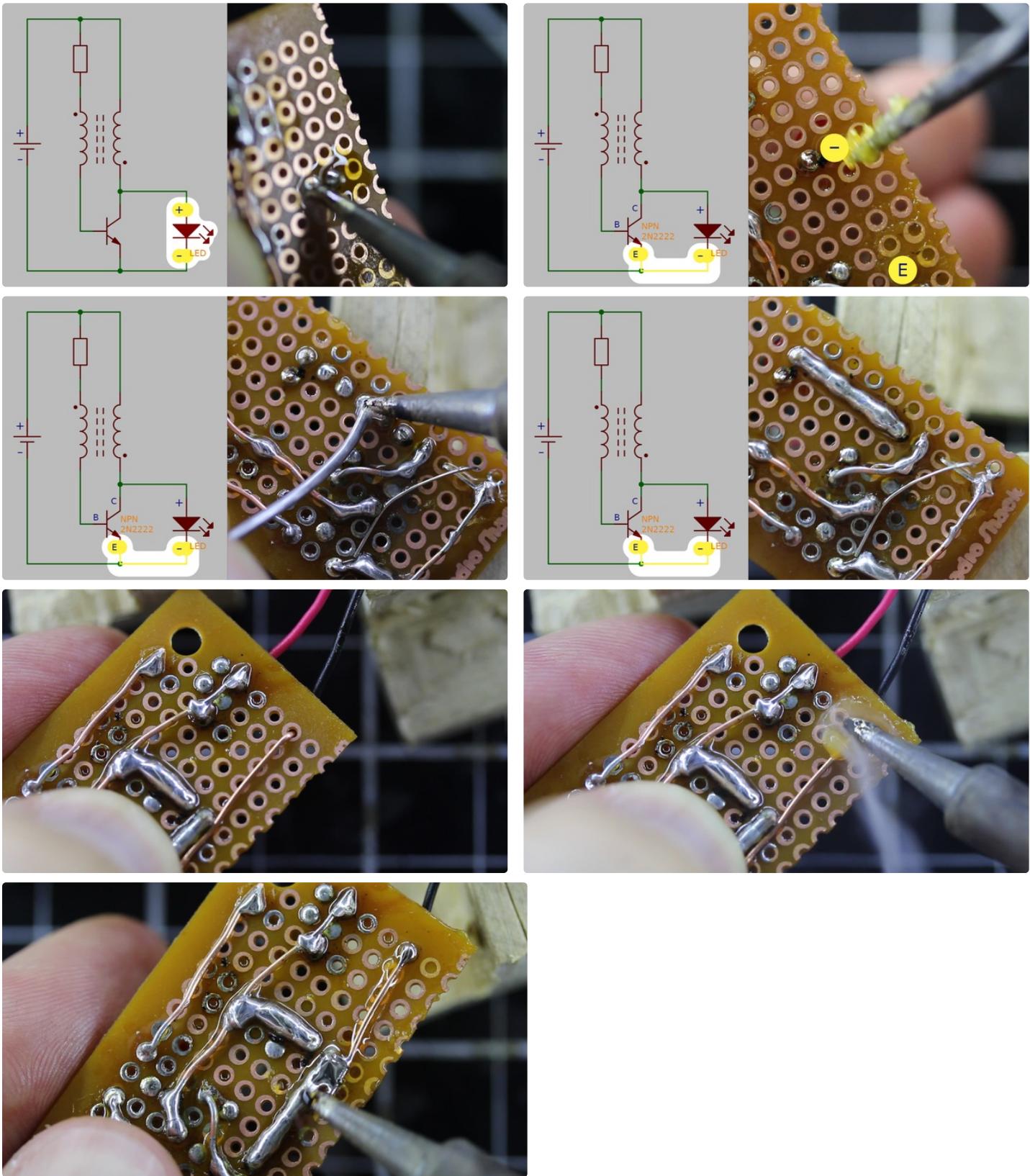


## Step 6: LED - Forth Component

The 4th part is the LED. The LED that I used is one that I salvaged from another board, so the leads are already cut short. The emitter of the transistor will connect to the negative pin of the LED. Since the LED leads are short, I created a path with solder.

I also connected a black wire to this same point for the battery negative.

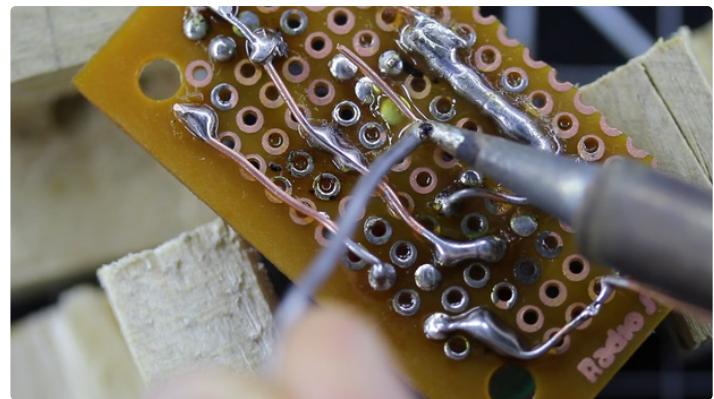
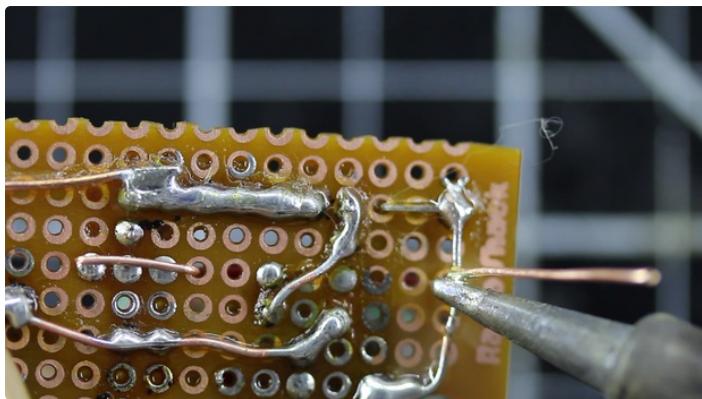
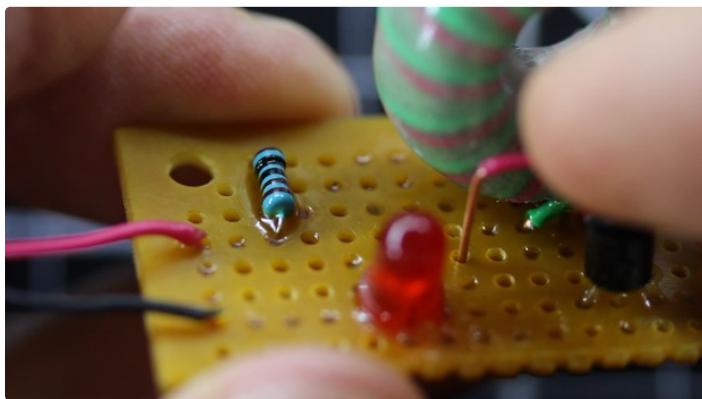
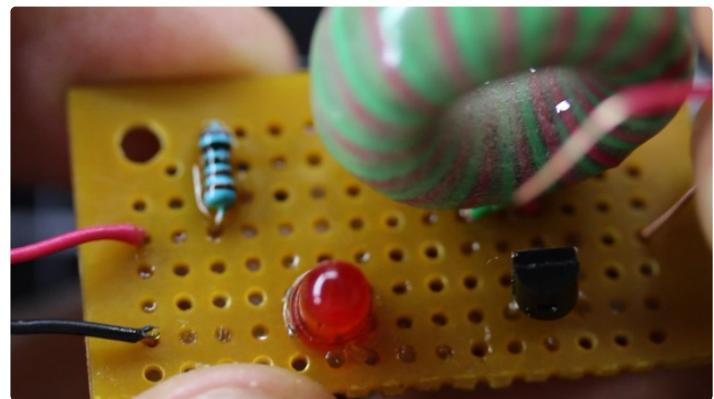
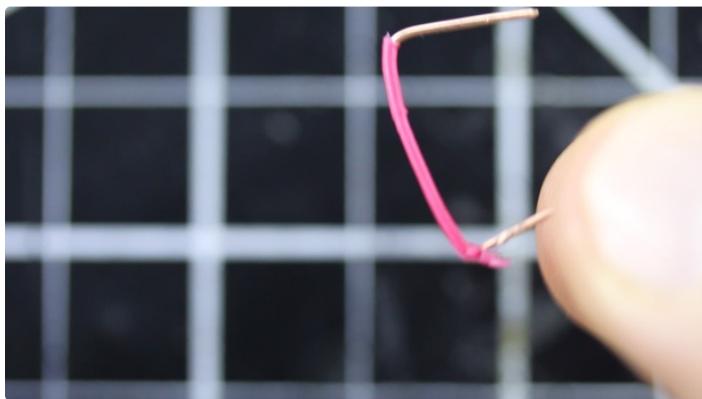
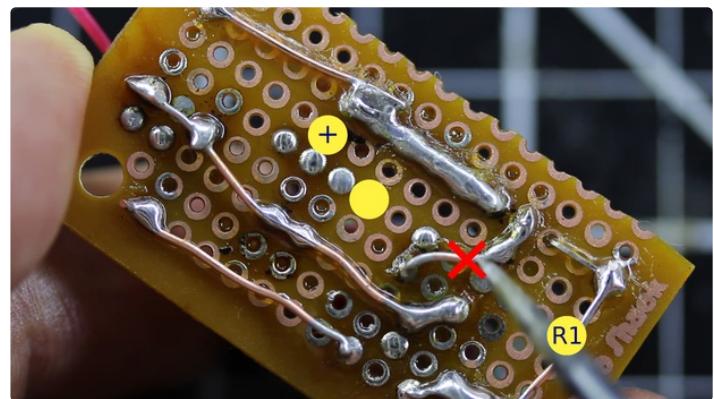


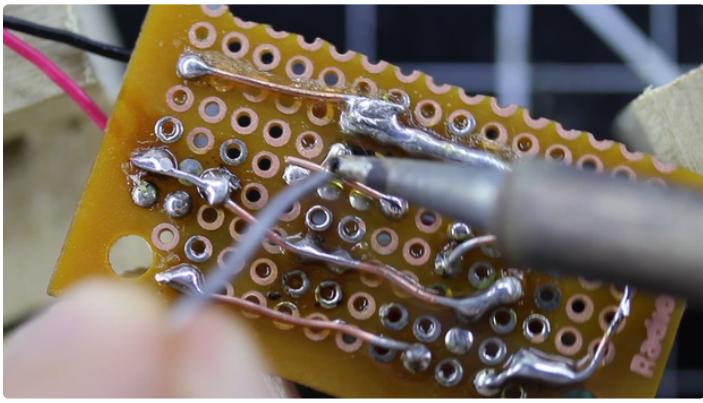


## Step 7: LED + Connection

The LED positive lead needs to connect to the same wire as R1 from the toroid inductor and the collector of the transistor. It also needs to pass over the wire for G2 without connecting to it. I used a jumper wire on the other side of the

perfboard to do this.

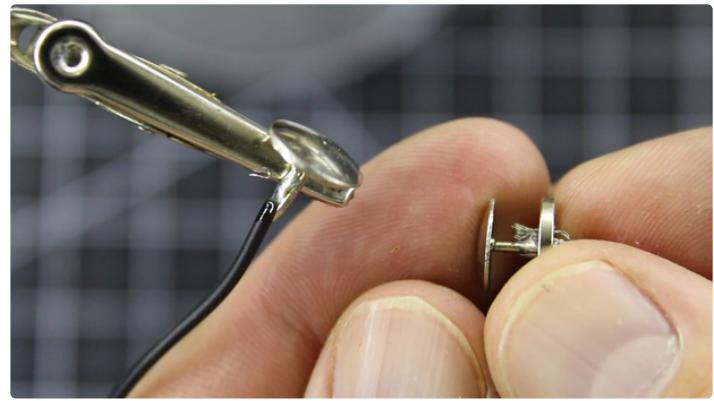
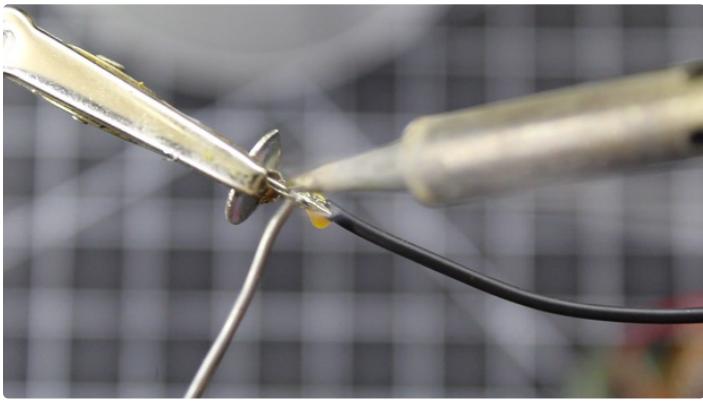
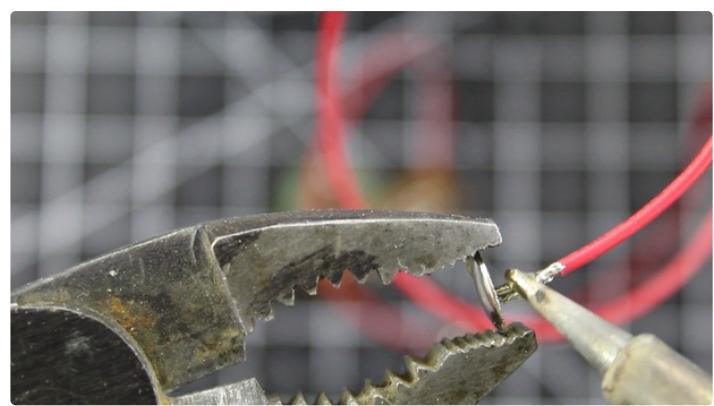
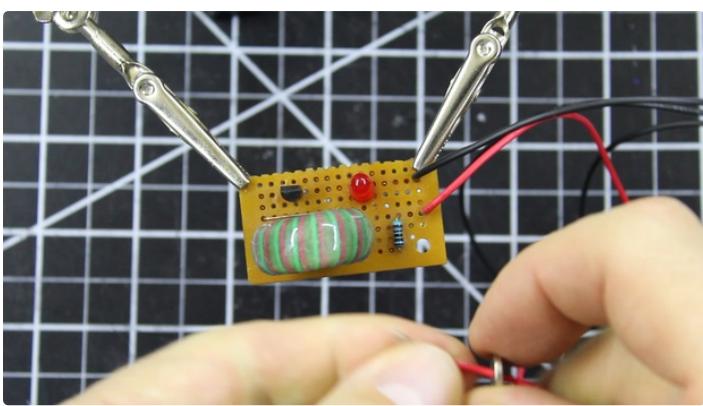
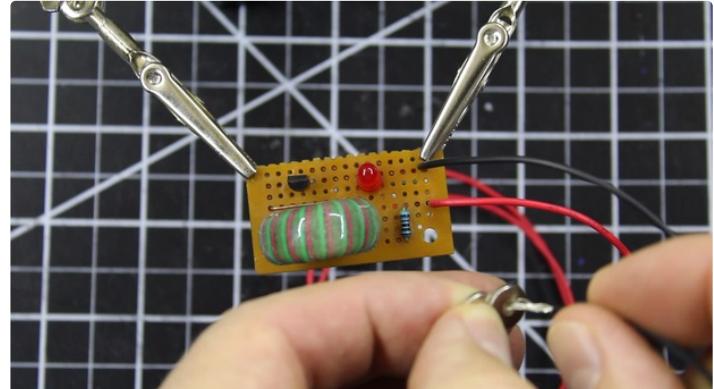
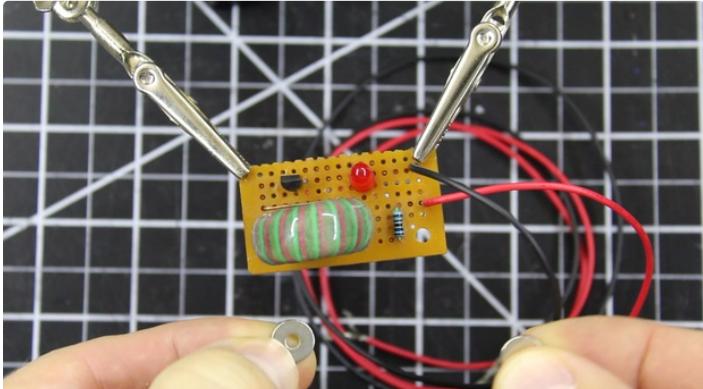


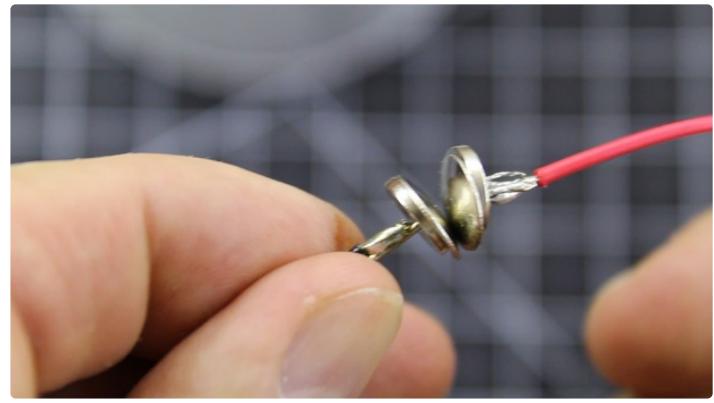
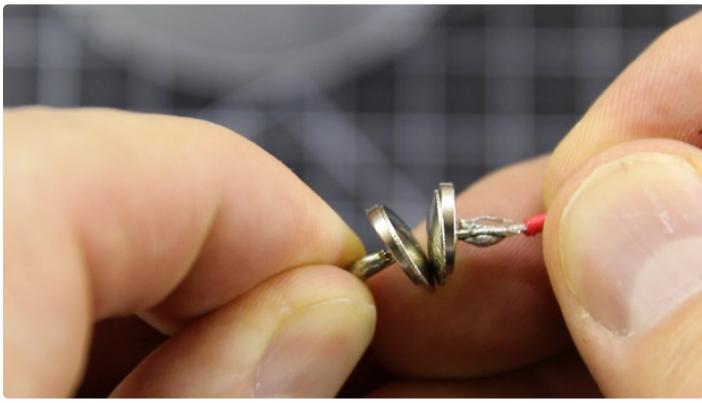


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## Step 8: (Optional) Semi-Universal Battery Connector

This next step isn't necessary for the circuit to work, but it will give you a convenient way to connect to a variety of batteries. After sliding a disk magnet onto each of the power wires, solder a thumbtack onto each of those wire.





## Step 9: Demo

Now it's complete so let's do a couple demonstrations with AA batteries. First I'm using a battery that's not new, but also not dead. You can see that it lights up the LED. Next I use a battery that is drained, and most devices consider it dead. And again, the LED lights up. With this circuit the toroid inductor may buzz a bit, so don't worry if it makes a high pitched sound. Thank you for checking out this Instructable!





## Step 10: Schematic Reference Pictures

