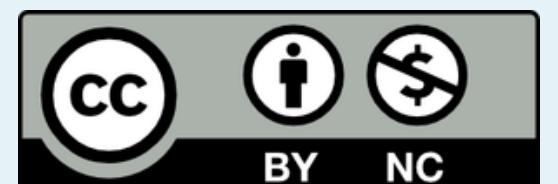


コードとデザイン

東京藝術大学 芸術情報センター開設科目 金曜4-5限 第3週

2024.04.26 松浦知也 (matsura.tomoya@noc.geidai.ac.jp teach@matsuuratomo.ya.com)



本日のスケジュール

- 前回の質問コーナー (20分)
- 今回作るもの解説 (20分)
- ラボに移動、製作 (120分、適宜休憩)
- 片付け (10分)

電気と増幅器

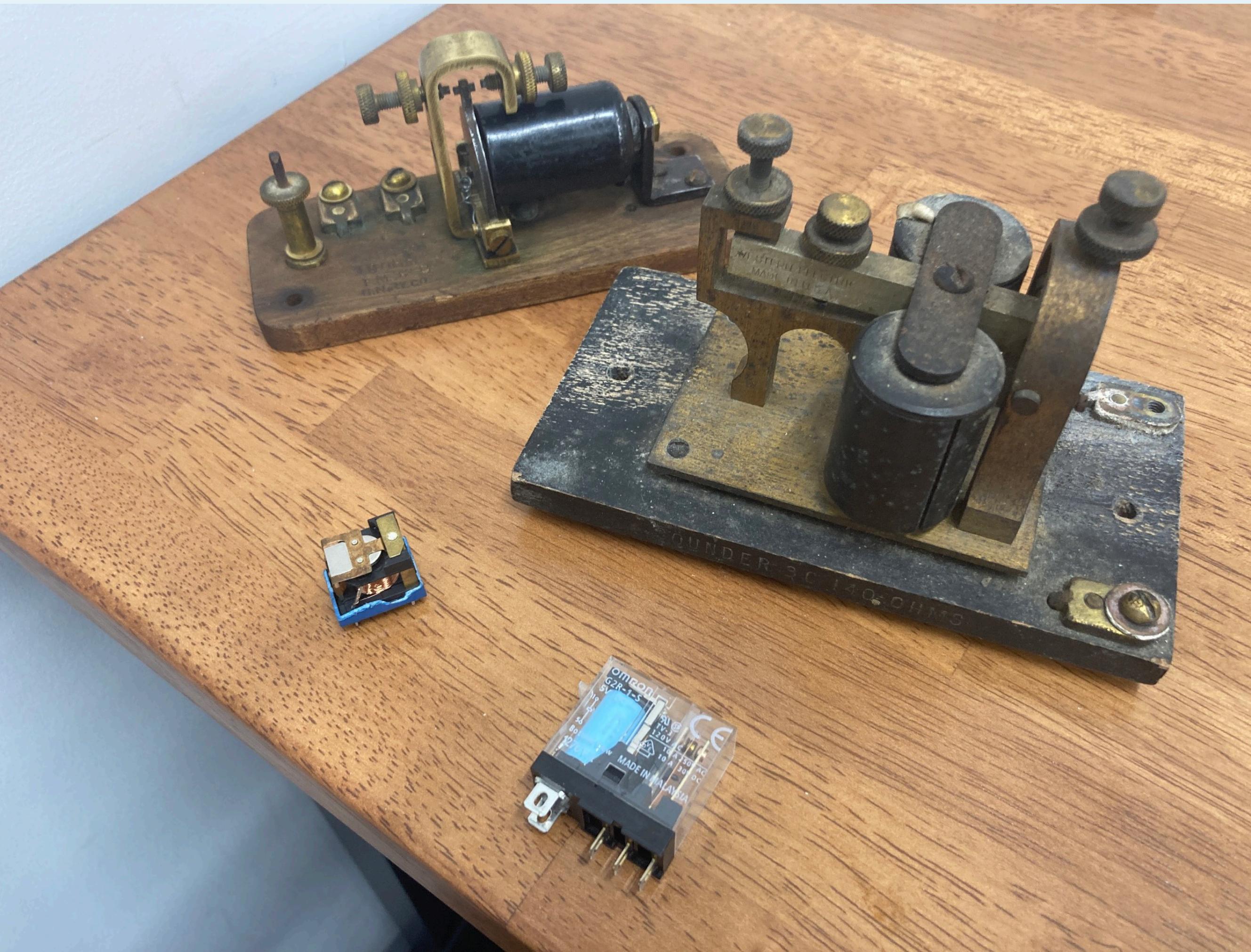
増幅器 と 発振器

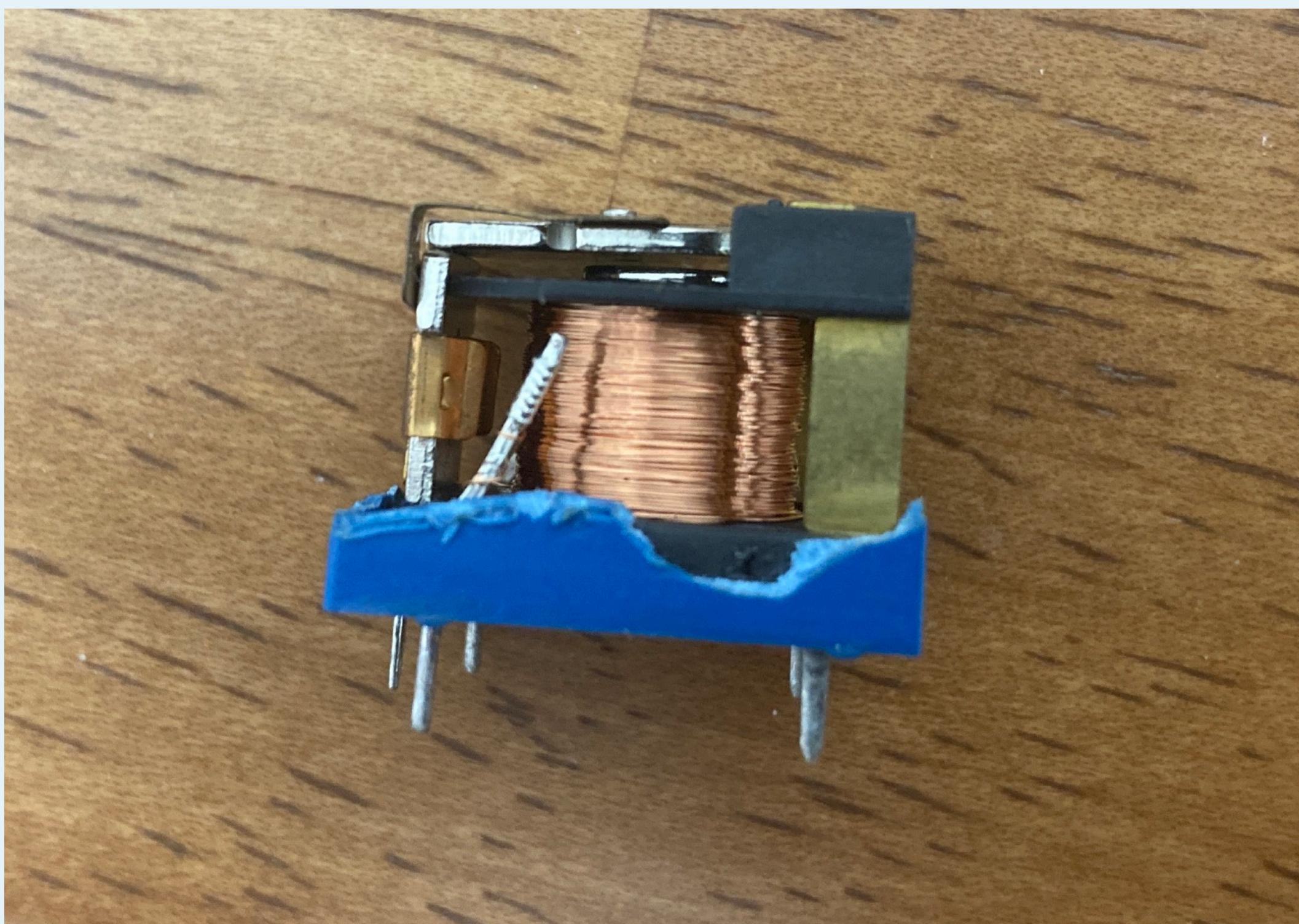
増幅器があると、論理回路を構成するスイッチが作れる

増幅器があると、発振器が作れる

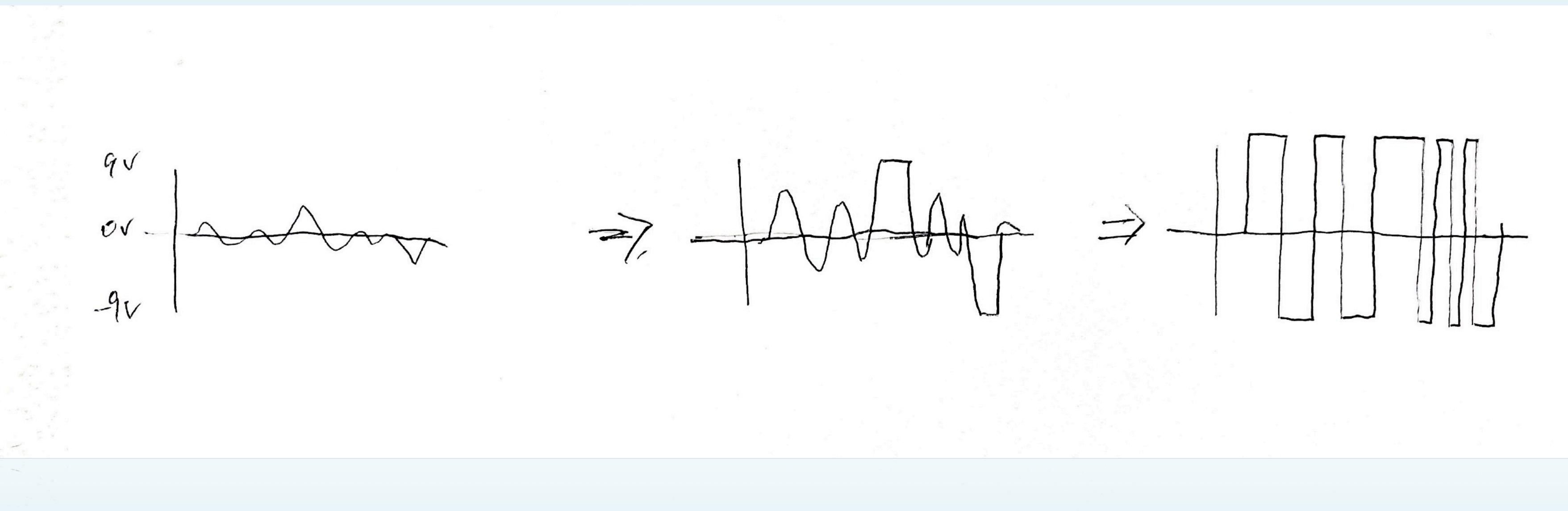
発振器がコンピューターを駆動するクロックになる

リレー：微弱な信号で大電力を操作





極端な増幅=スイッチング



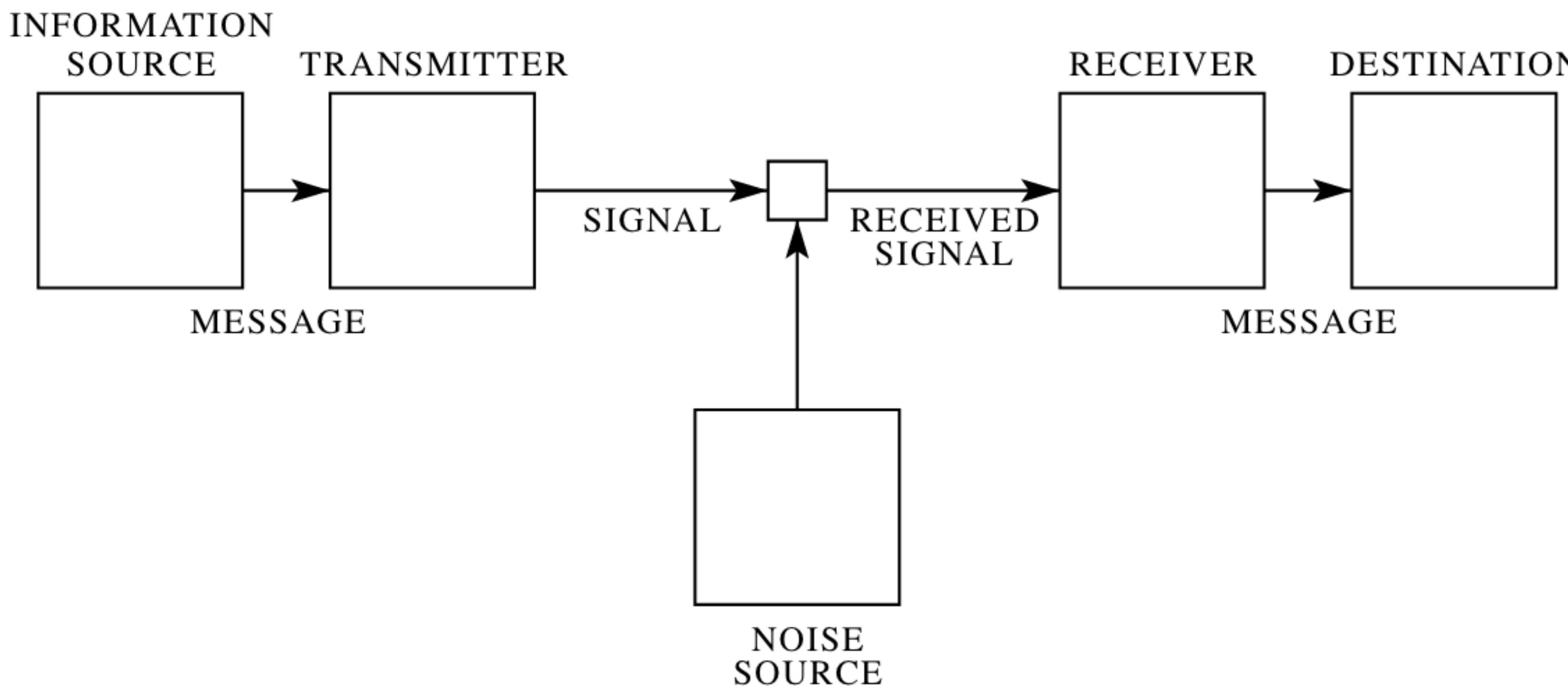
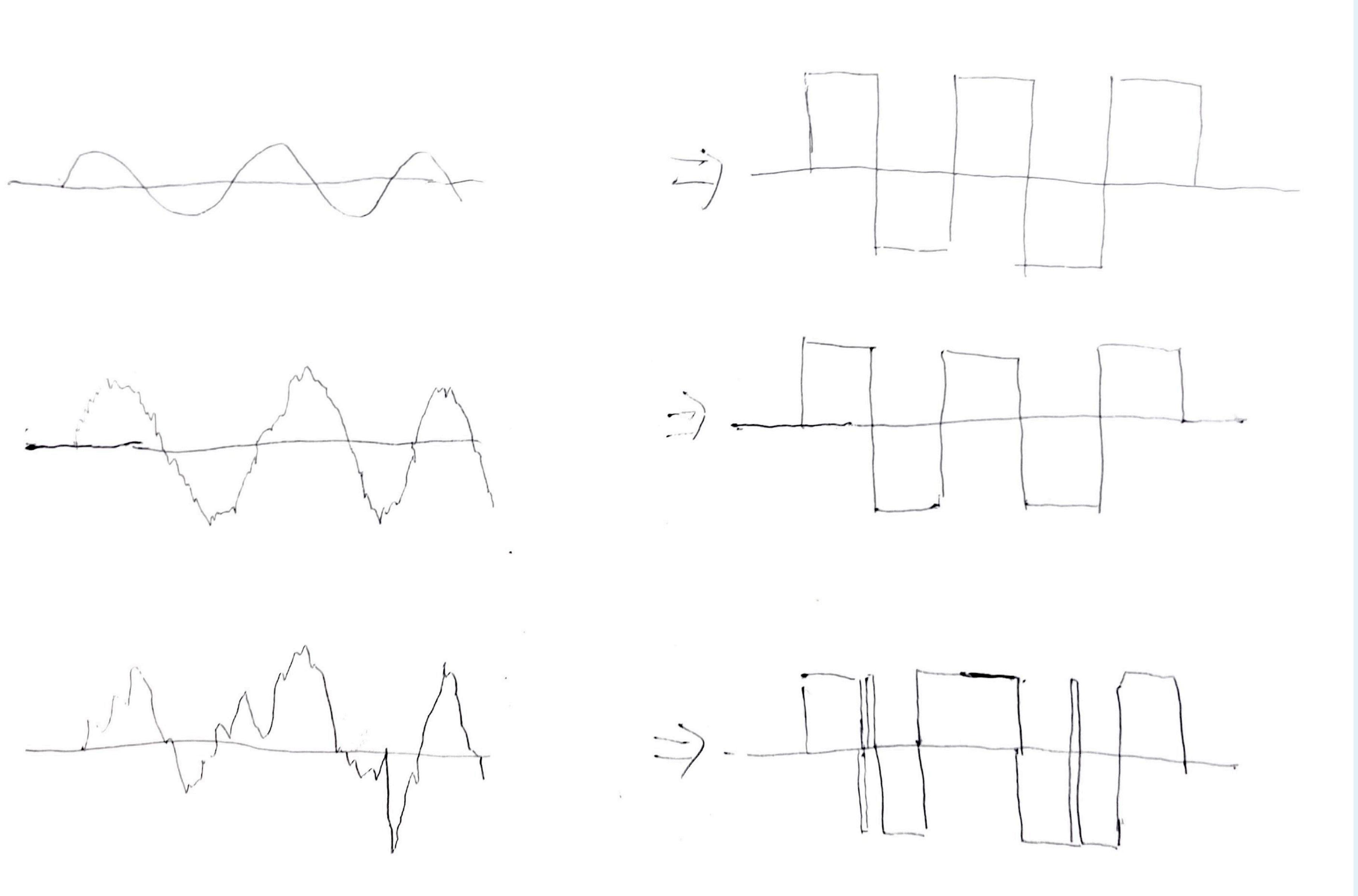


Fig. 1 — Schematic diagram of a general communication system.

Shannon, Claude E. 1948. "A Mathematical Theory of Communication." *The Bell System Technical Journal* 27: 379–423.
<https://doi.org/10.1145/584091.584093>.

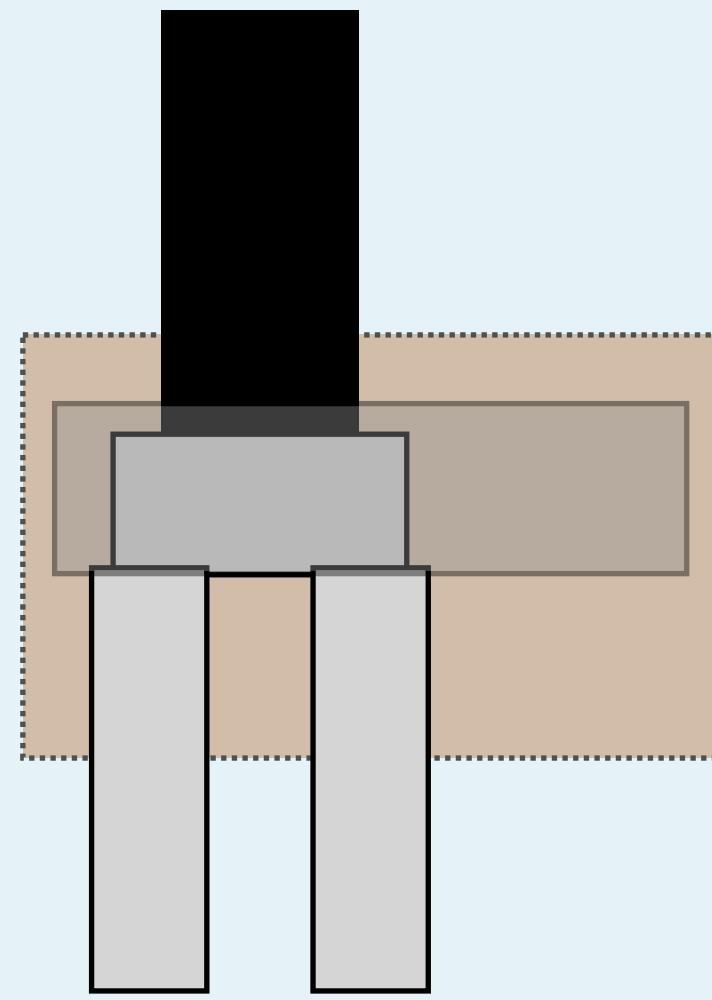


今日使う部品等の解説

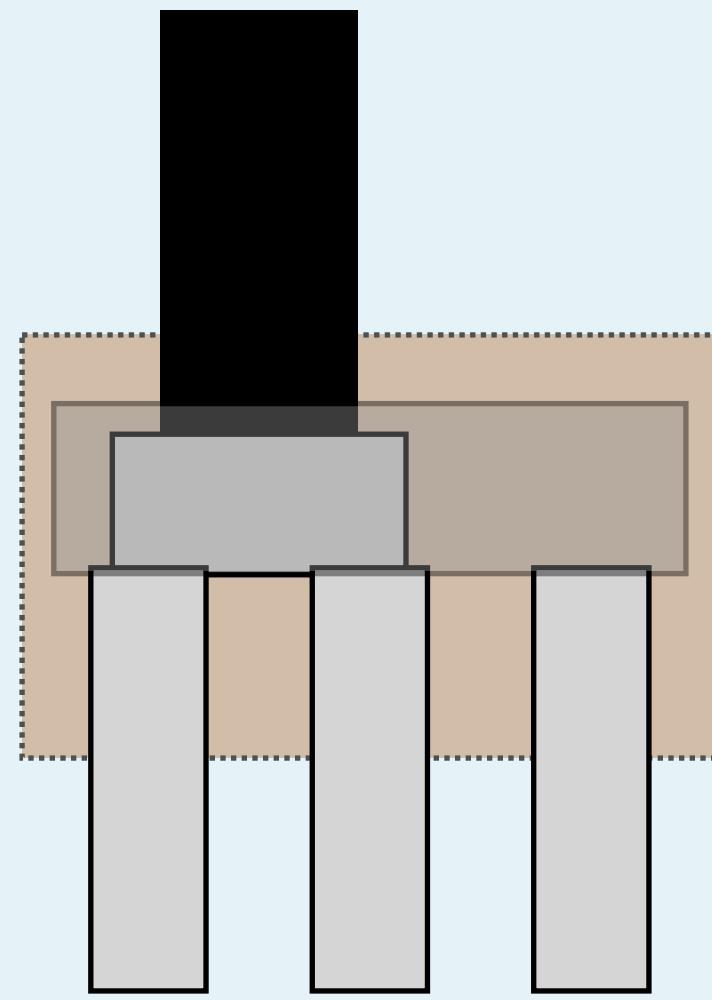
材料一覧

- 画用紙
- 銅箔テープ (30cm分くらい)
- ボタン電池 (CR2025,CR2032など) ×1
- LED × 2
- SPDTスイッチ ×1
- NPNトランジスタ (2SC1815) ×1
- 抵抗
 - 220Ω (赤赤茶金)×1
 - 10kΩ (茶黒橙金) ×1
- マーカー
- はんだごて
- ハンダ
- フラックス

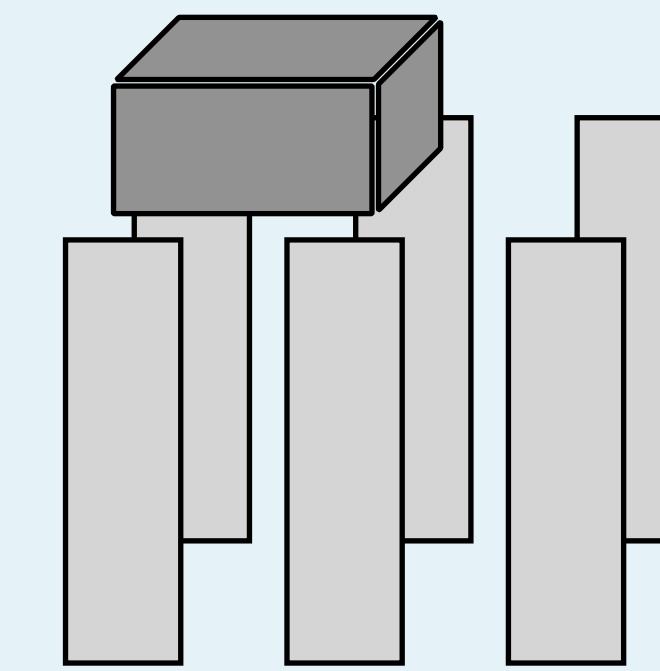
スイッチ



SPST
Single-Pole-Single-Throw



SPDT
Single-Pole-Double-Throw

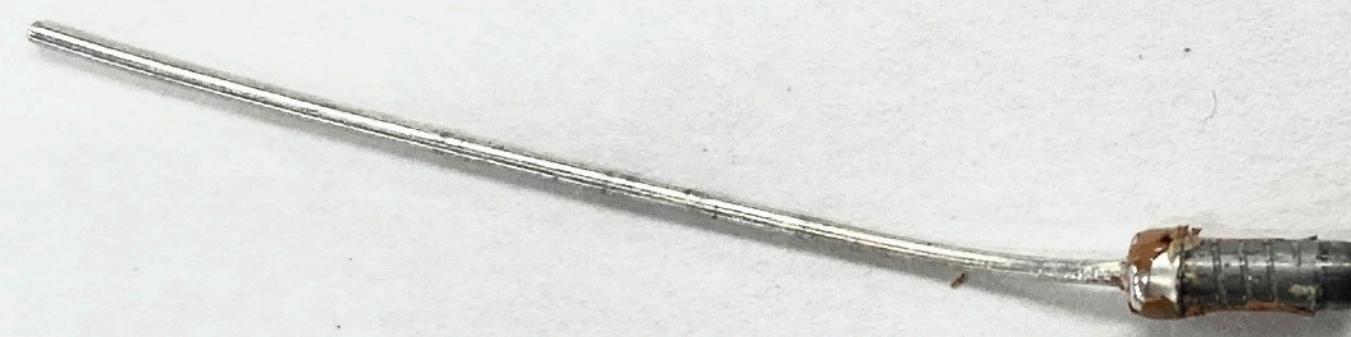


DPDT
Double-Pole-Double-Throw

抵抗



30Ω

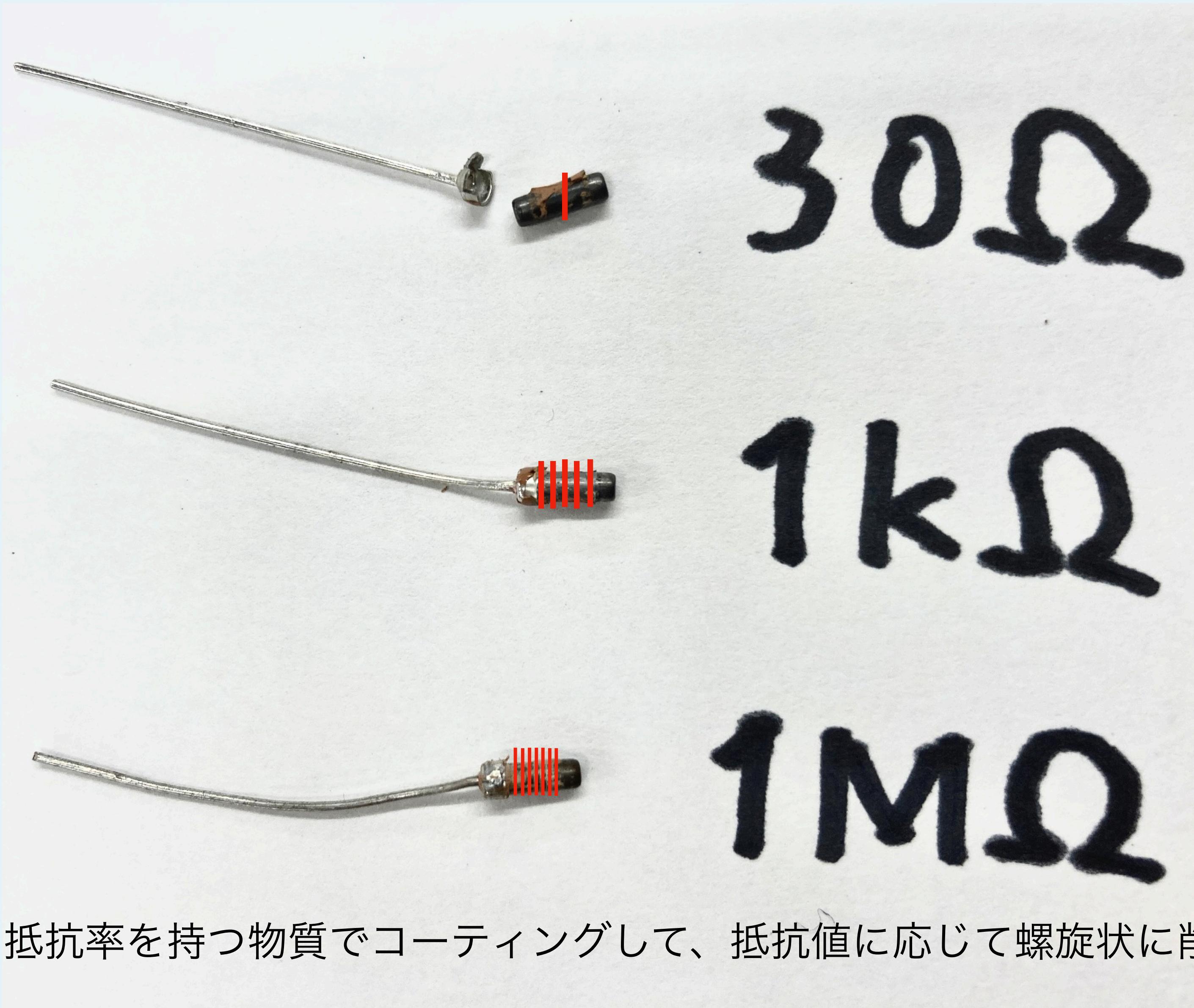


1kΩ



1MΩ

抵抗



一定の抵抗率を持つ物質でコーティングして、抵抗値に応じて螺旋状に削り落とす

抵抗器のカラーコード計算機

この抵抗器カラーコード計算機は、スルーホール抵抗器の抵抗と公差値の検索のために設計されています。

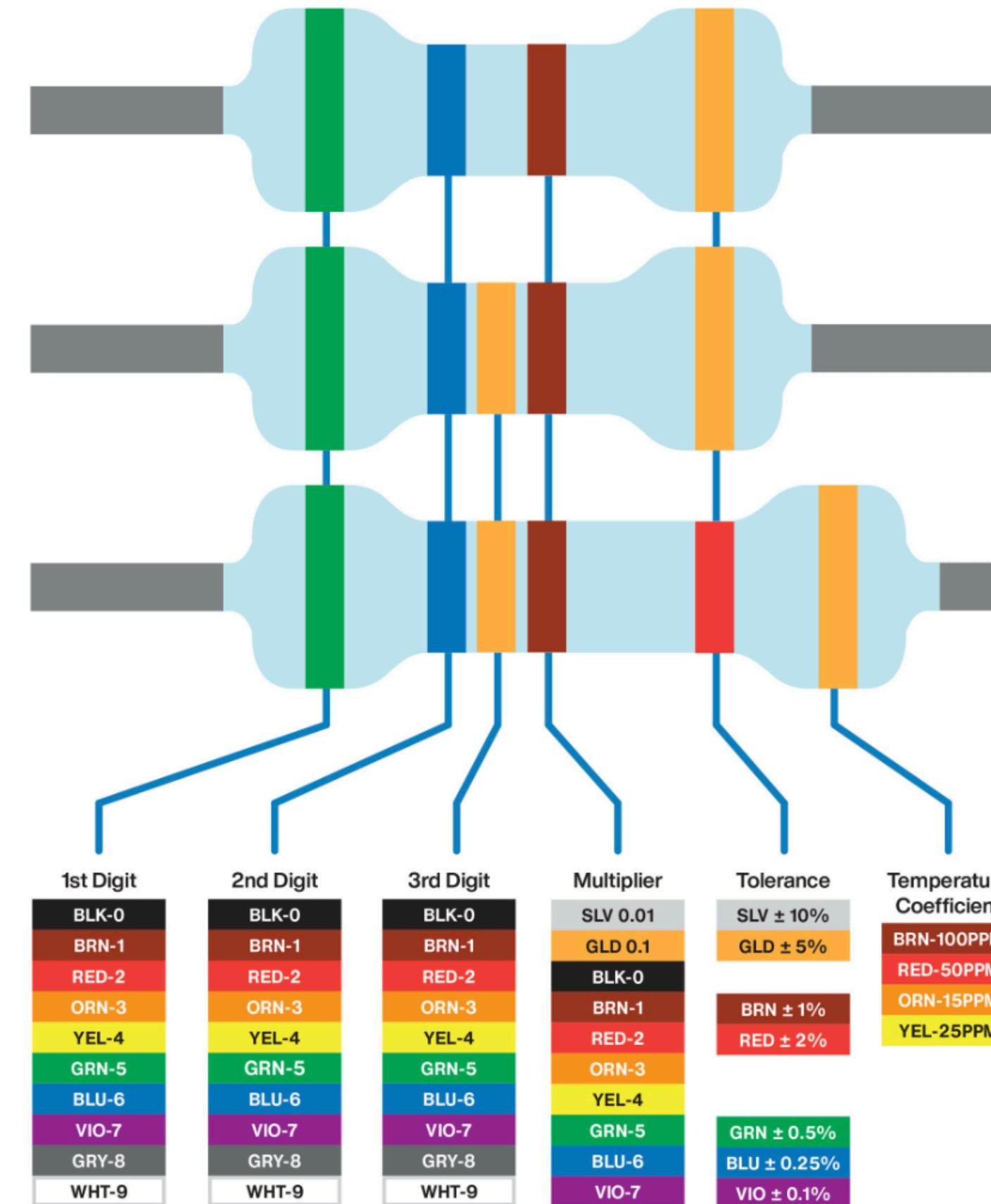
抵抗器のカラーコード計算機

抵抗器のカラーコードチャート

フィードバックを送信



Widest selection of electronic
components in stock



1st Digit

BLK-0
BRN-1
RED-2
ORN-3
YEL-4
GRN-5
BLU-6
VIO-7
GRY-8
WHT-9

2nd Digit

BLK-0
BRN-1
RED-2
ORN-3
YEL-4
GRN-5
BLU-6
VIO-7
GRY-8
WHT-9

3rd Digit

BLK-0
BRN-1
RED-2
ORN-3
YEL-4
GRN-5
BLU-6
VIO-7
GRY-8
WHT-9

Multiplier

SLV 0.01
GLD 0.1
BLK-0
BRN-1
RED-2
ORN-3
YEL-4
GRN-5
BLU-6
VIO-7
GRY-8
WHT-9

Tolerance

SLV ± 10%
GLD ± 5%
BRN ± 1%
RED ± 2%
GRN ± 0.5%
BLU ± 0.25%
VIO ± 0.1%

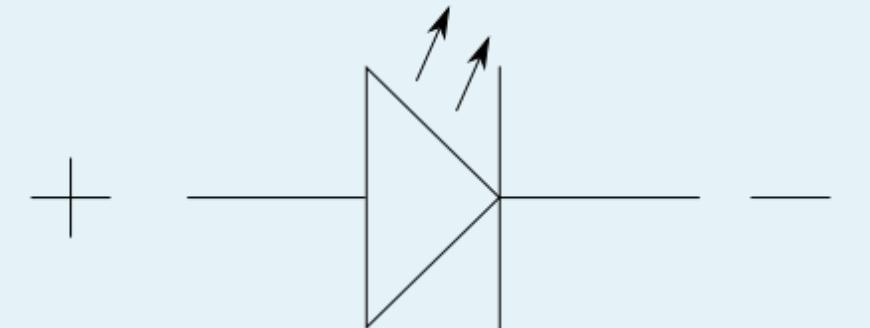
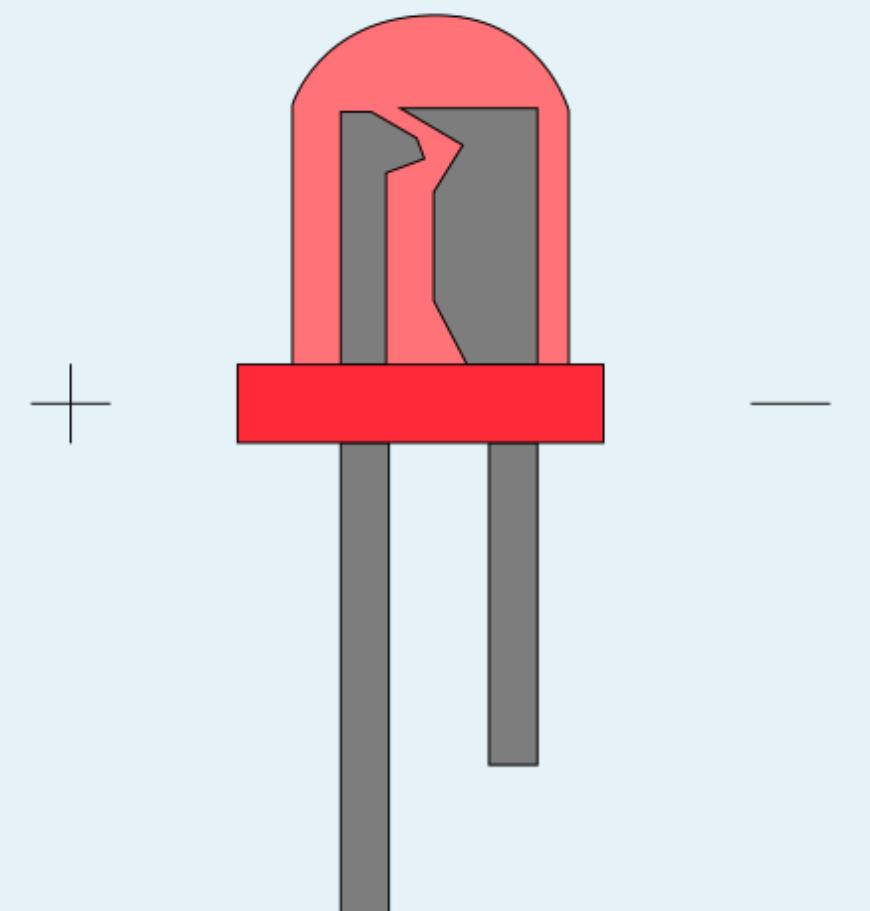
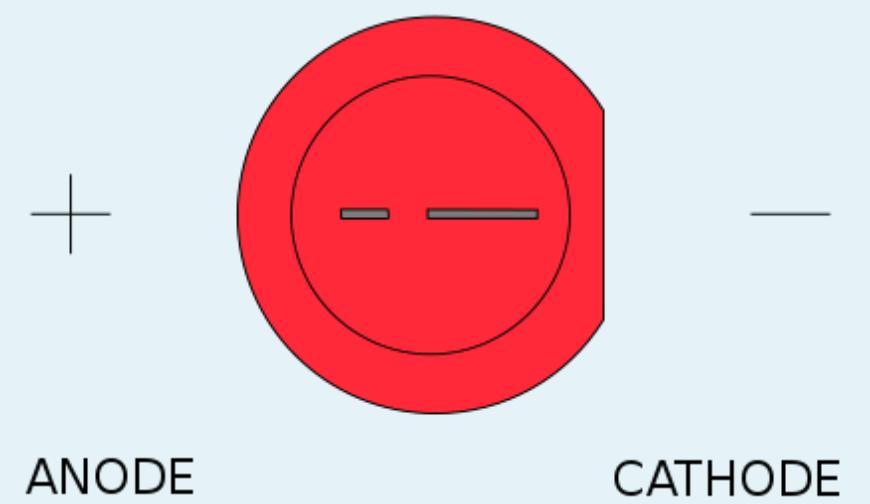
Temperature Coefficient

BRN-100PPM
RED-50PPM
ORN-15PPM
YEL-25PPM

8.5 x 11のPDFをダウンロード

LED

- ダイオード（電流を片方向のみに流す半導体）
- 足が長い方が+（アノード）
- 回路図記号では、電流が流れる方に矢印が向いてる
- 電源と直結させると、壊れる（ボタン電池ならOK）
- $220\Omega \sim 1k\Omega$ くらいの抵抗と直列で繋ぐ





P R I M I T I V E L E D

<https://www.youtube.com/watch?v=gPQyZ6jRYHk>

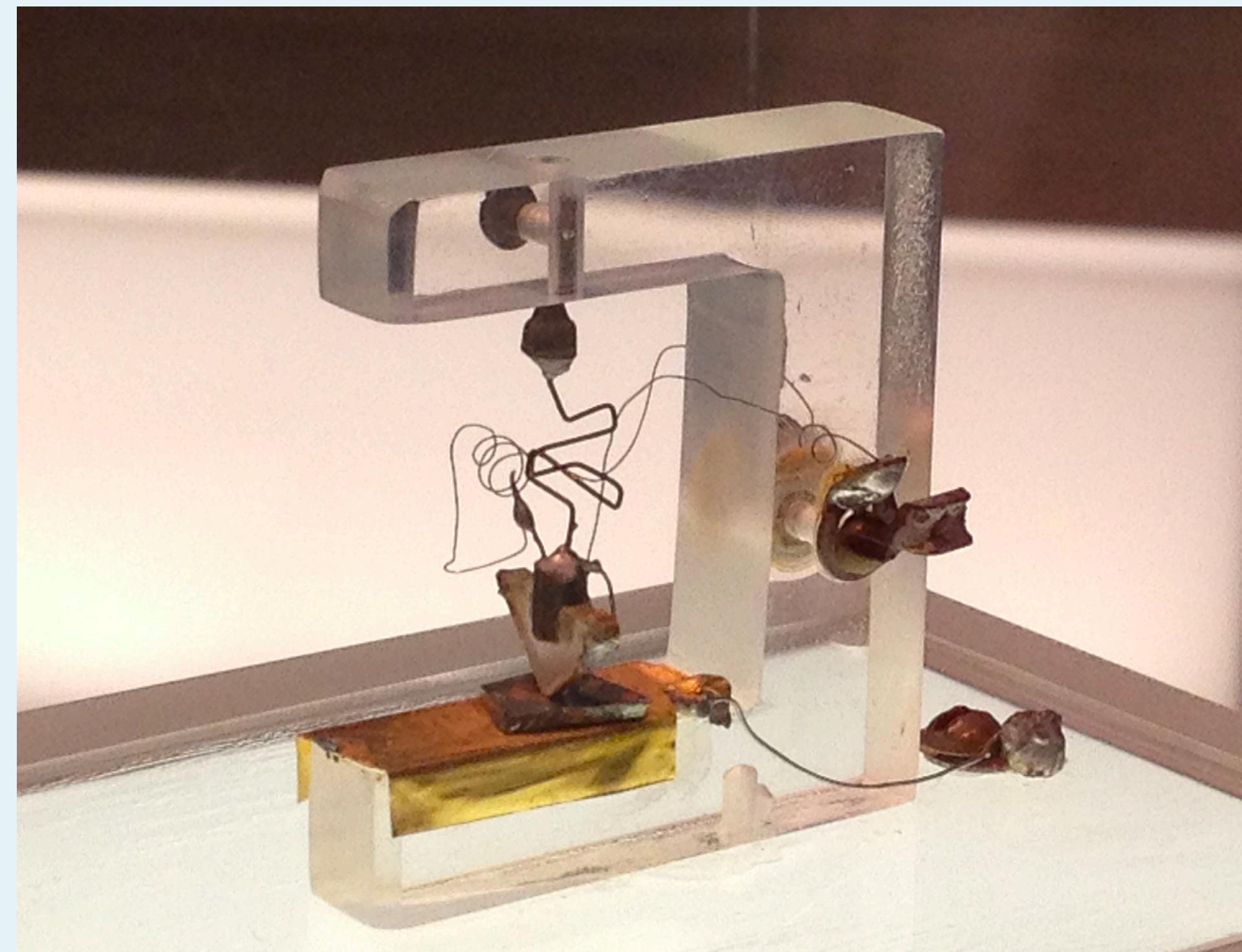
シリコンカーバイドの結晶に針を立てるとLEDになる



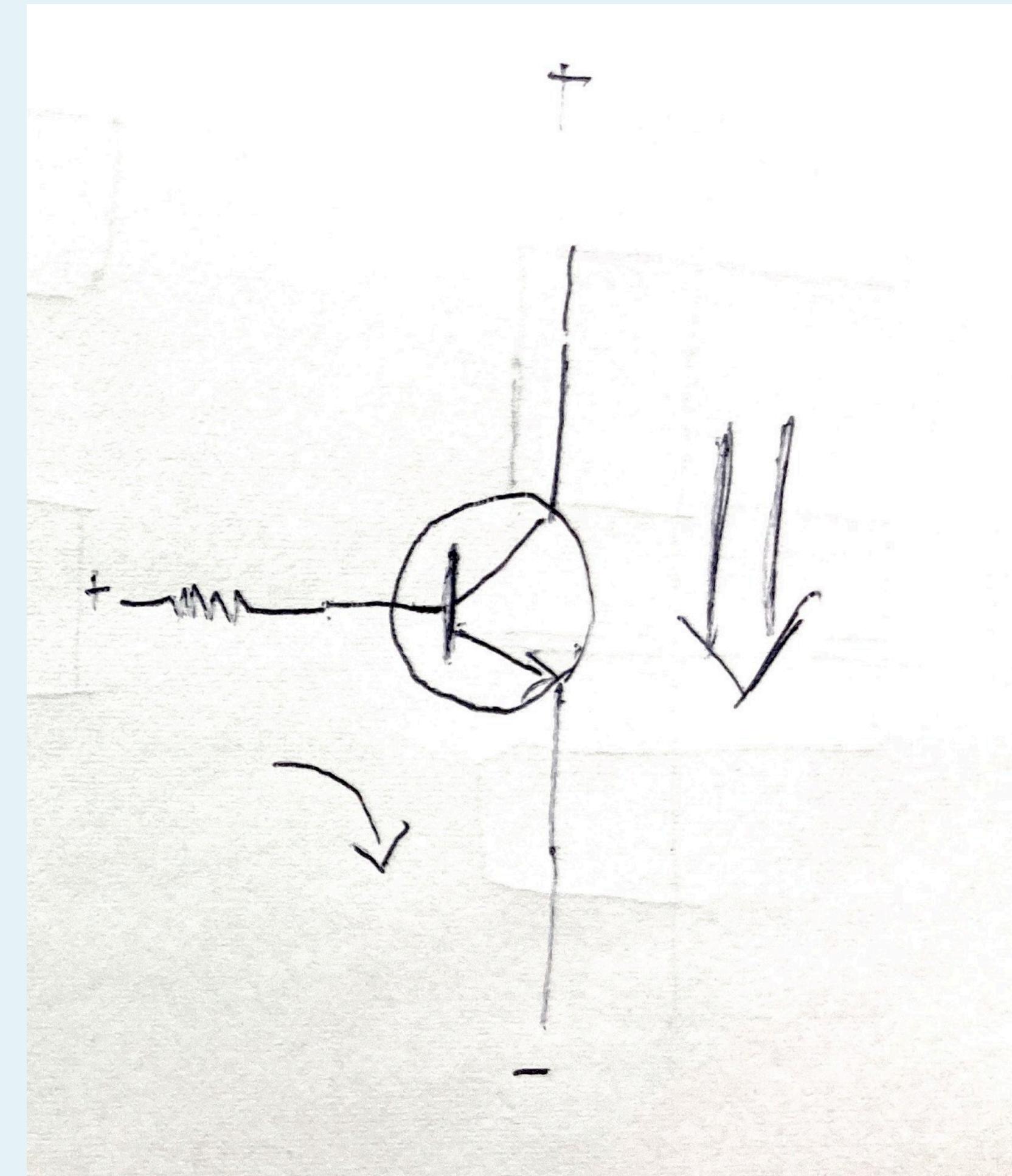
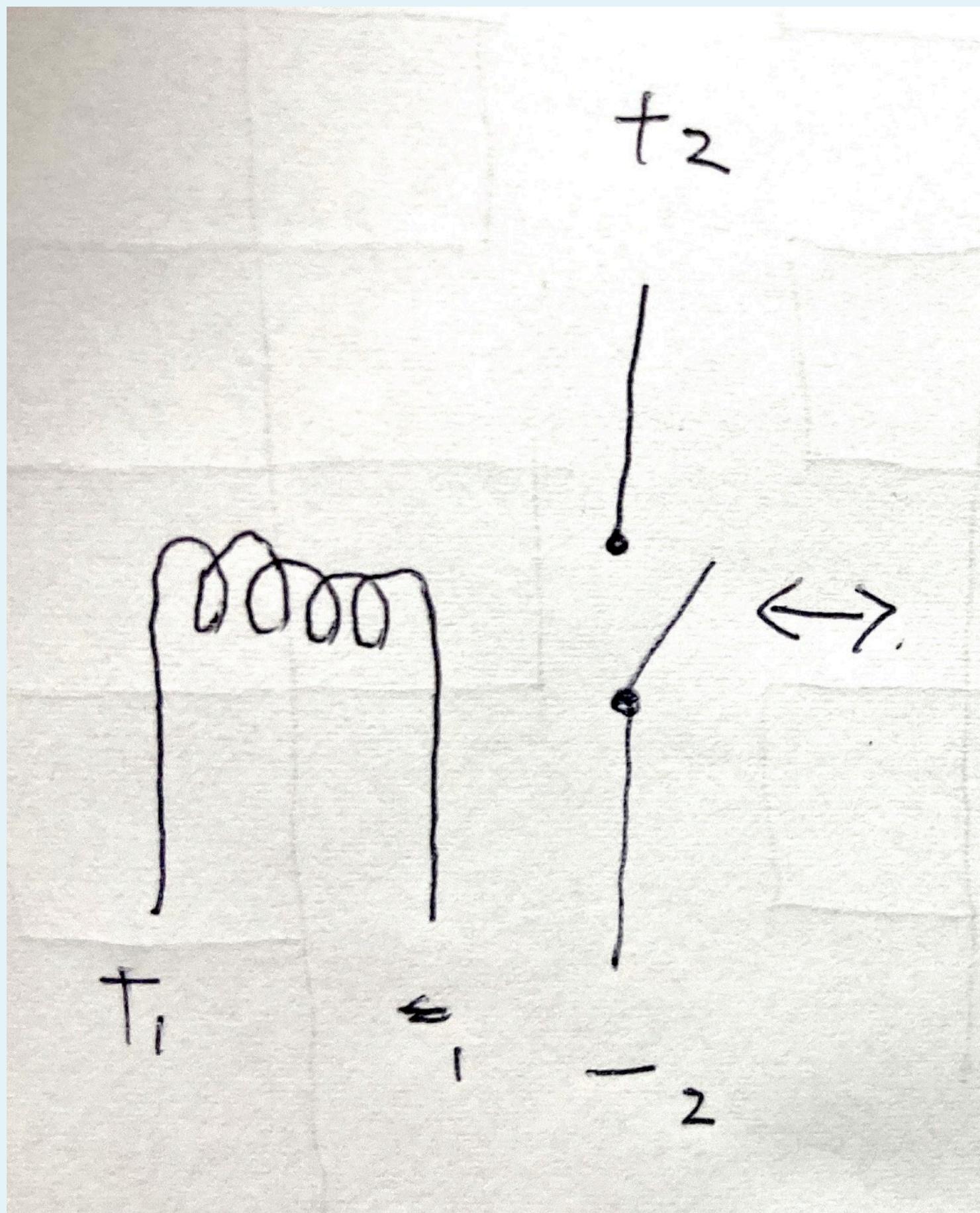
<https://hackaday.com/2012/06/05/homemade-silicon-carbide-led/>

トランジスタ

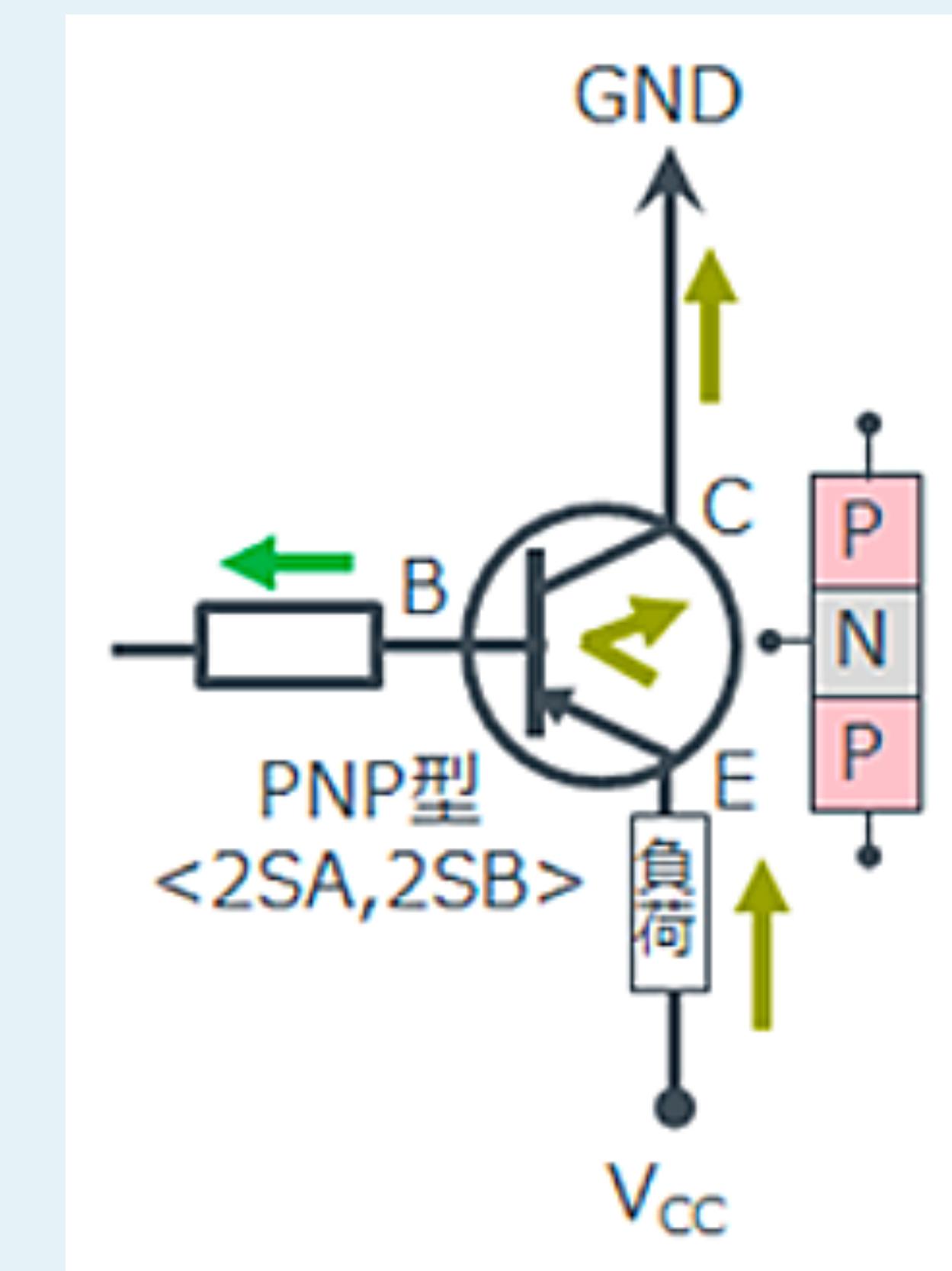
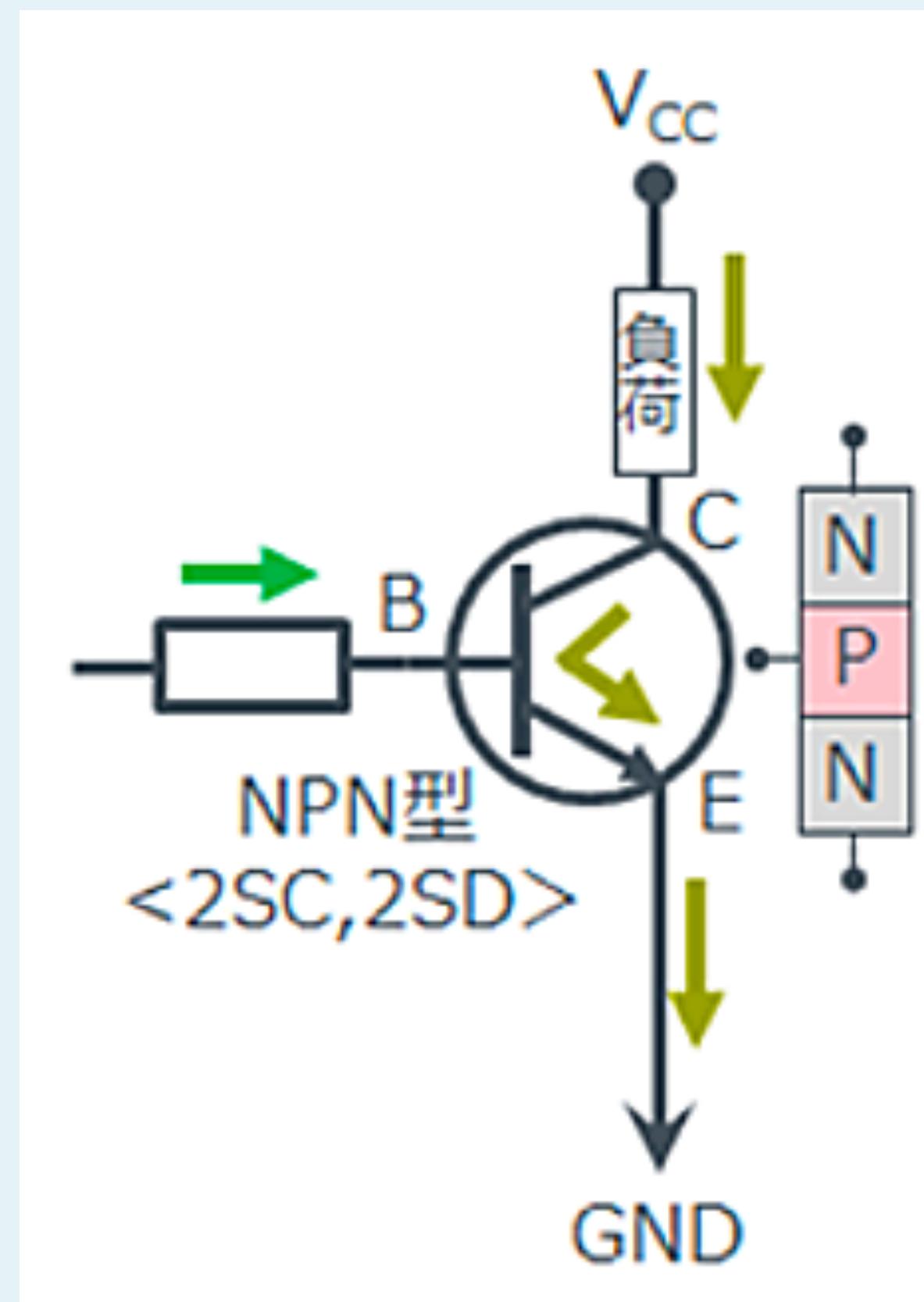
トランジスタ



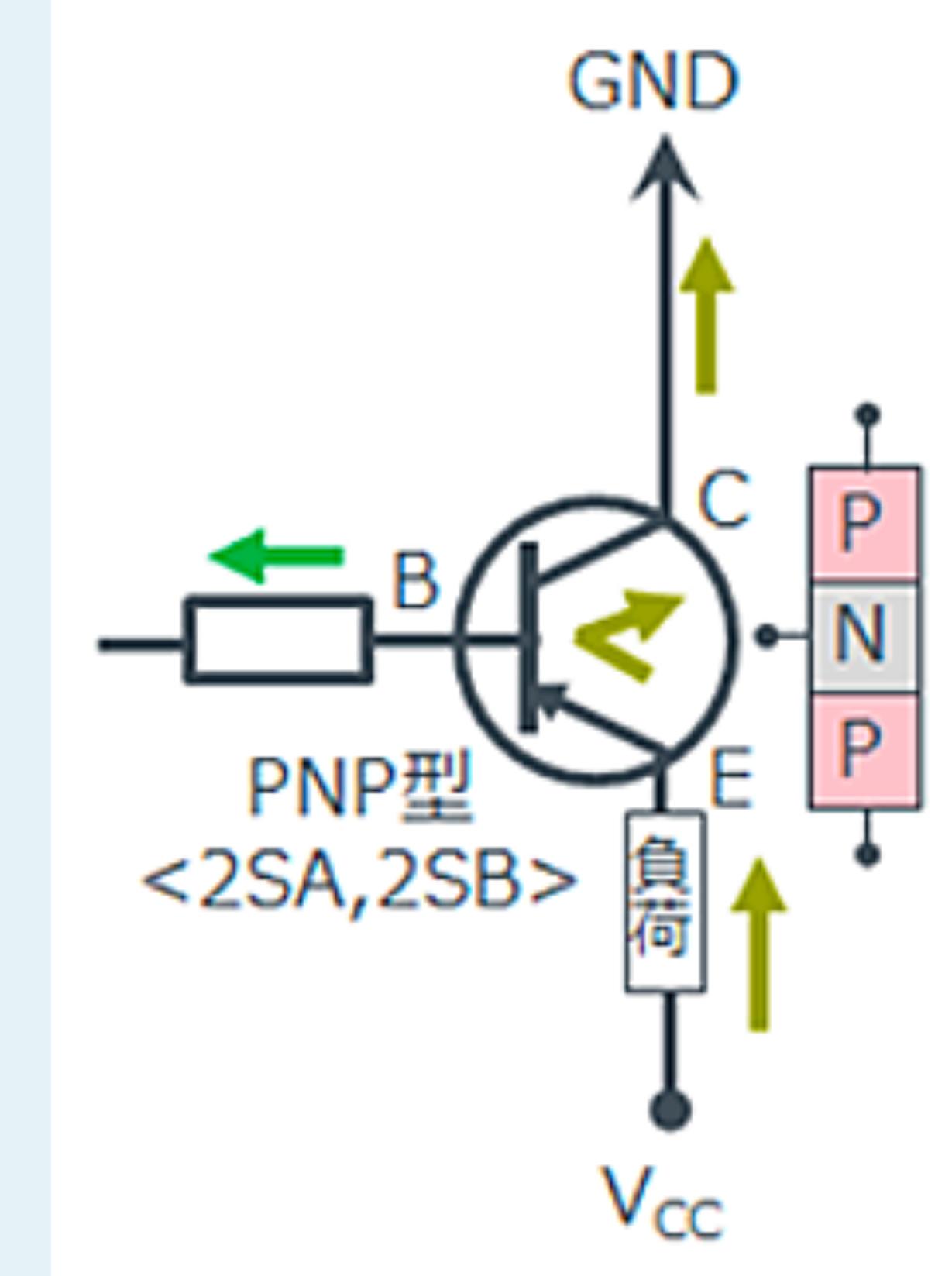
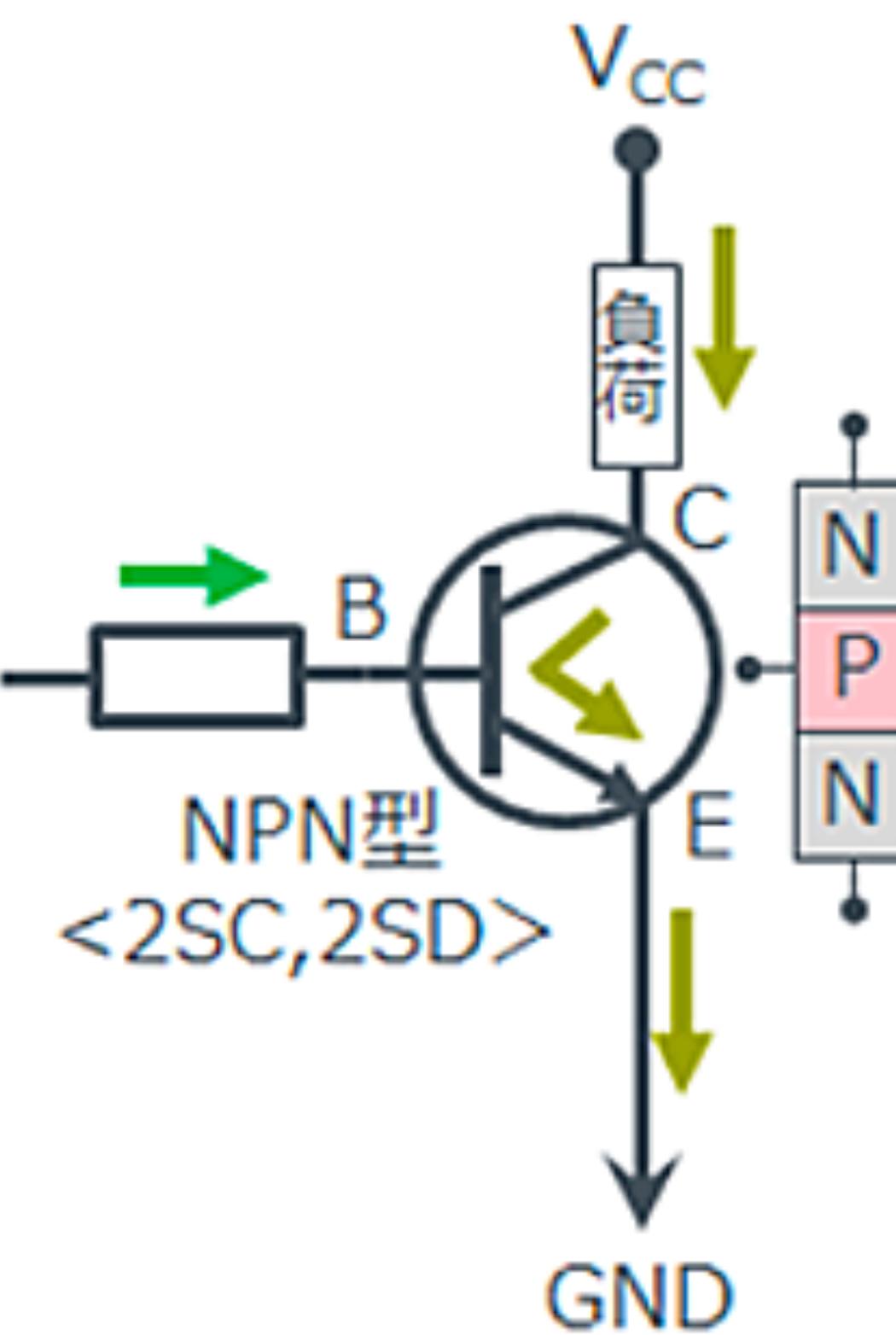
The first transistor ever made, built by John Bardeen, William Shockley and Walter H. Brattain of Bell Labs in 1947.
Original exhibited in Bell Laboratories, Photo by unitronic, licensed under cc 3.0 by-sa



NPN型とPNP型

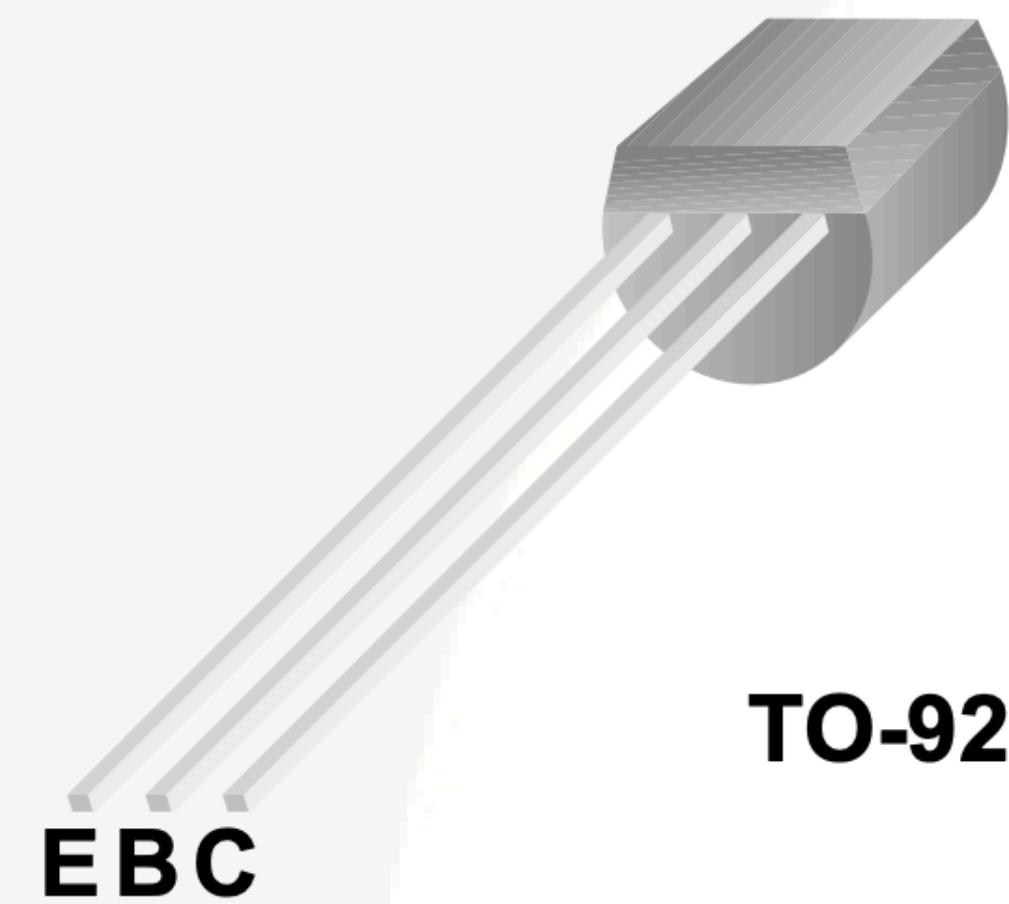


NPN型とPNP型



今日使うのはこっち

2N3904



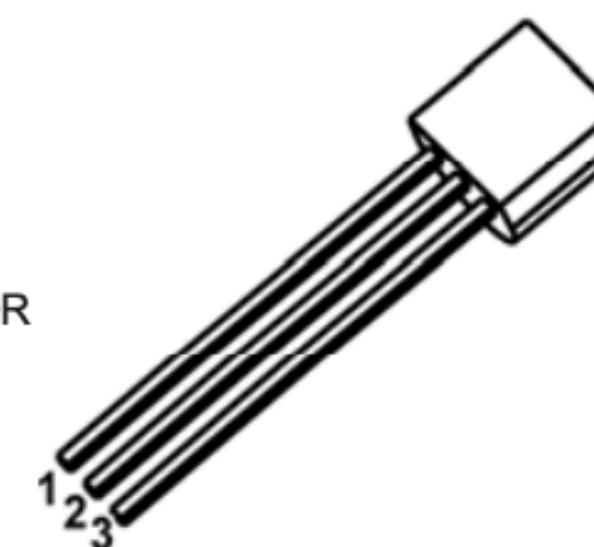
2N3904

TO-92

1.EMITTER

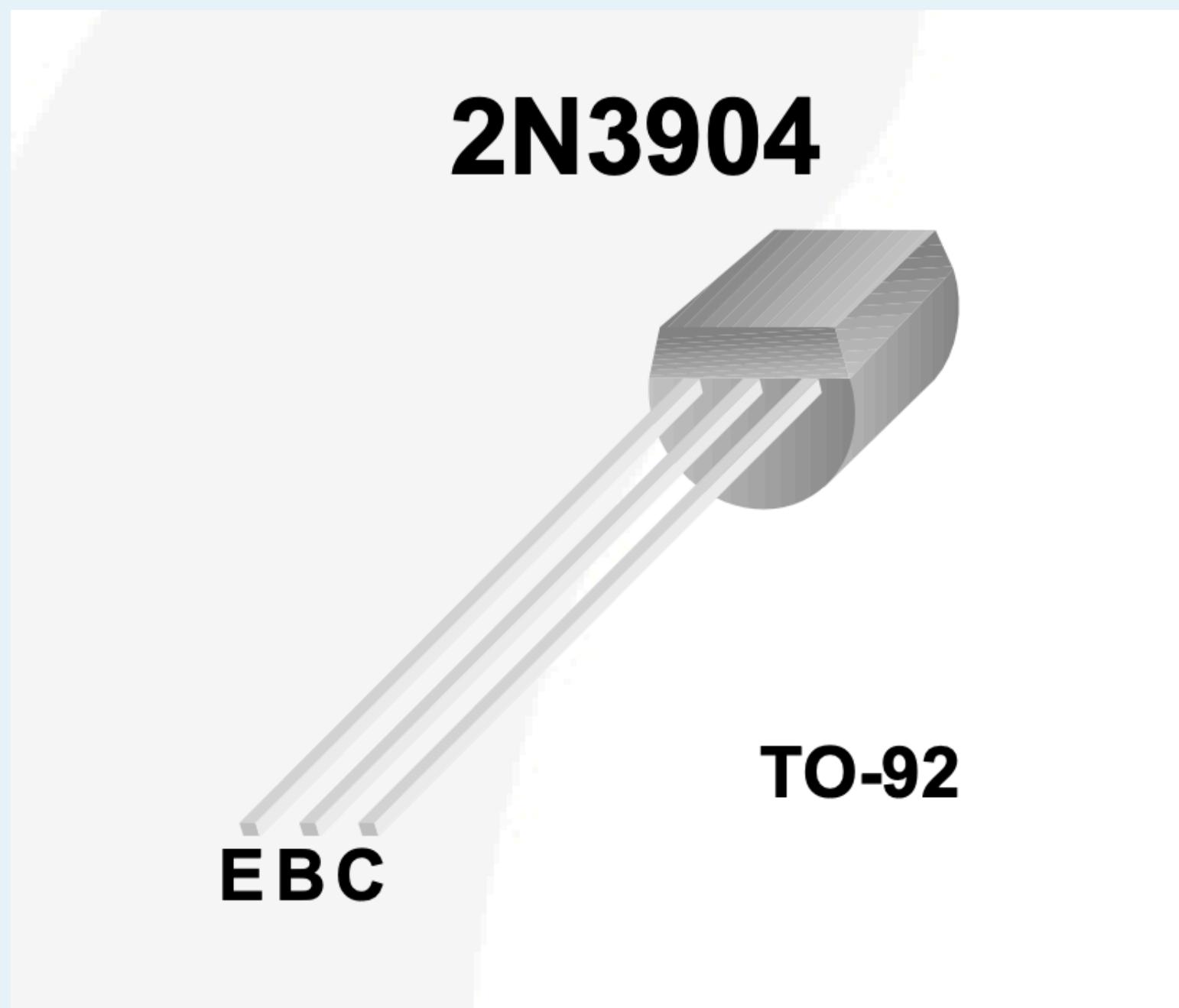
2.COLLECTOR

3.BASE

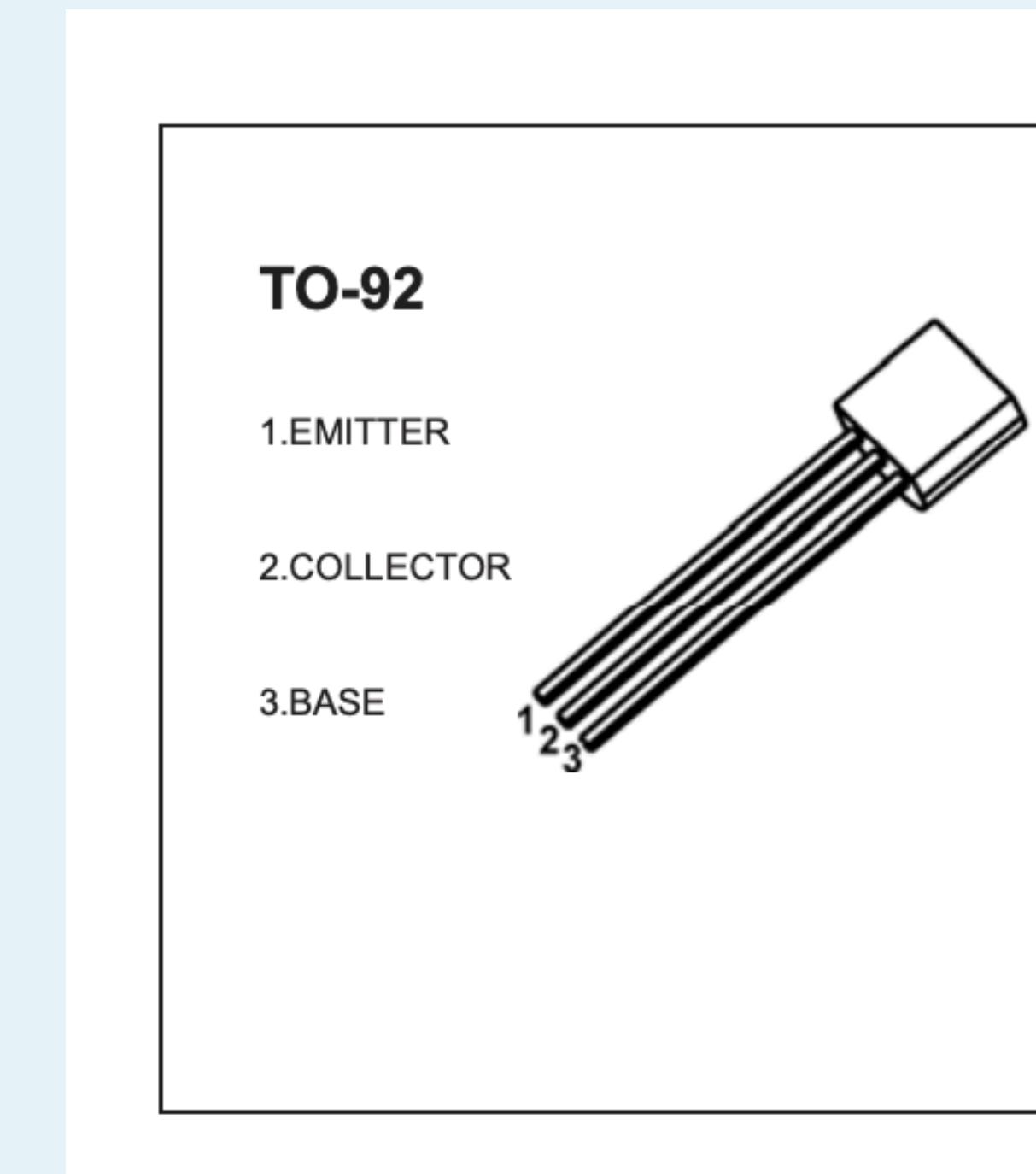


2SC1815

E-B-Cのものと、E-C-Bのものとがあるので気をつけましょう



2N3904



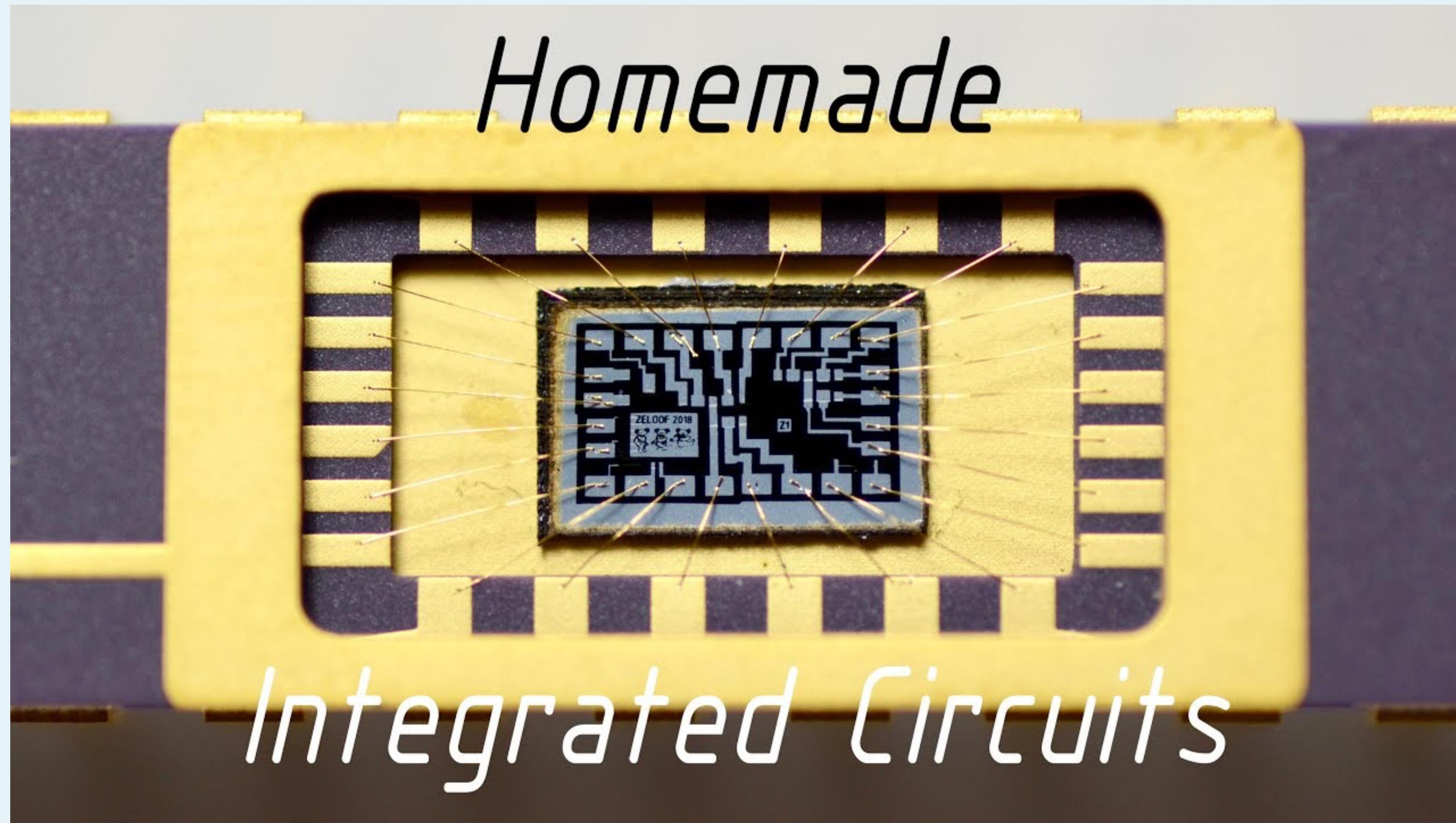
2SC1815

今日使うのはこっち

E-B-Cのものと、E-C-Bのものとがあるので気をつけましょう

電子基板（PCB）、IC

- PCB : Printed Circuit Board IC : Integrated Circuit
- どちらも、産業での製造方法的にはフォトリソグラフィ：版画の延長
- 金属や半導体を平面上にうまく形成したり削り取ったりして、重ねていく



<https://www.youtube.com/watch?v=XrEC2LGGXn0>

藝大生のための 電子基板制作

2022.07.26

東京藝術大学 芸術情報センター

特任助教 松浦知也 me@matsuuratomoaya.com



A Kit-of-No-Parts

Recipes for Materially Diverse, Functionally Transparent and Expressive Electronics

Workshops

Ingredients

Recipes

PARTS

Traces and Connections
Sensors
Actuators
Resistors
Capacitors
Transistors
Power

CRAFTS

Drawing and Painting
Electroplating
Gilding
Printing
Carving
Cutting and Engraving
Etching
Molding and Casting
Sculpting
Assemblage

A Kit-of-No-Parts: Recipes for materially diverse, functionally transparent and expressive electronics

Conventionally electronics that are built from a kit-of-parts have been optimized for speed, efficiency and repeatability of assembly. While this approach demonstrates the power of modular systems that have made many of the technologies we rely on possible, it also constrains us to particular styles of building, influencing what we build as well as impacting how we come to think about electronics.

A Kit-of-No-Parts demonstrates a new approach to building electronics that emphasizes the expressive qualities of diverse materials as well as the skill and creativity of the builder. I believe that a more insightful and skilled process is also capable of producing more intelligible and personal results.

In order to promote a different approach I have developed a series of techniques that allow us to build electronics using a variety of craft materials and tools. This website documents these techniques in the form of "recipes". Besides containing instructions on how to build electronics these recipes are also detailed accounts of my development process that aim to promote further exploration and material investigation, instead of straightforward replication.

This website is both the documentation and result of my thesis work towards a masters degree in the High-Low Tech research group at the MIT Media Lab. My thesis describes A Kit-of-No-Parts as an approach to crafting electronics, rather than designing discrete components. While the thesis has been written and handed in, this website remains a work in progress. I continue to add new information and update the existing. >> [Download Thesis](#)

high-low tech



HOW TO
GET WHAT
YOU WANT

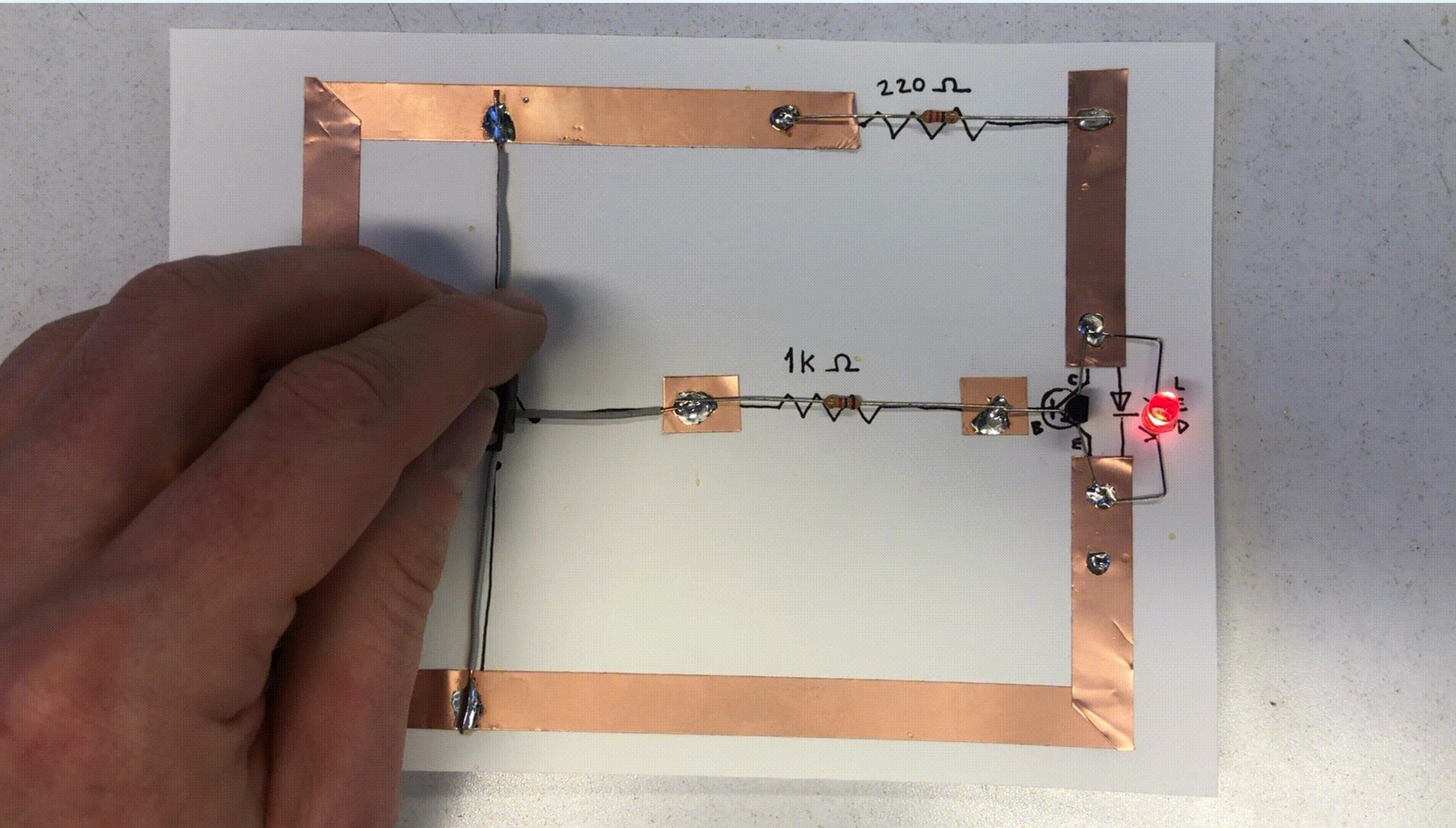
Plusea

<http://konp.plusea.at/>

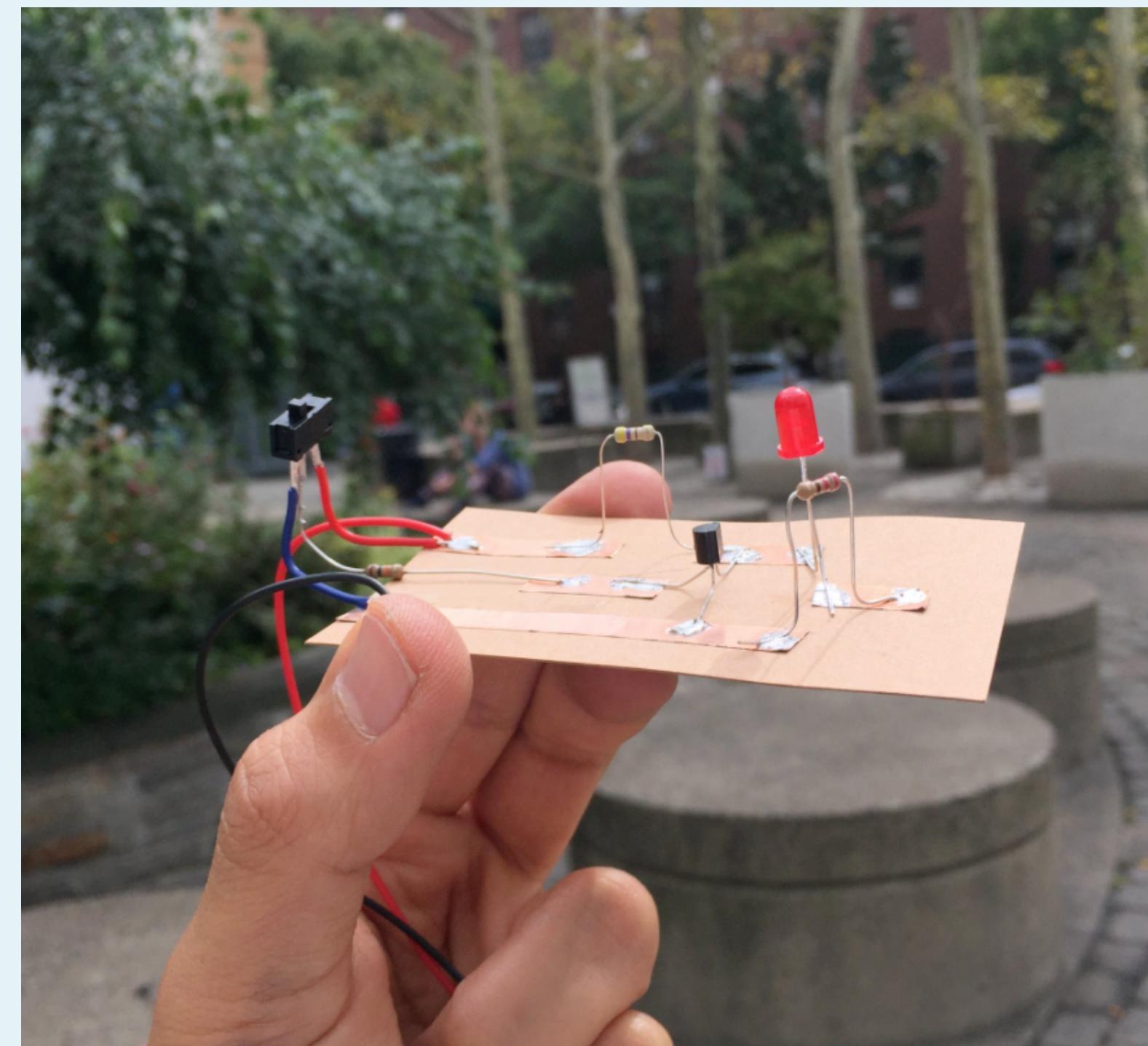
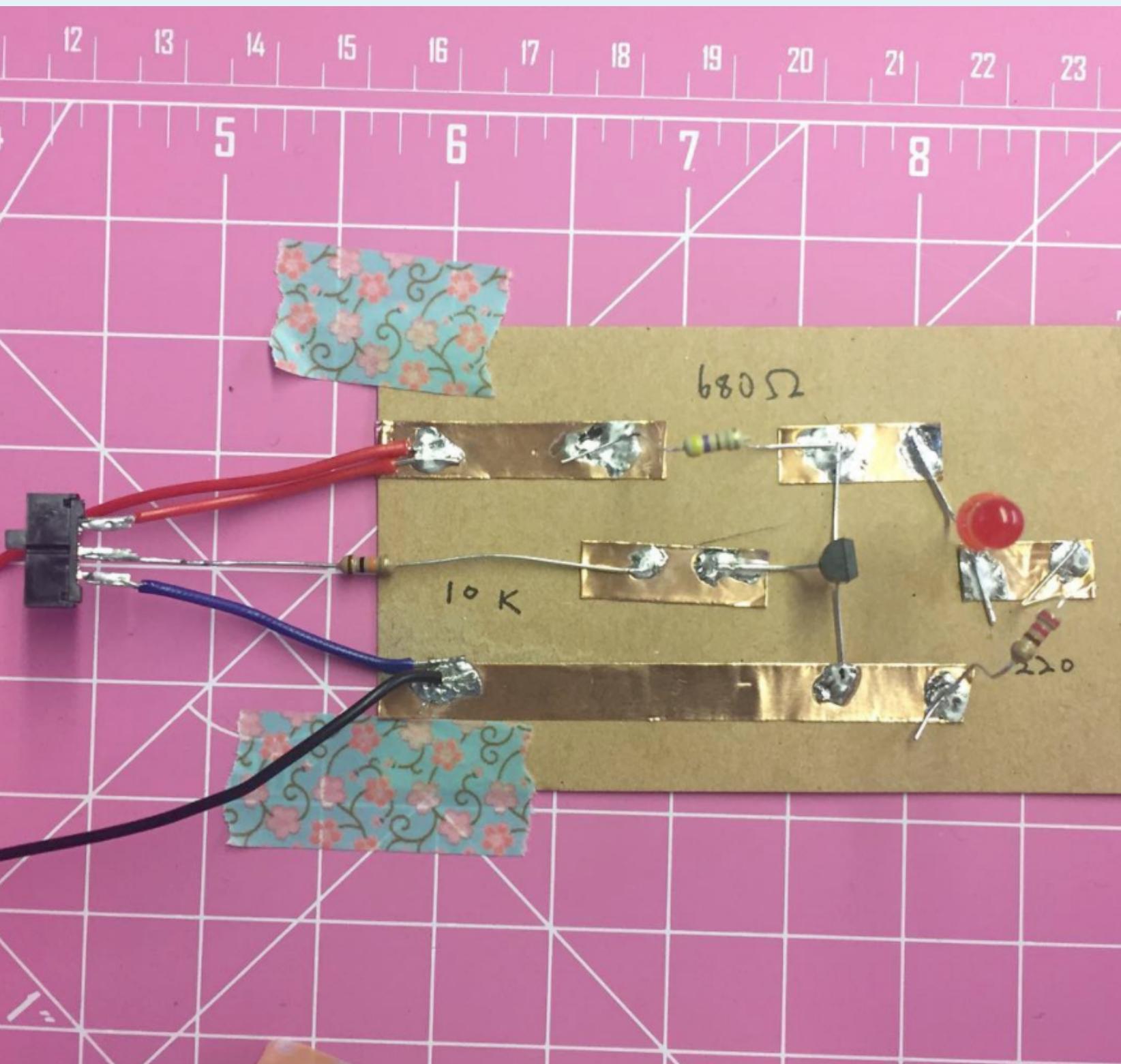


最も単純な論理回路: インバーター

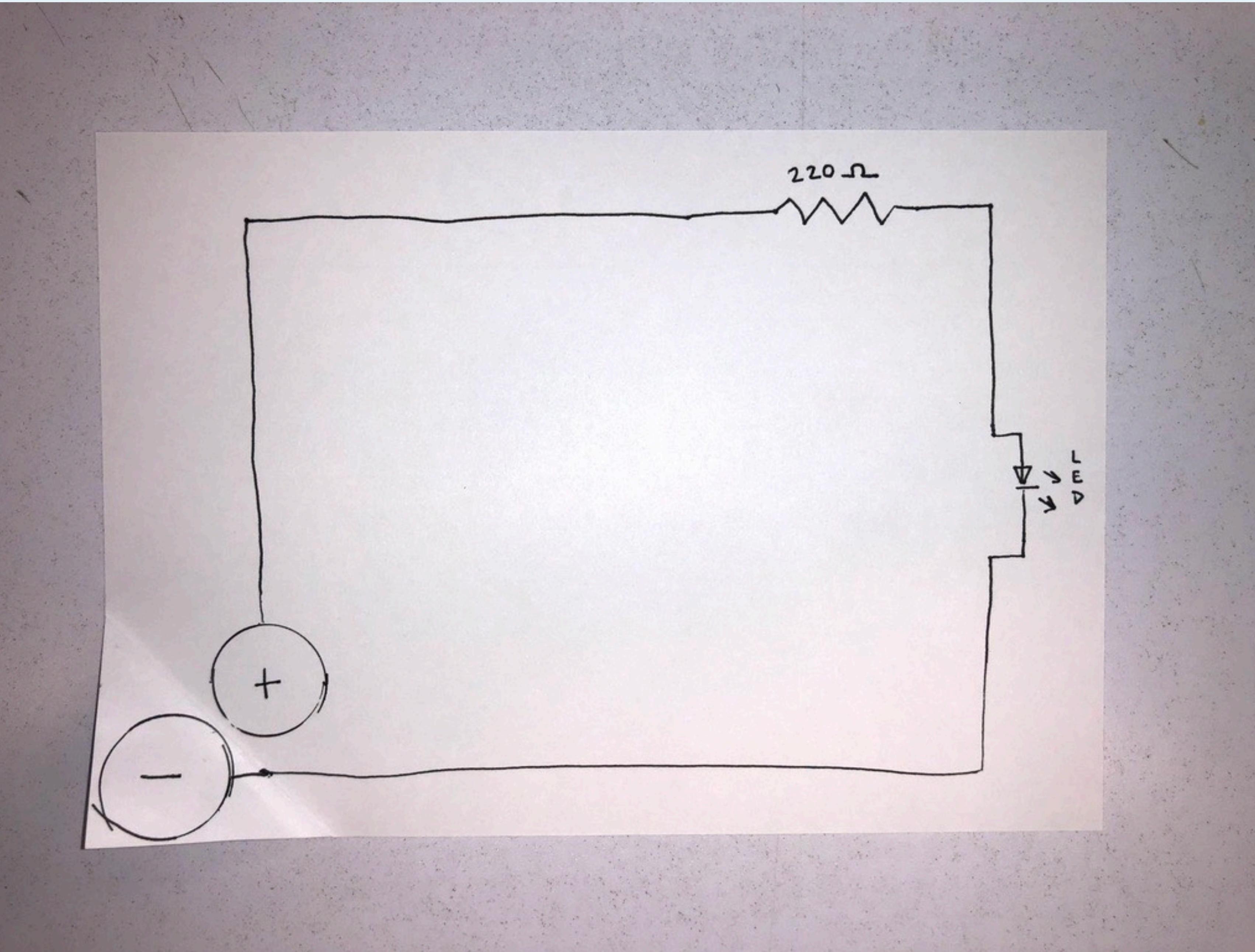
Paper Circuitで作るインバーター

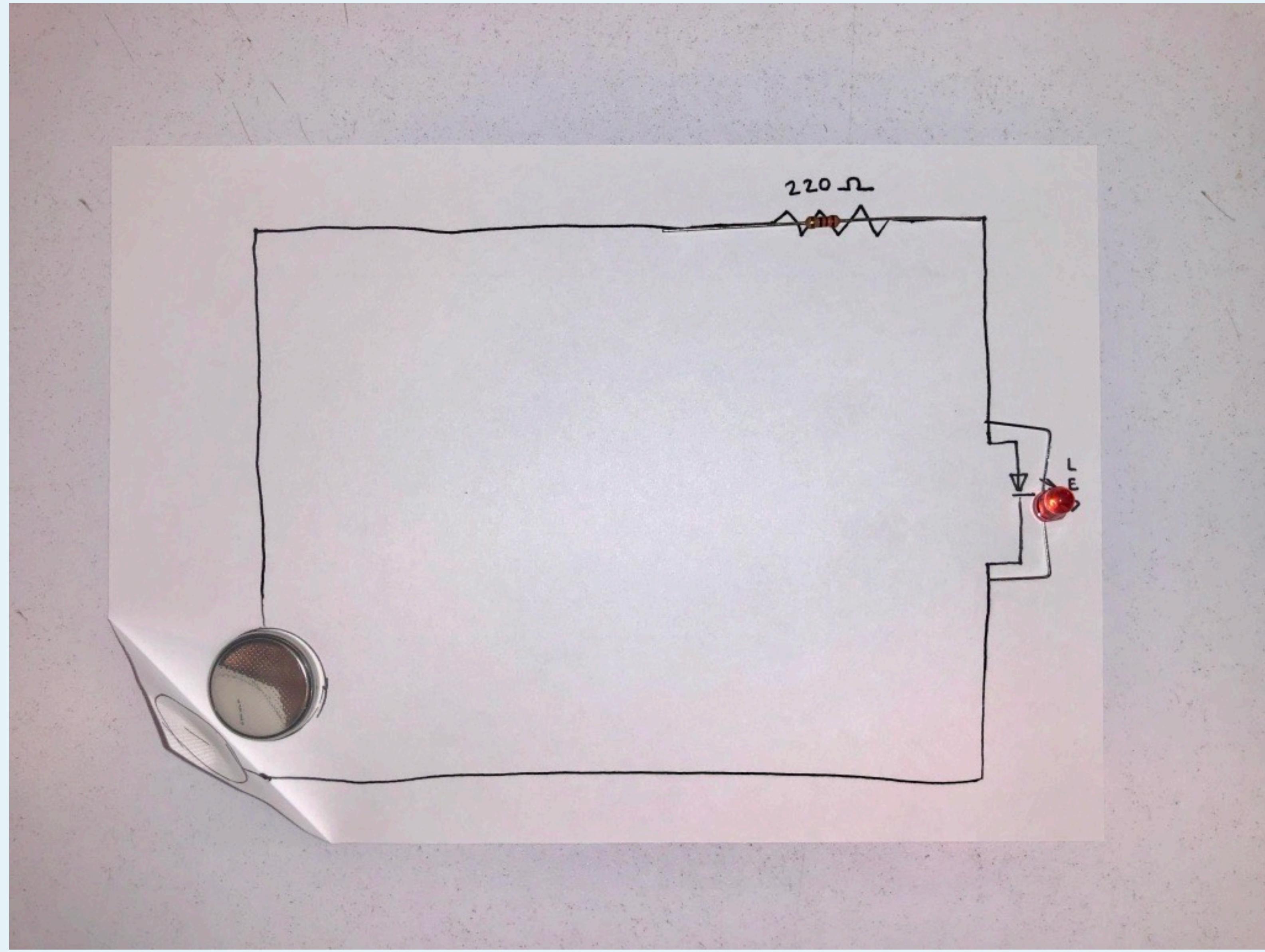


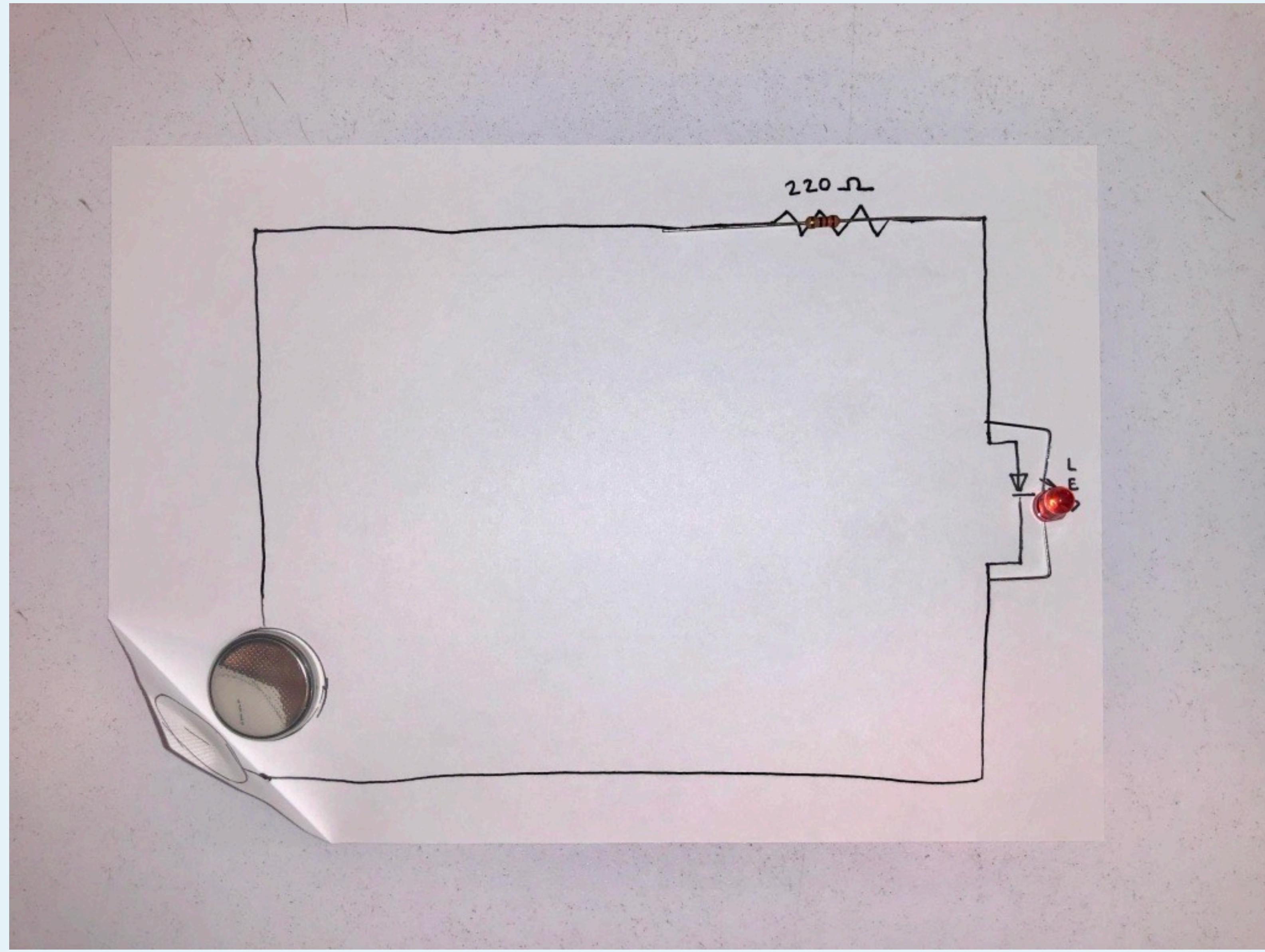
Paper Circuitで作るインバーター

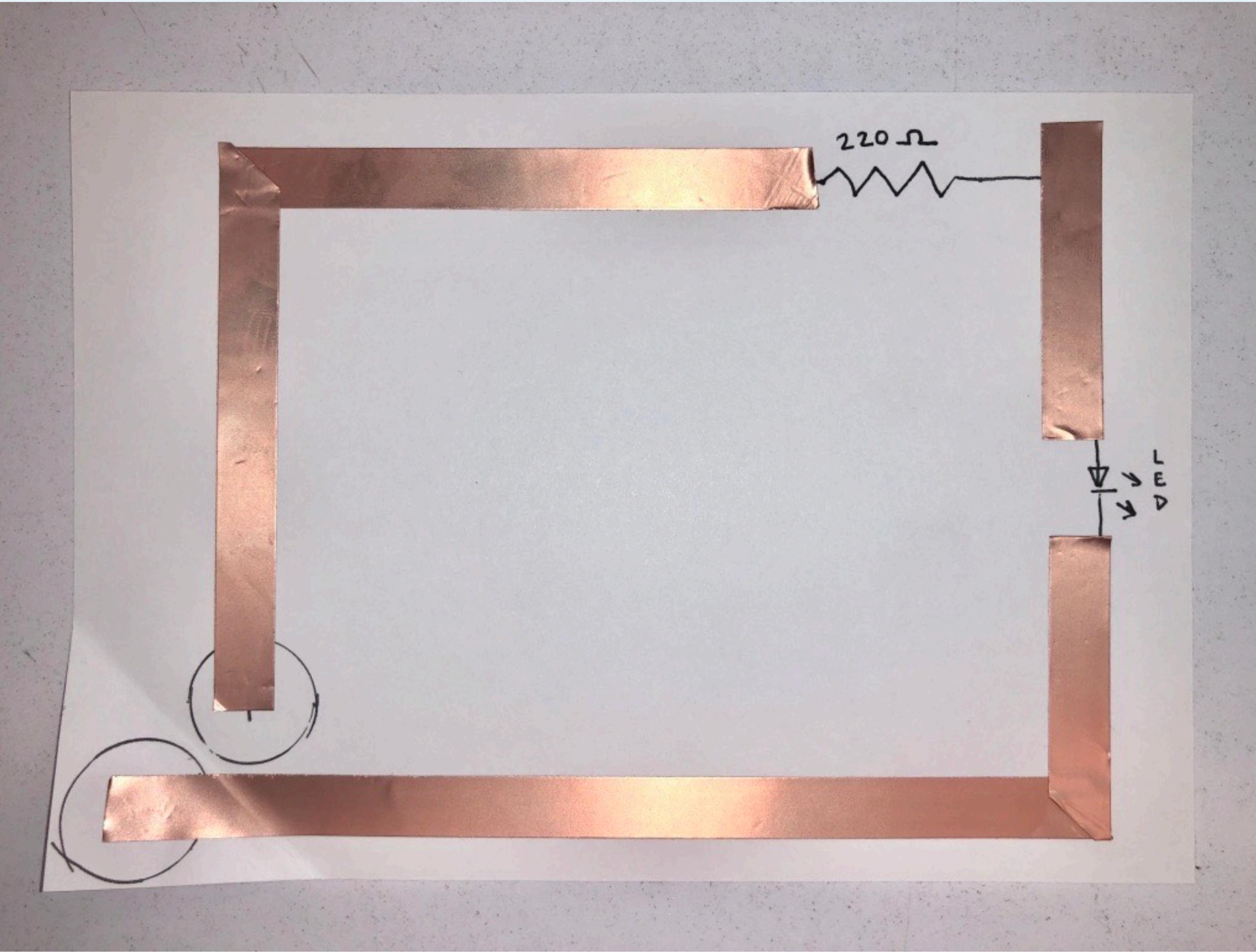


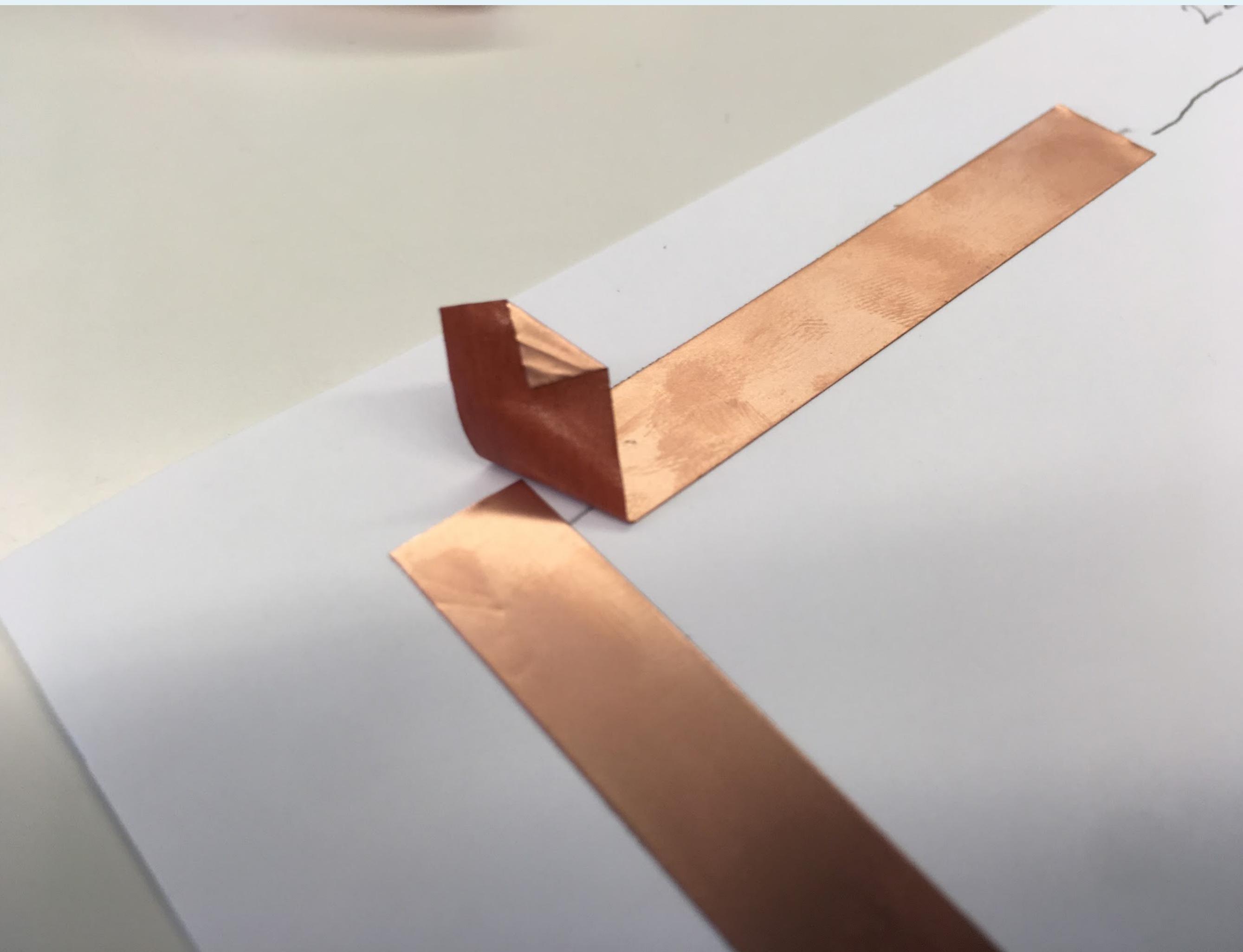


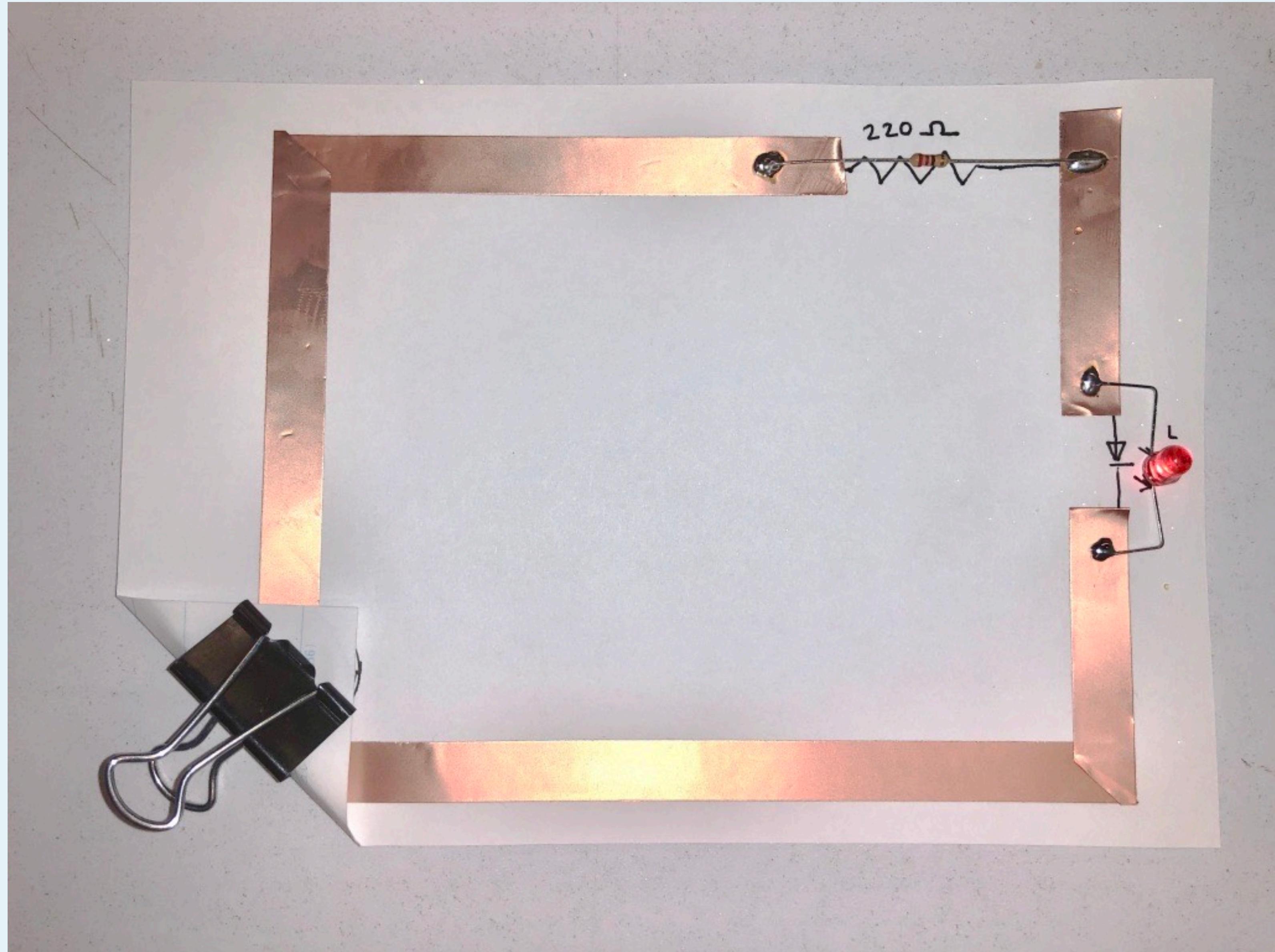


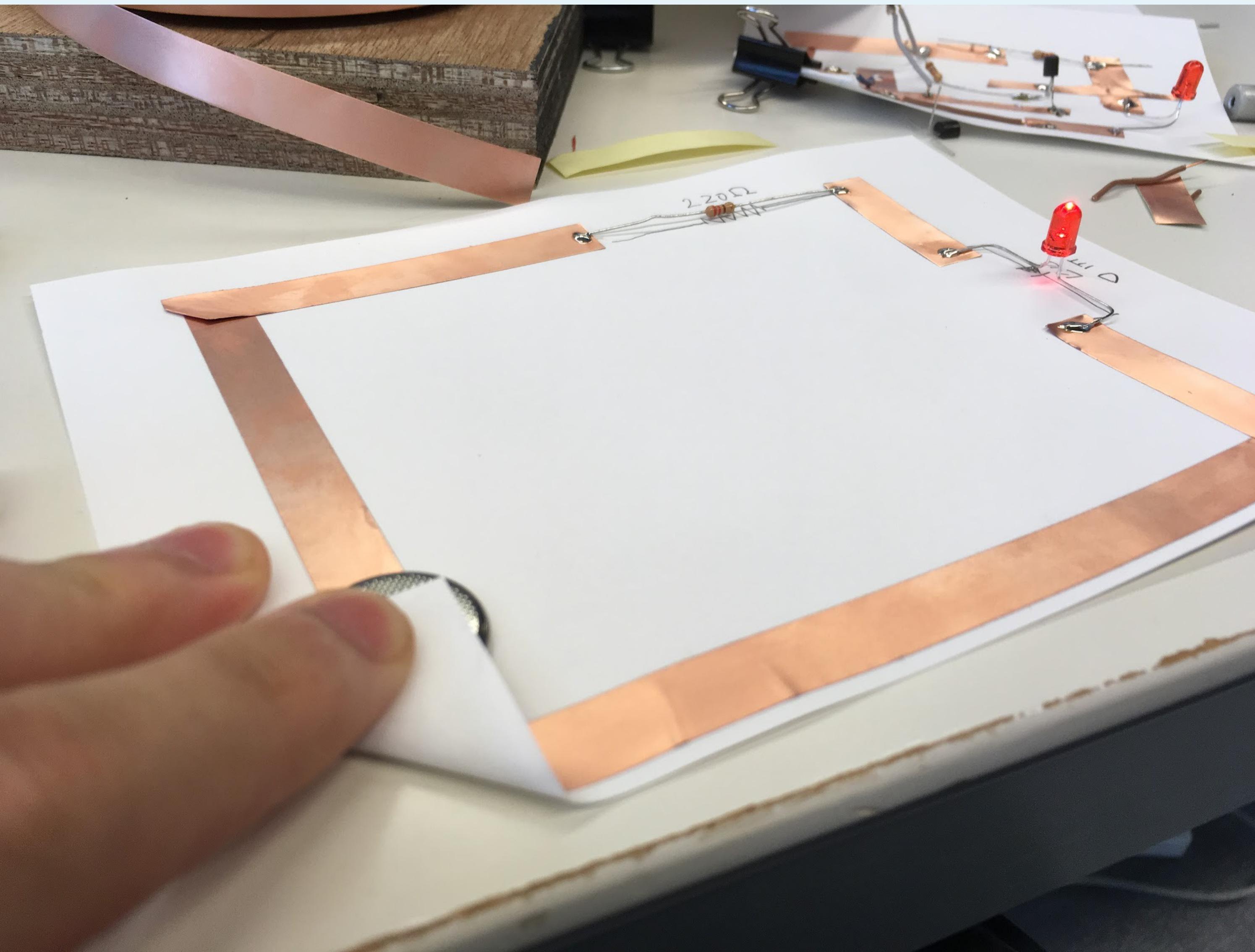


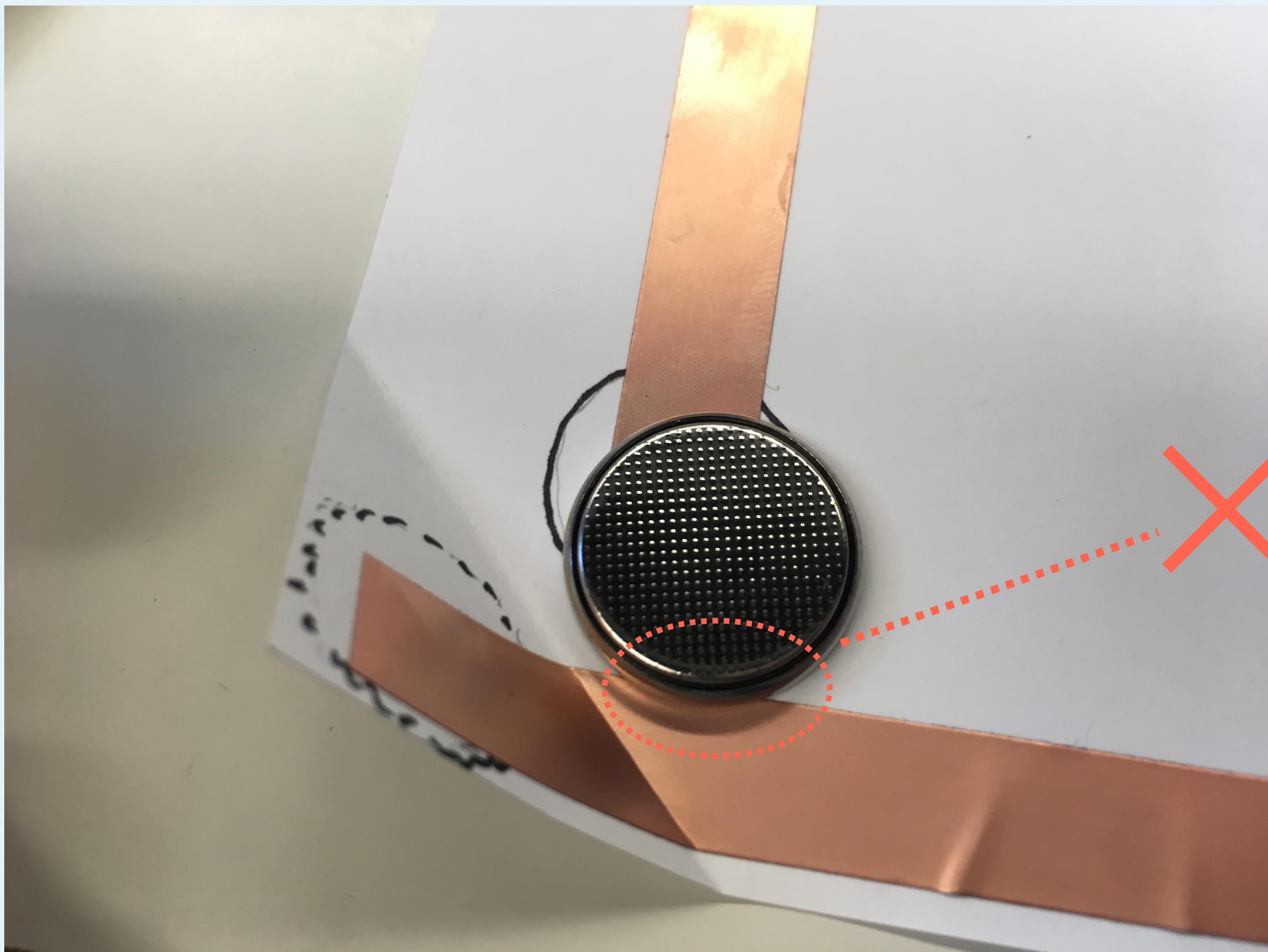


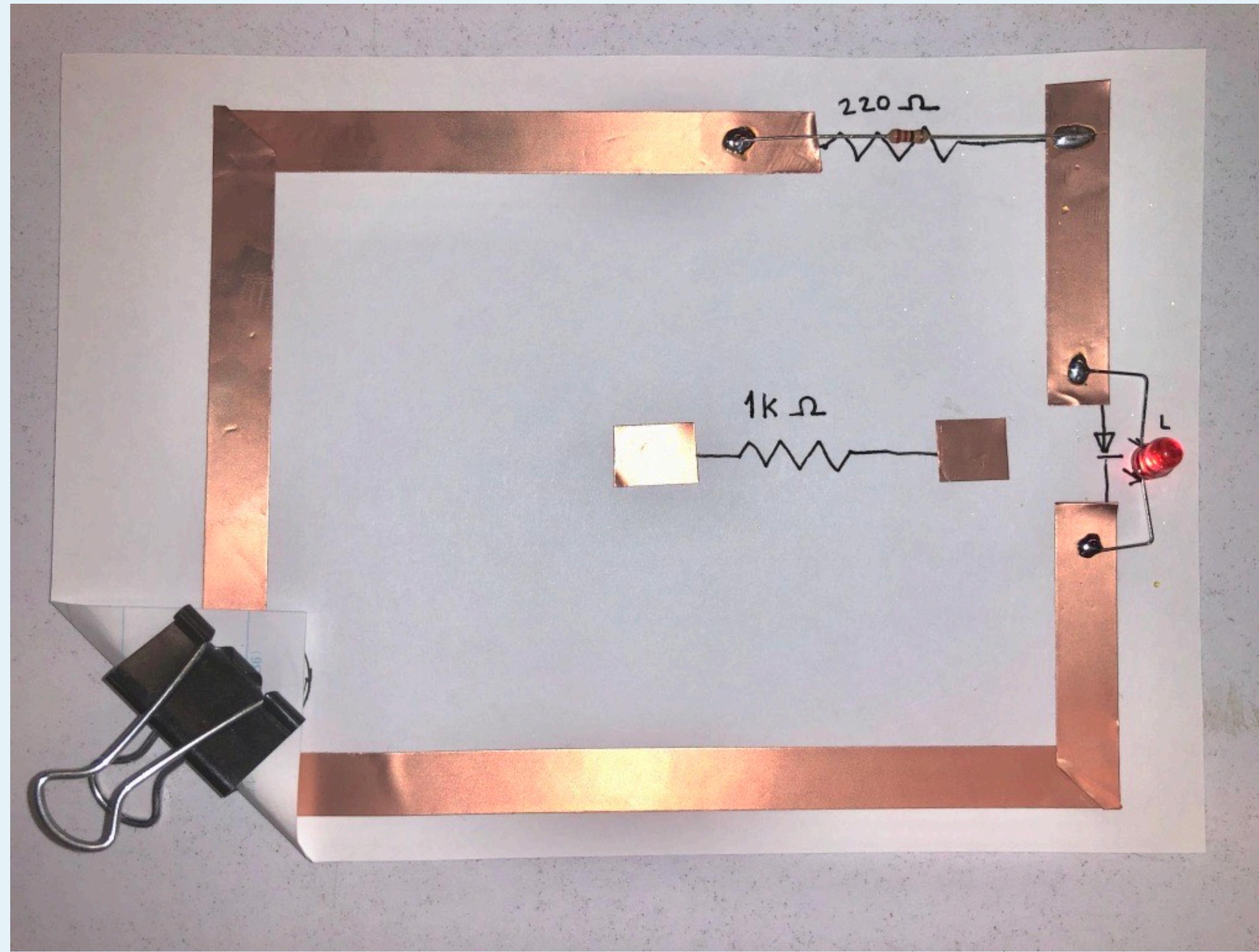


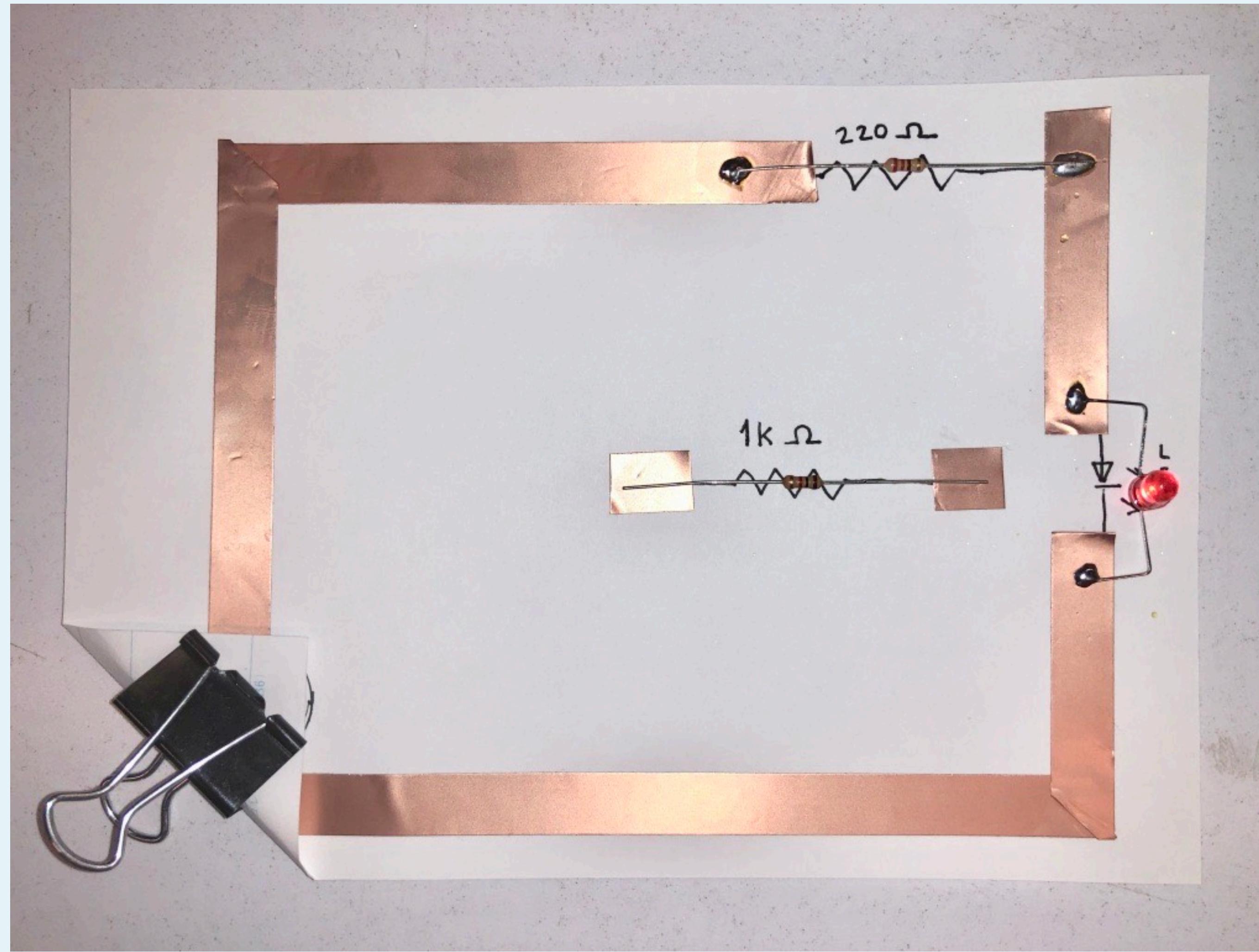




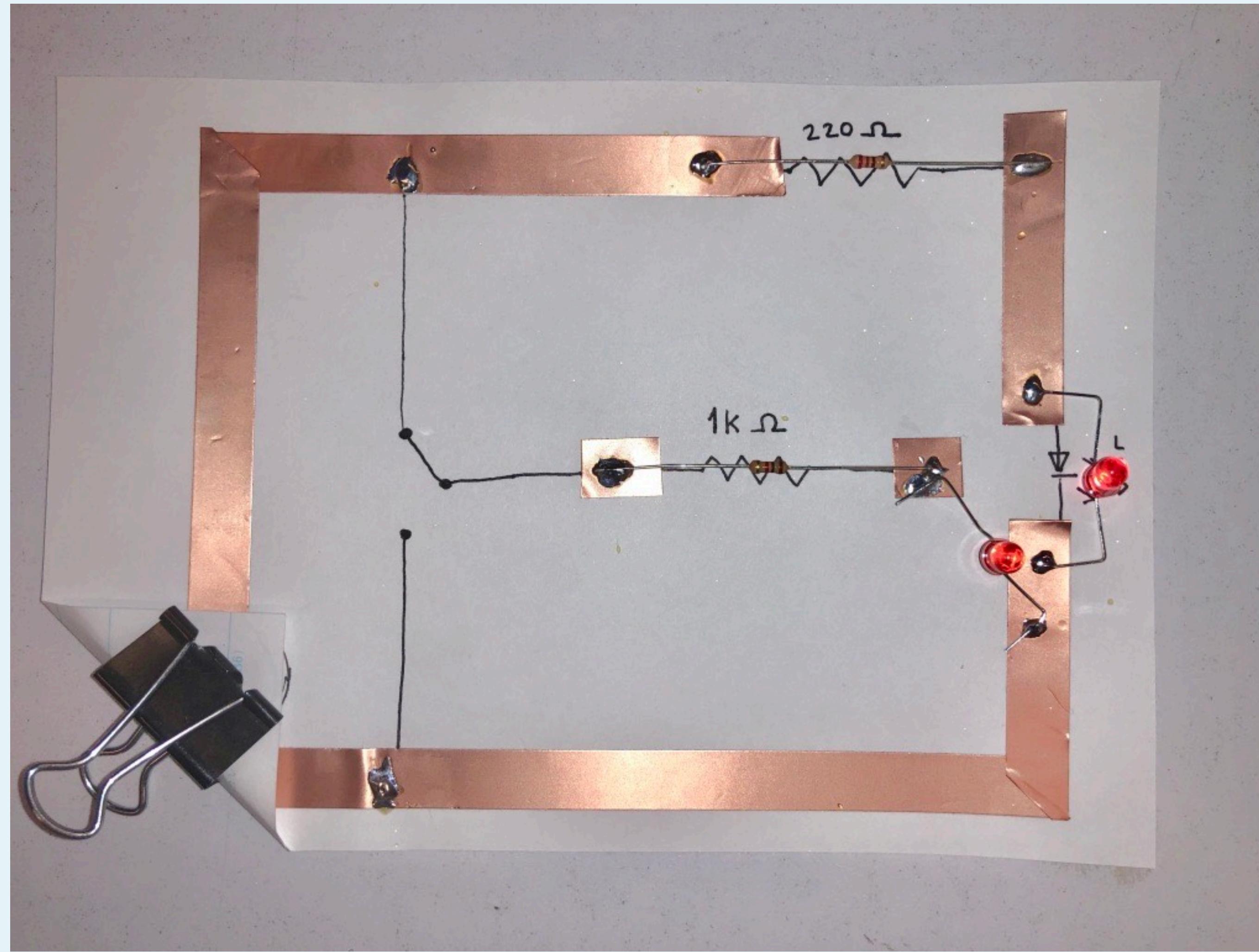


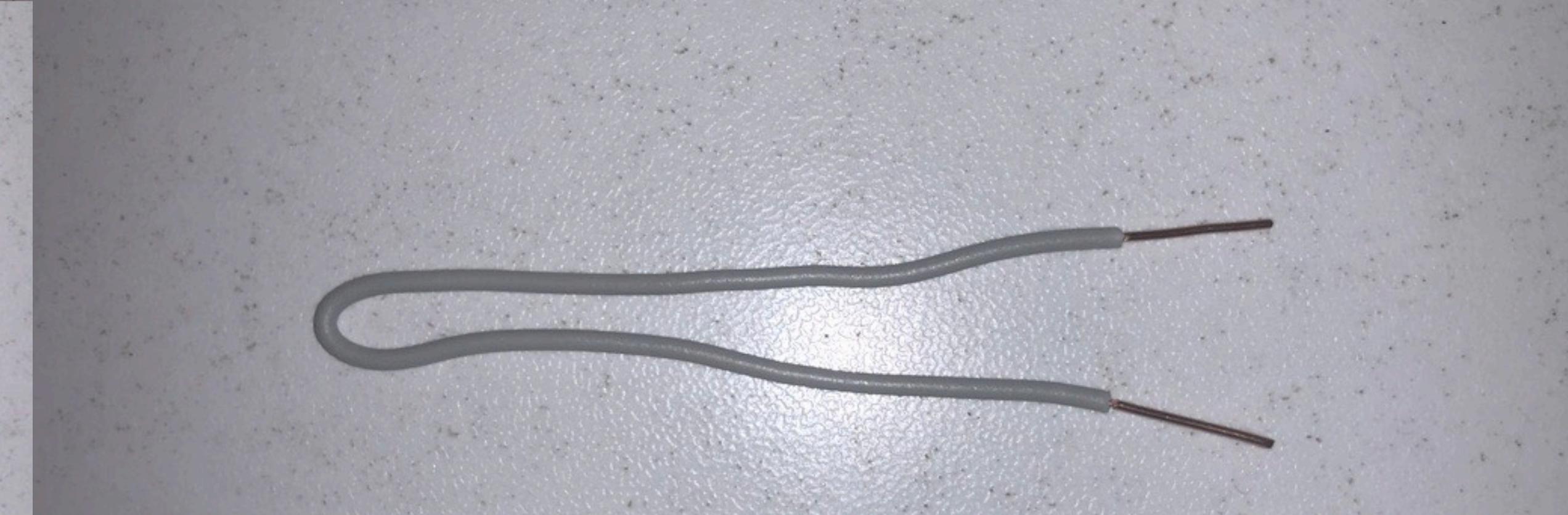
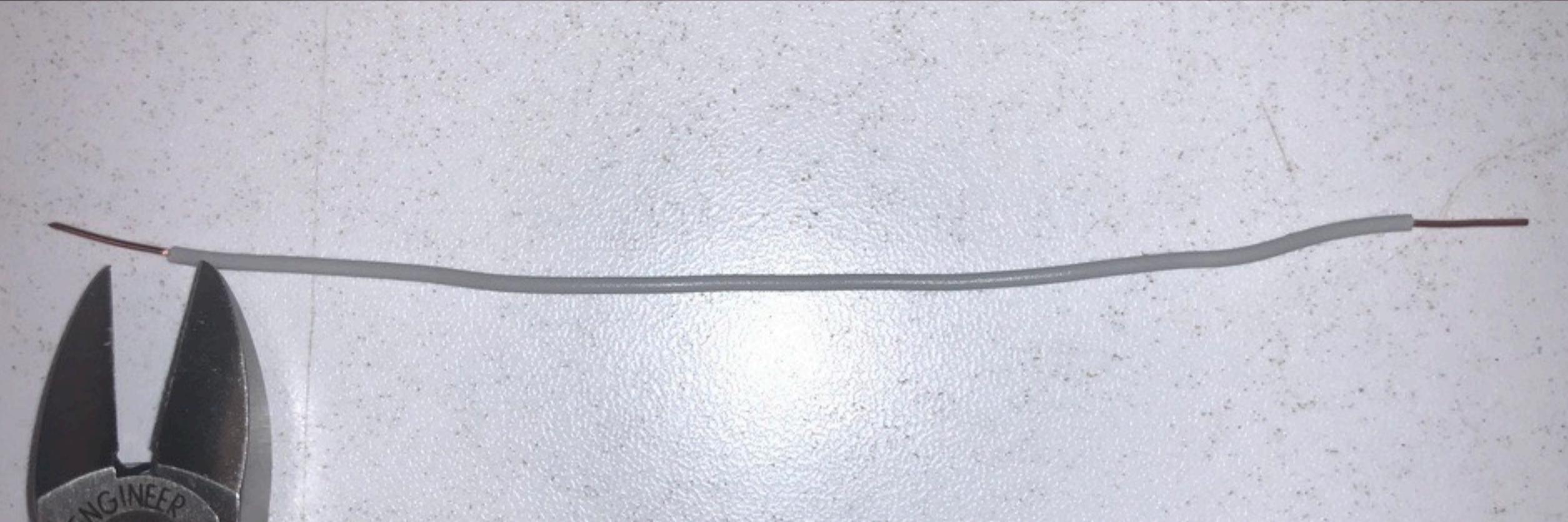
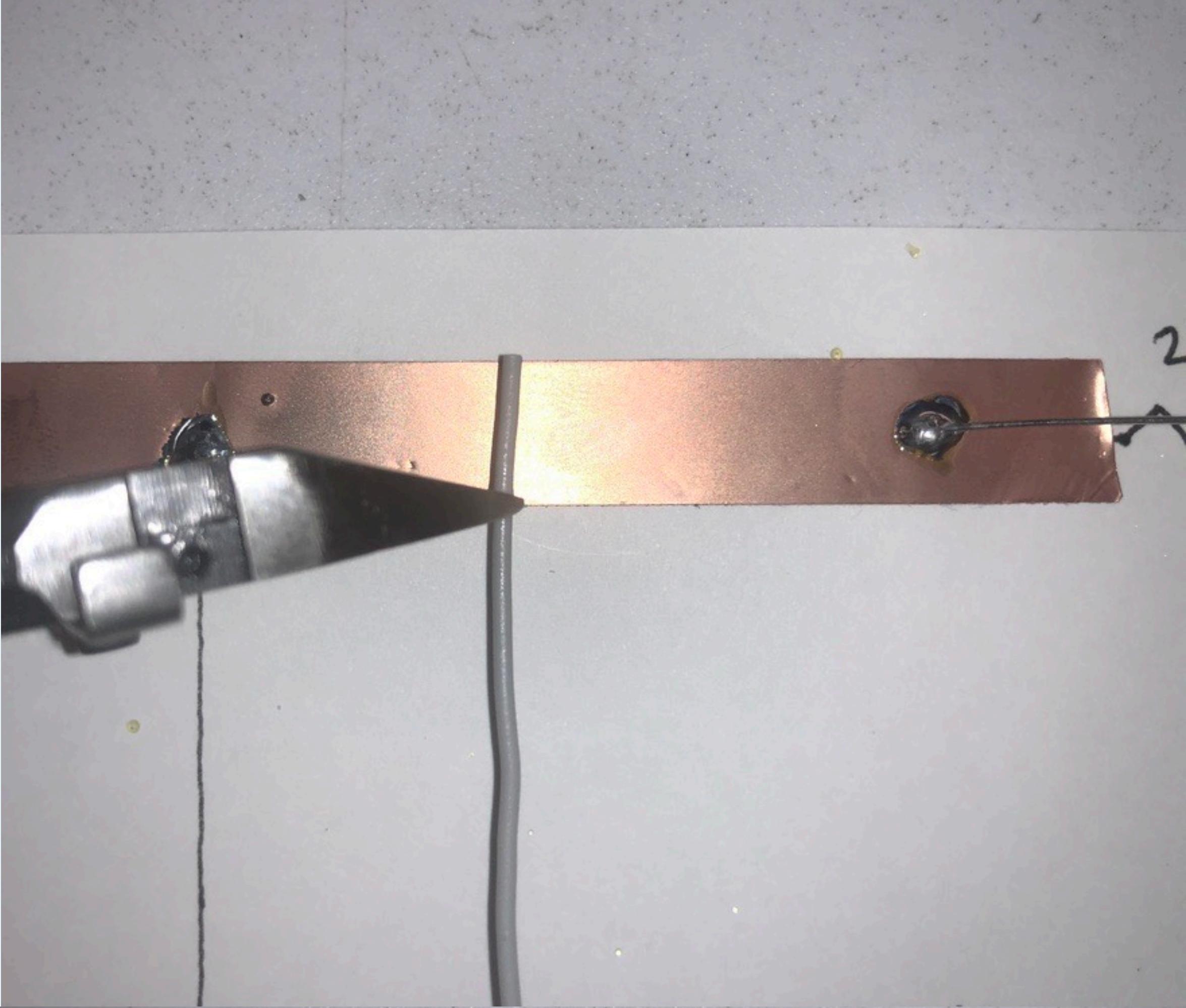
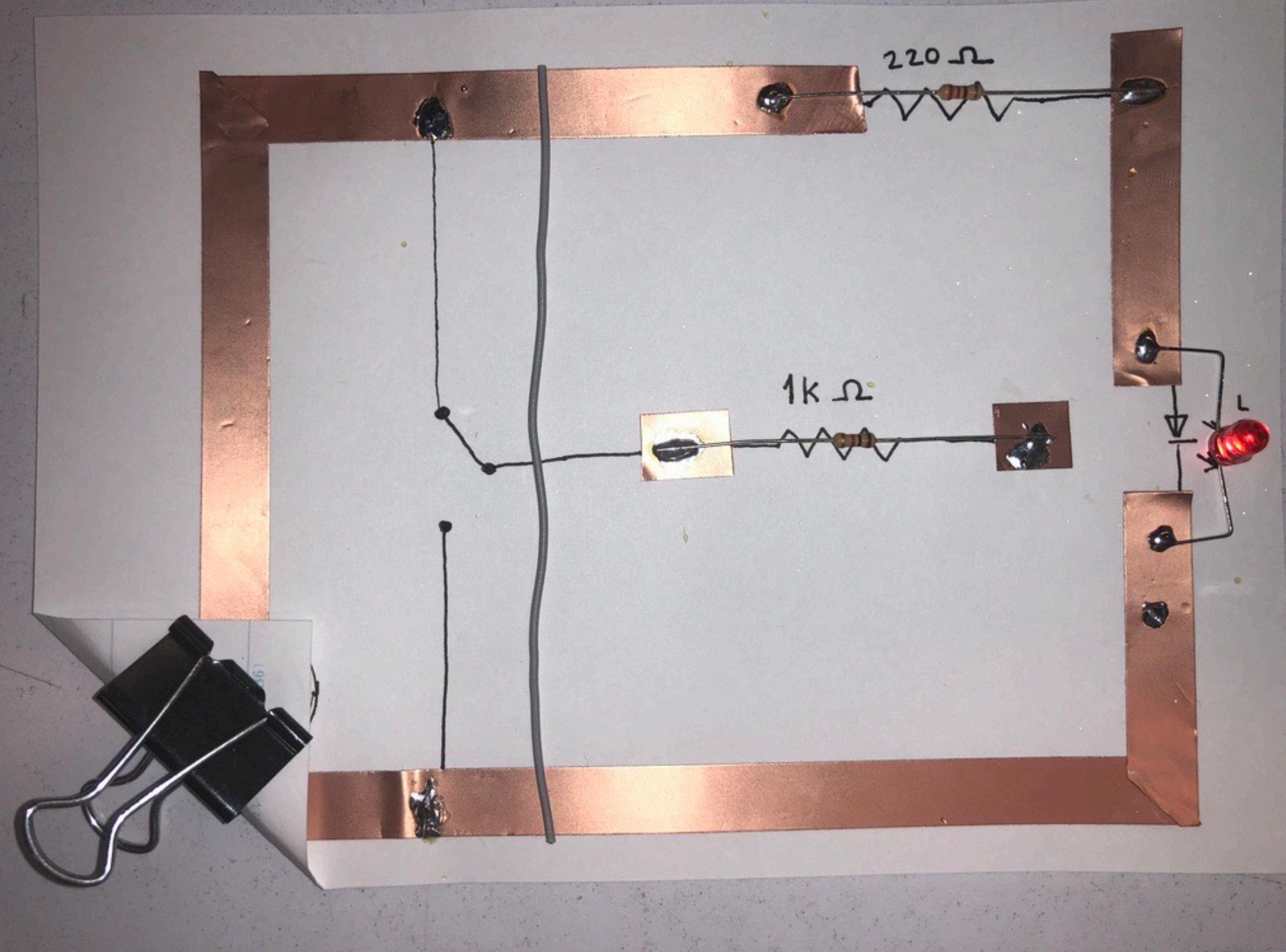


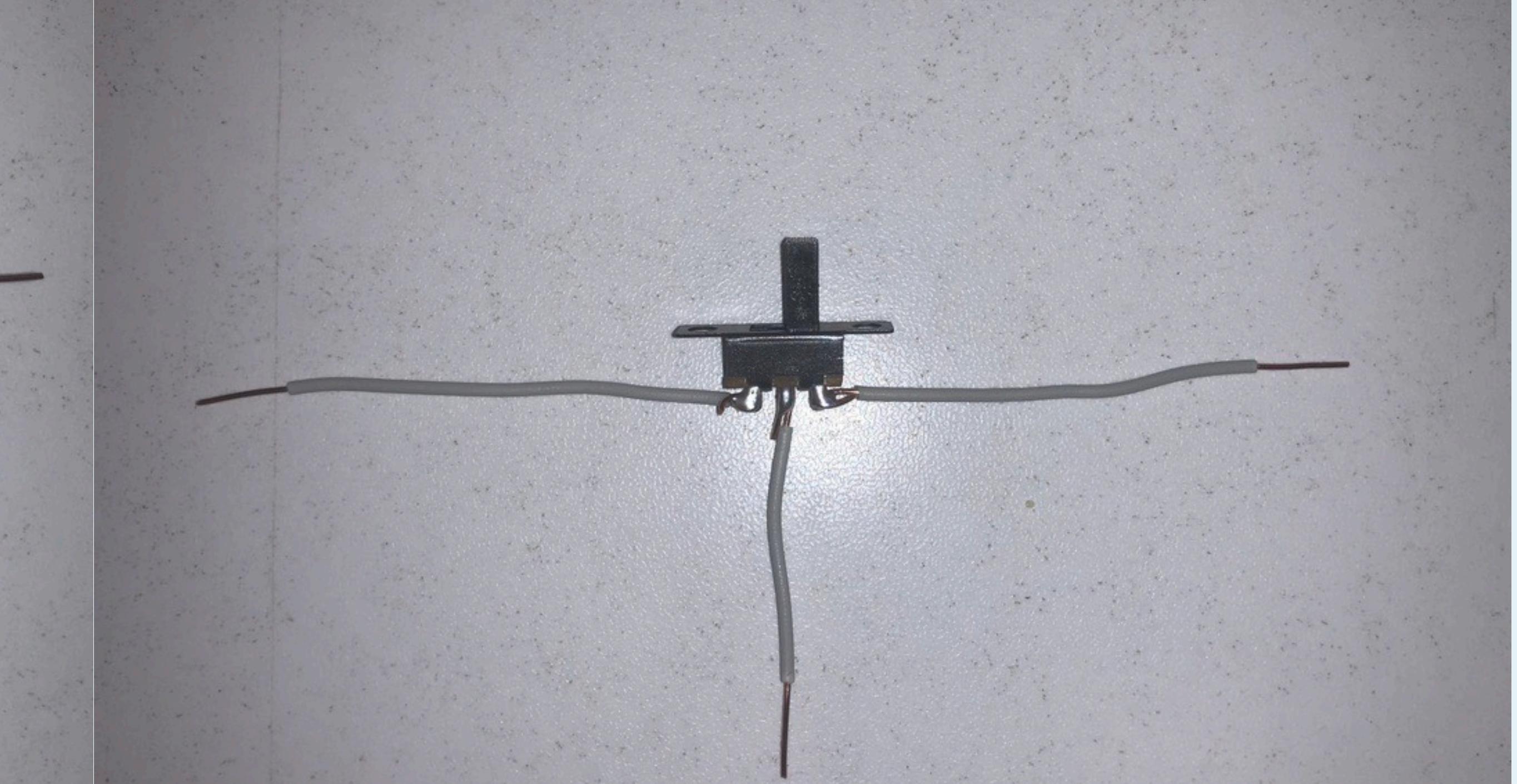
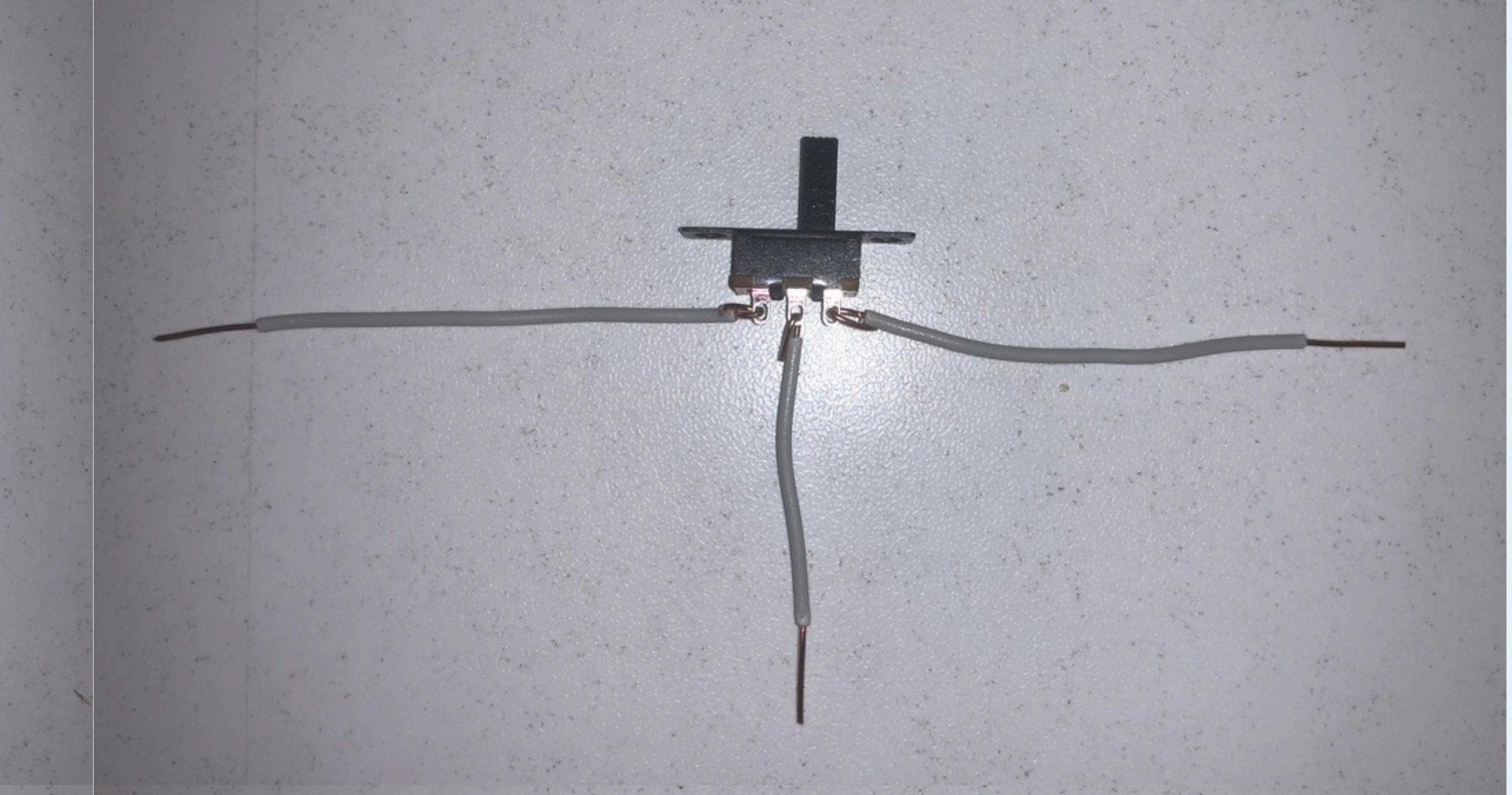
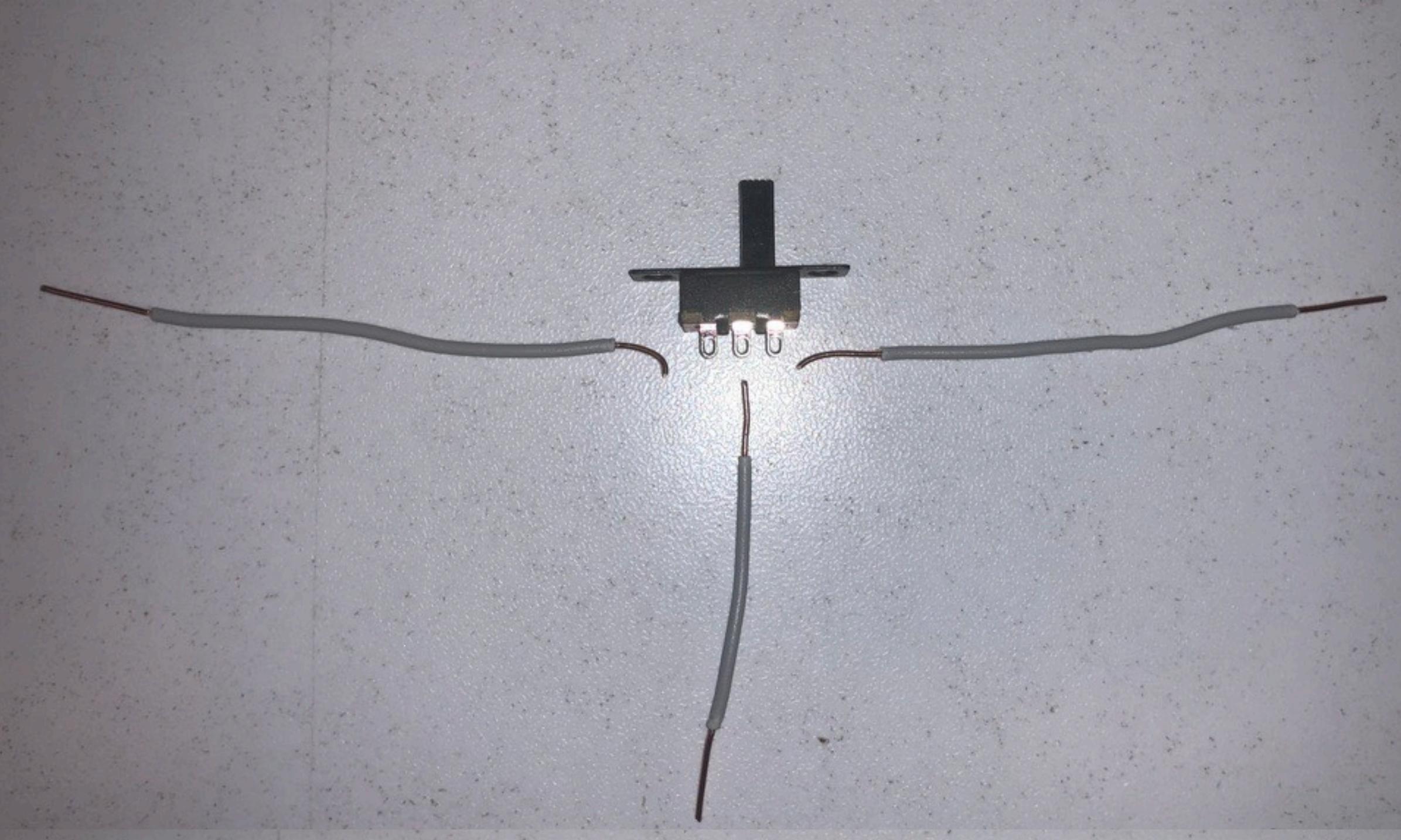


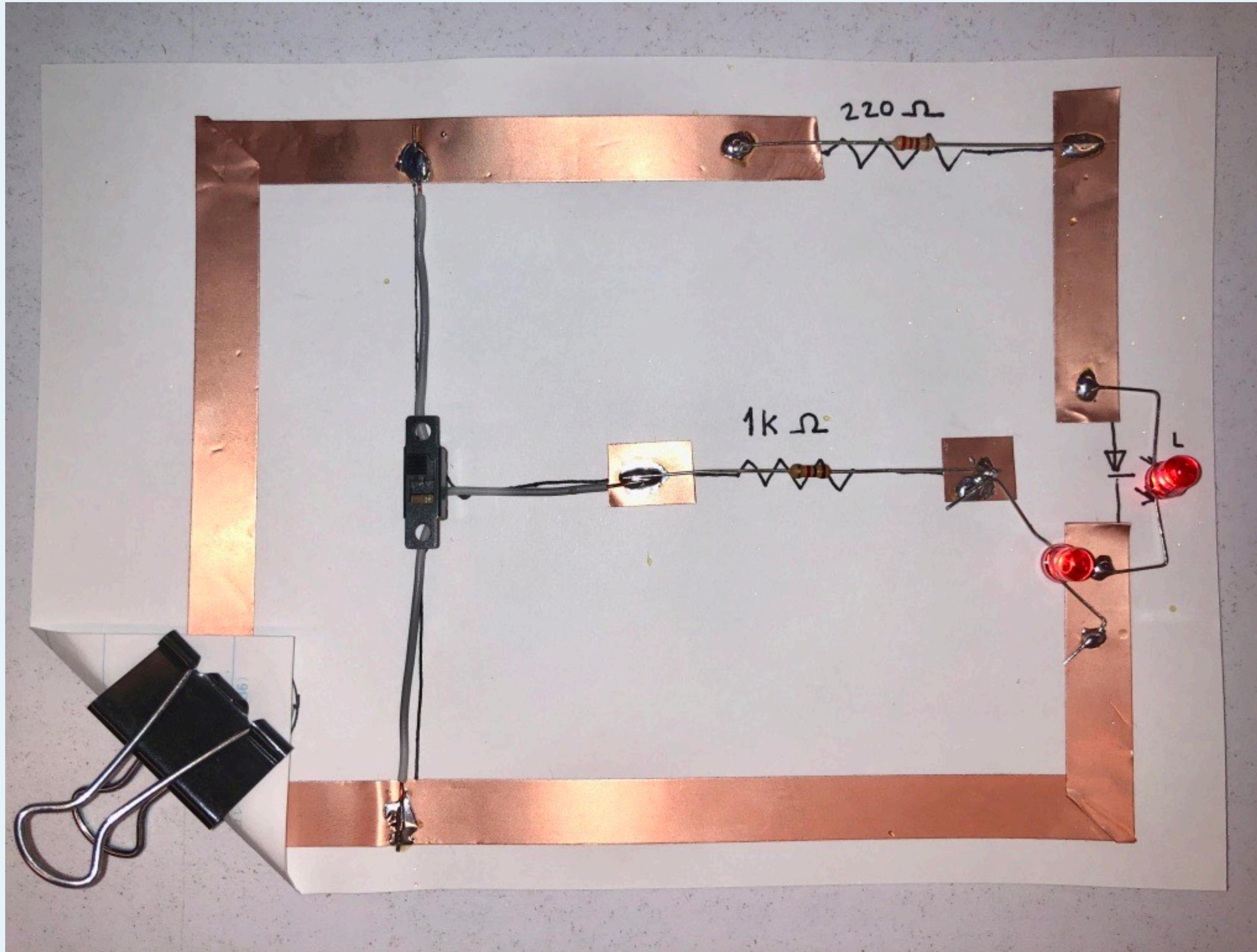


*1kになってますが今日使うのは10k（どっちでも良いが、1Mなど多すぎると動作が不安定になります）









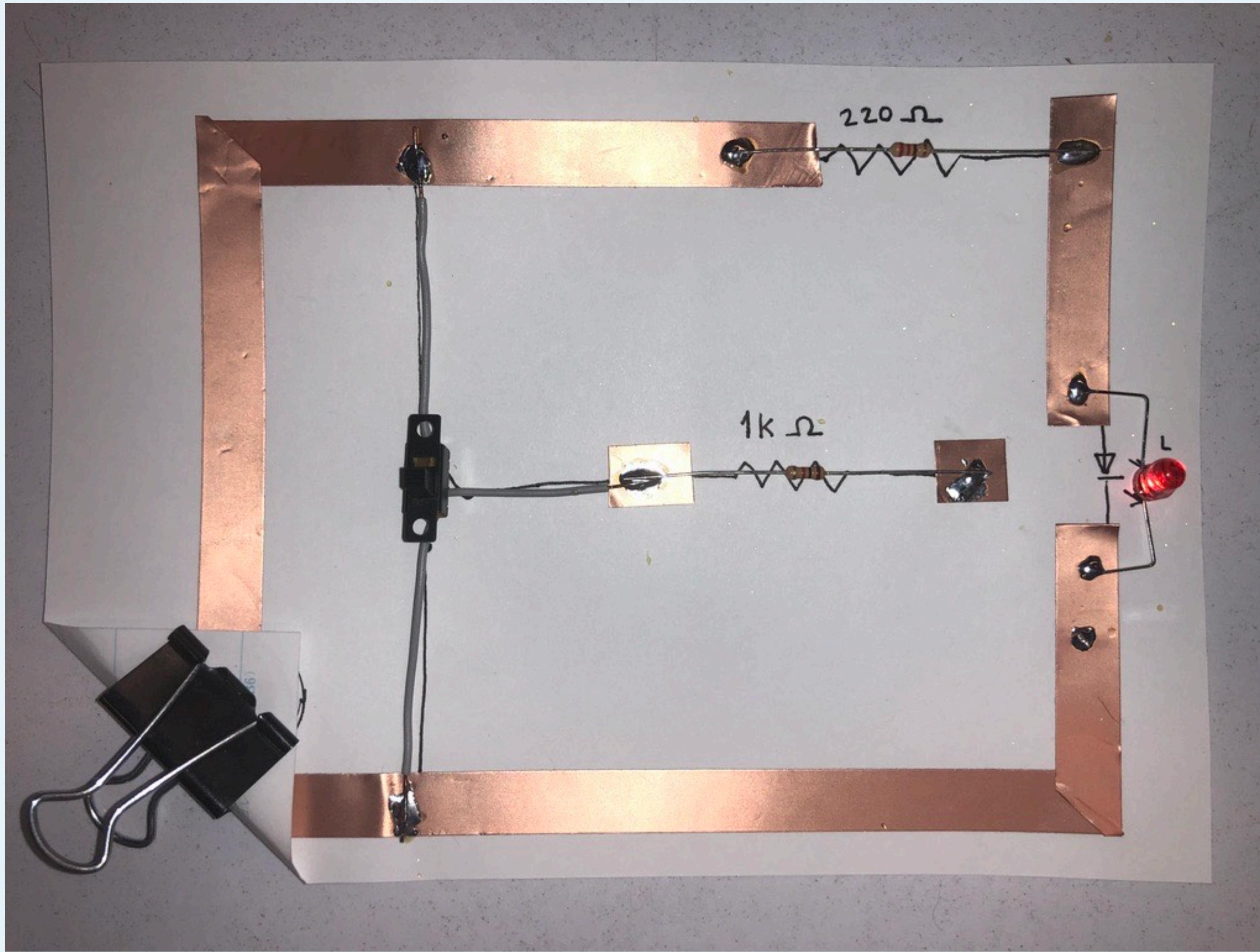
$$V=IR$$

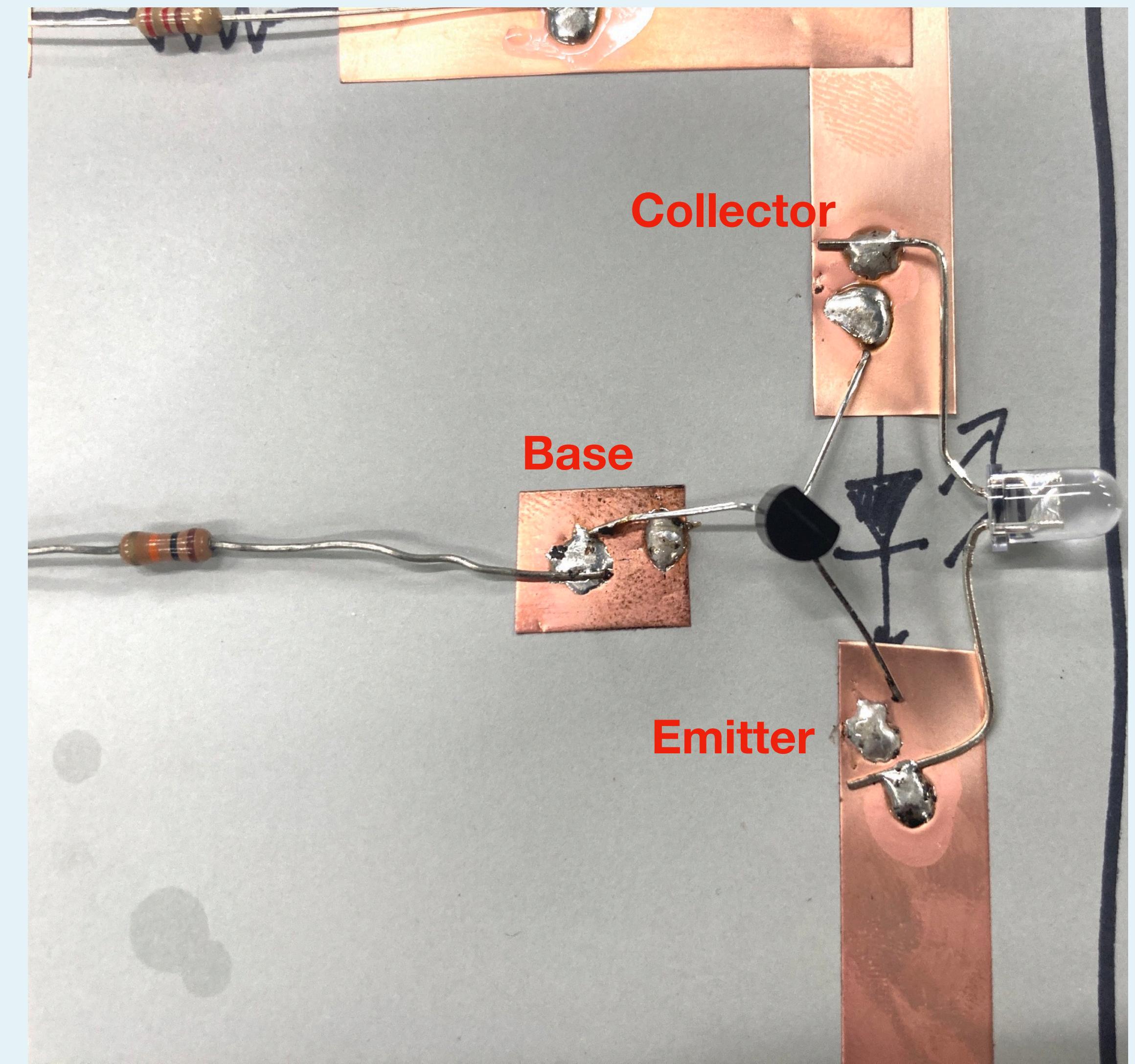
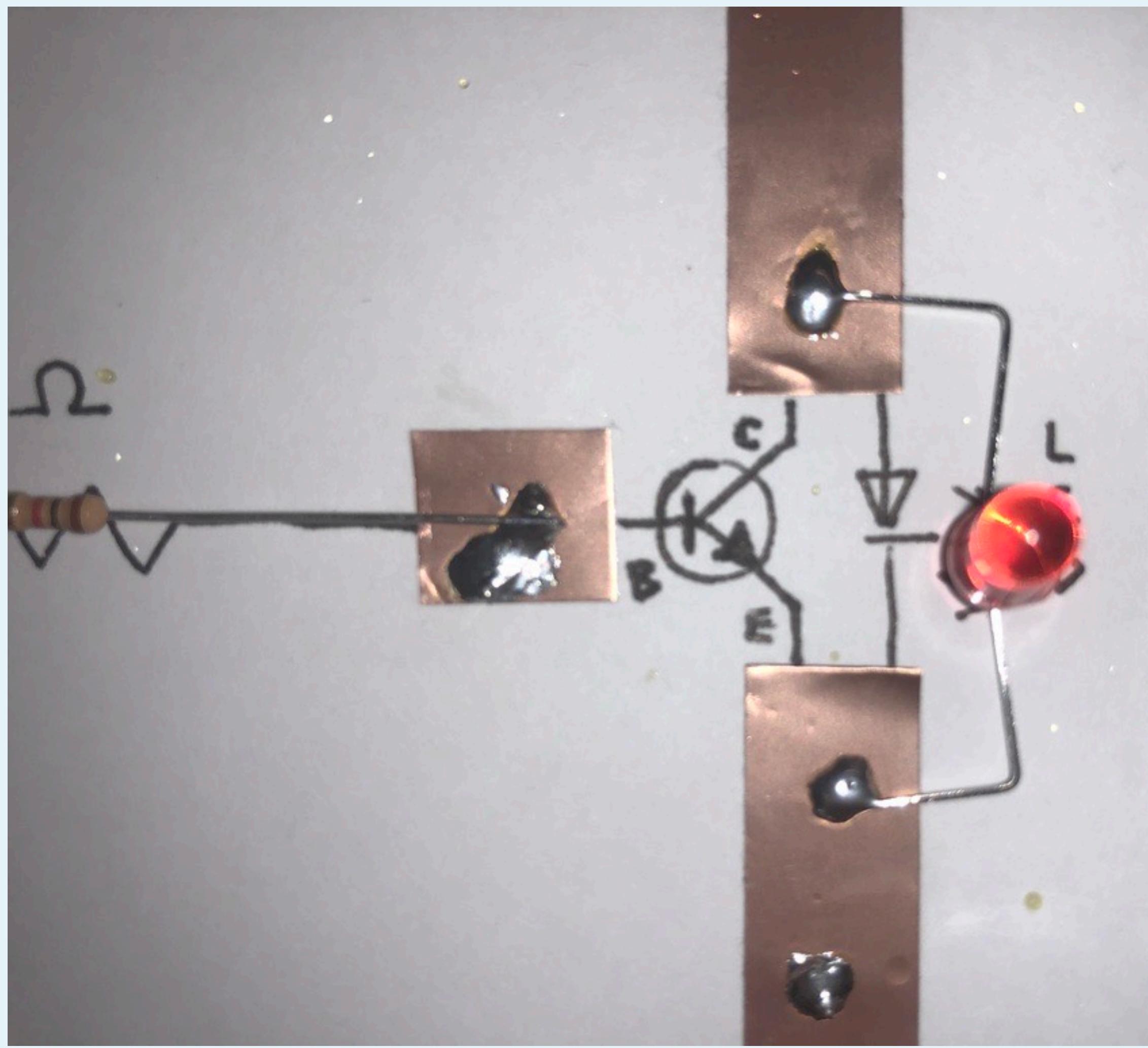
$$3v=I \cdot 220\Omega$$

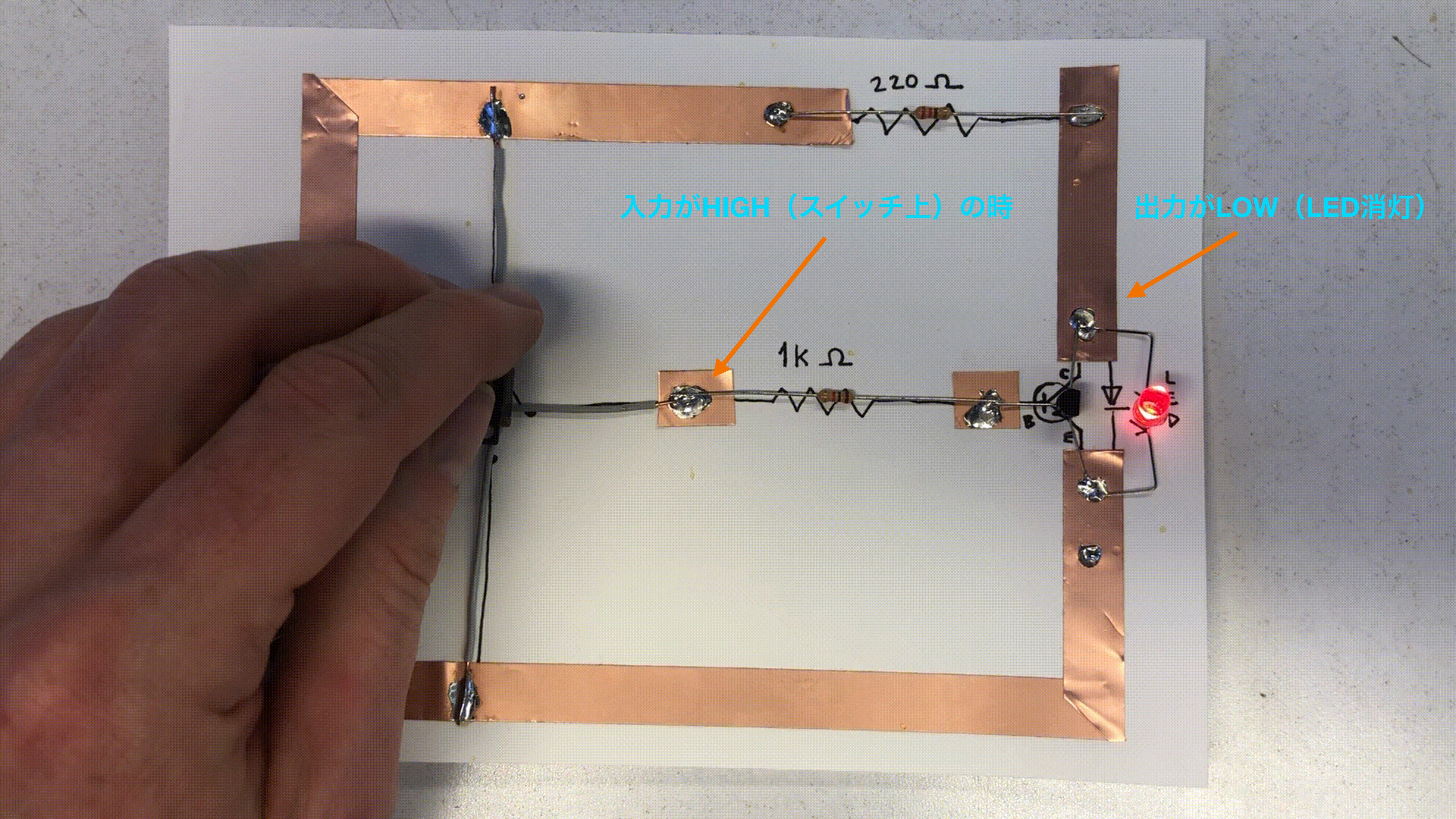
$$I=3/220 \approx 14mA$$

$$3v=I \cdot 10k\Omega$$

$$I=3/10k \approx 0.3mA$$







小課題

- 今日作ったものの記録を写真に撮ってアップロード
 - 必要に応じてあれば学んだことのメモなども書き加えましょう
- +日常生活の中から「インバーター」として表現できるものを1つ以上探してきてください（家電、流通、自然、感情、いろんなパターンを考えてみましょう）

来週以降の内容：

- 二進数の計算についてカードゲームで学ぶ
- ↓
- Paper CircuitでNAND回路を作って、足し算をしてみよう

補添：はんだ付け入門

安全第一

- ・ 金属部分を触らない
- ・ 換気する
- ・ 席を離れるときは電源を切る
- ・ コードを整理する
- ・ 化織の服の人は袖とか注意
- ・ 髪が長い人はまとめておく方が無難

はんだ付けに使うもの



Goot PX-280 (安くて高性能)



HAKKO FX-888D (高いけど使いやすい)



ALIENTEK T-65 (USB-typeC充電式)

はんだ付けに使うもの



- 鉛フリーはんだは融点高いので少し難易度上がる

あると便利



逆作用ピンセット



ヒートクリップ



フラックス



ハンダ吸い取り線



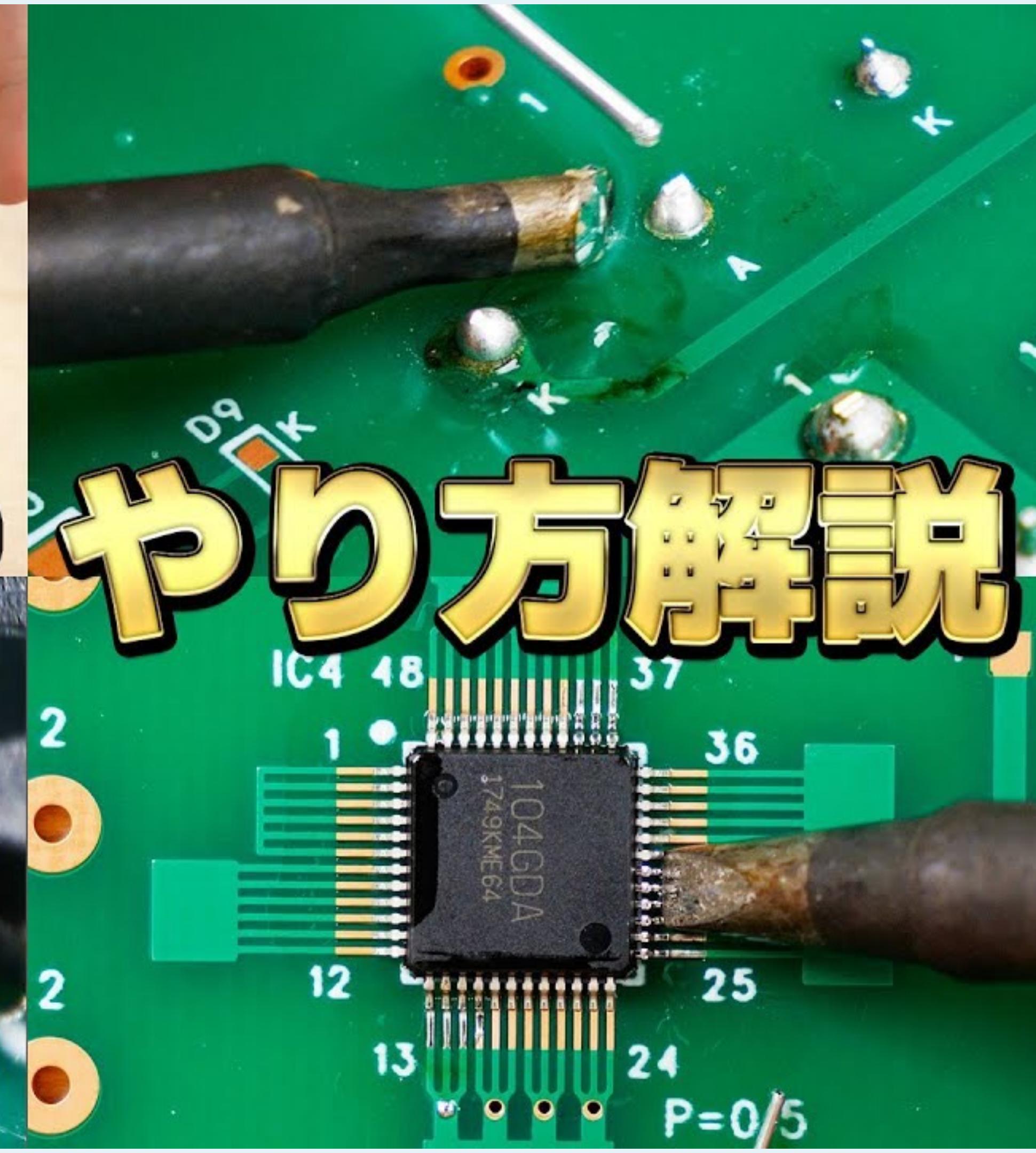
ハンダ吸い取りポンプ



フラックスクリーナー

コテの當て方

- ・ **✗** ハンダを溶かしてパツに乗せる
- ・ 乗せるところにフラックスを塗り、接点をコテで十分に熱してからハンダを持っていく



【永久保存版】はんだ付けのやり方を解説します 【はんだづけの原理, DIP部品, 表面実装】 【イチケン電子基礎シリーズ】 RX-802AS

<https://www.youtube.com/watch?v=dQ7AUjb1tkA>