

Brain Machine kit

Hack Your Brain With Sound & Light



open source
hardware



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cornFIELD electronics

What is a Brain Machine?



Photo by Sam Murphy

“Entrain” your brain to a desired brainwave sequence through light and sound.

“Entrain” – definition:



Photo by Sam Murphy

“Entrain”: When your brain synchronizes to external brainwave frequencies

Brainwave Types

Beta: 13 to 30Hz

Conscious, External Focus

Alpha: 8 to 13Hz

Spacey, Dreamy, Receptive, Passive

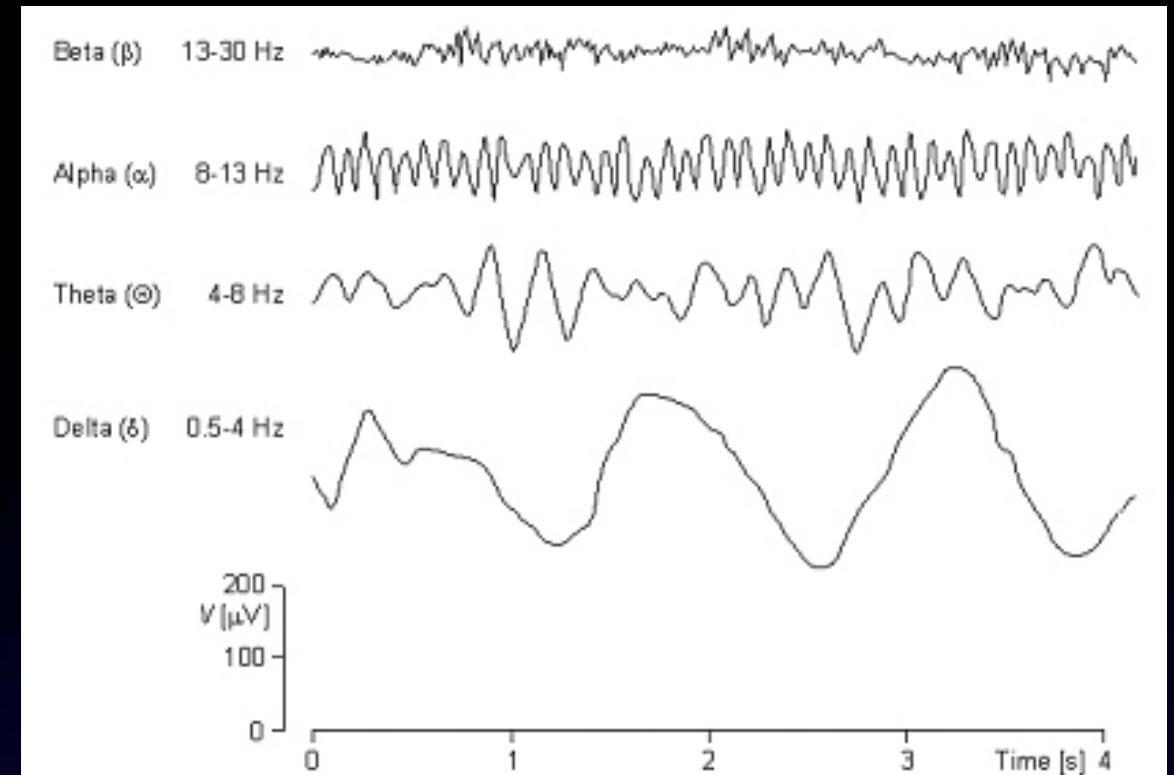
Theta: 4 to 8Hz

Subconscious, Deep Relaxation, Creativity

Delta: ½ to 4Hz

Unconscious, Intuition, Insight

Gamma: 30 to 100Hz Not well understood, linked to Perception, Alertness, Anxiety



Brainwave Sequences

Essentially the same for all healthy adults

Such as

Awake → Sleep

or

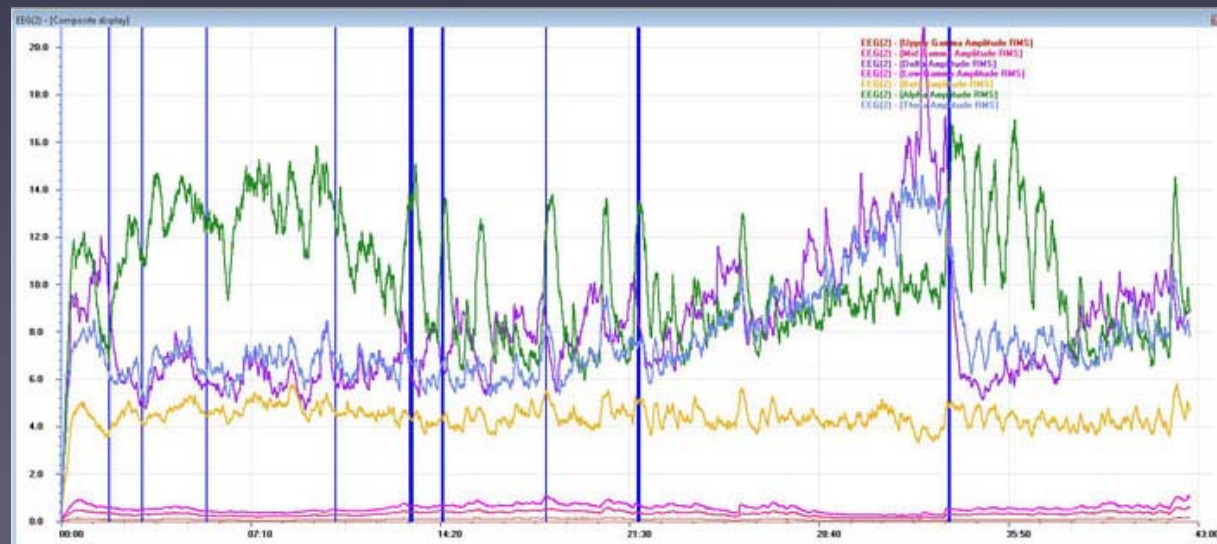
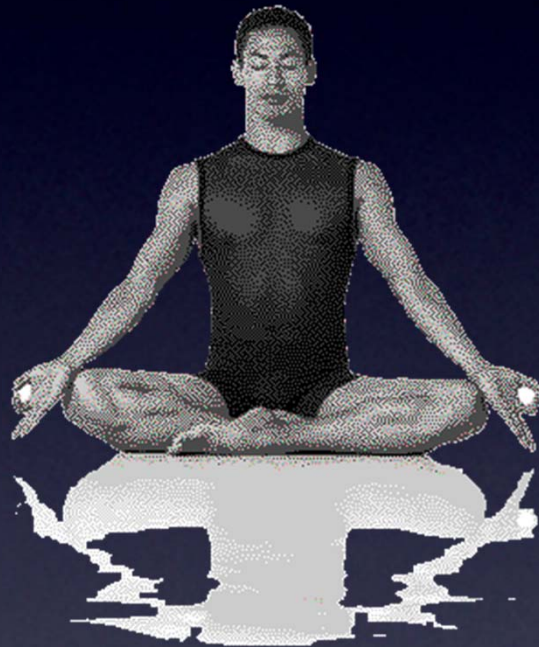
Awake → Meditation

Measurable with EEG
(brainwave monitor)

Brainwave Sequences

Essentially the same for all healthy adults

Example – Awake → Meditation:



- o Beta (awake)
- o add Alpha (spacey, dreamy)
- o less Beta (less awake)
- o add Theta (subconscious)
- o Delta (unconscious, insight)
- o hang out here awhile
- o reverse process
(come up feeling fabulous)

Genesis of My Idea (1993)

Questions popped up while meditating:

What would happen if you played back a
brainwave sequence?

Would your brain synch up?

Would you be in the associated state?

Brief history

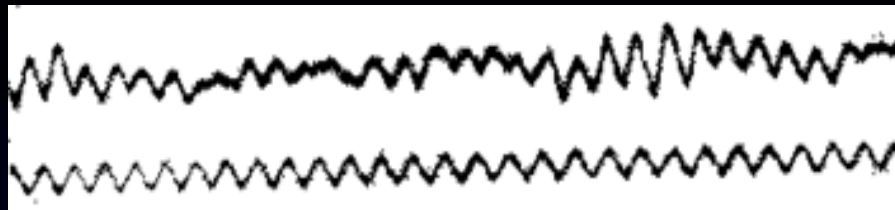


Pulsing Sound in Ancient times:
Alpha and Theta
induced by ritual drum rhythms

Pulsing Light in the 2nd Century:
Ptolemy



Brief history (cont'd)



1920s:

Invention of EEG

Hans Berger categorizes
brainwave types

1930s:

W. Grey Walter first to knowingly
play brainwaves



Brief history (cont'd)



1950s:
Invention of Dream Machine

1970s:
Research, first patent,
recordings of brainwave
sequences, Monroe Institute

United States Patent [19] 3,838,417
Charas [45] Sept. 24, 1974

[54] VISUAL COLOR RESPONSE APPARATUS
[76] Inventor: Seymour Charas, 230 Jay St. N.E.,
Brooklyn, N.Y. 11201
[22] Filed: Nov. 2, 1972
[21] Appl. No.: 303,014
[52] U.S. Cl. 340/366 B, 340/148
[51] Int. Cl. G08b 5/38
[58] Field of Search 340/366 B, 148; 84/464

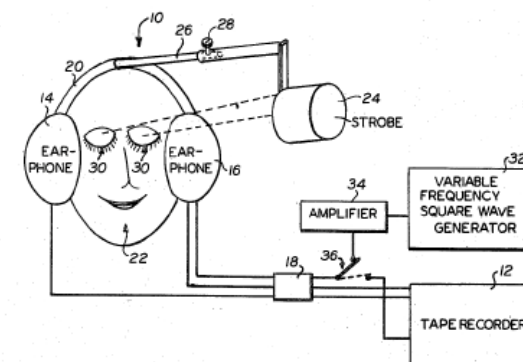
[56] References Cited
UNITED STATES PATENTS
3,478,637 11/1969 Reed 84/464

Primary Examiner—Harold I. Pitts
Attorney, Agent, or Firm—Hubbell, Cohen & Stiefel

[57] ABSTRACT
An apparatus for producing a visual color response in

an observer includes a flashing stroboscopic light and a means for controlling the flashing frequency of this light so as to provide a light signal having a predetermined flashing frequency substantially within the range of at least 1 to 16 cycles per second for producing at least a selected predetermined color within the visible light spectrum as the visual color response, the color being dependent on the flashing frequency, a different color being produced at a different flashing frequency. Means, such as a tape recorder in conjunction with a headset to which the strobe can be attached, are also provided for substantially simultaneously producing an audio response in the observer correlated with the visual response. The flashing frequency is preferably controlled independently of the audio signal, such as music, although subjectively correlated to the mood of the music.

11 Claims, 2 Drawing Figures



Brief history (cont'd)

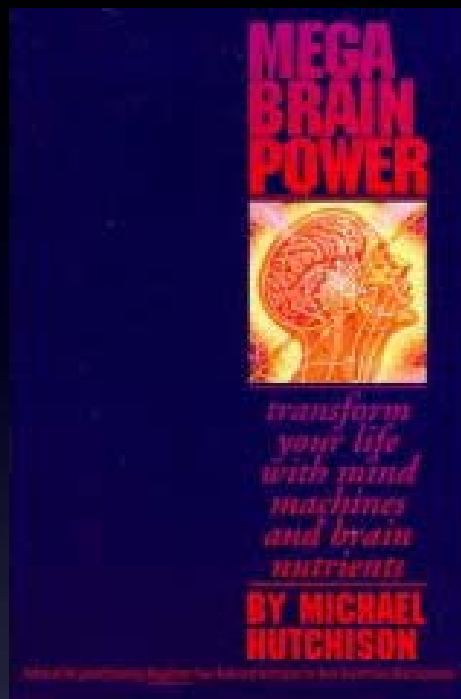


1950s:
Invention of Dream Machine

1970s:
Research, first patent,
recordings of brainwave
sequences, Monroe Institute,
Disco



Brief history (cont'd)



1980s & 1990s:

Medical studies

“Megabrain Power” by Hutchison

Popularity in mass culture

Beneficial claims

Are claims real?

Maybe some?

Certainly not all.

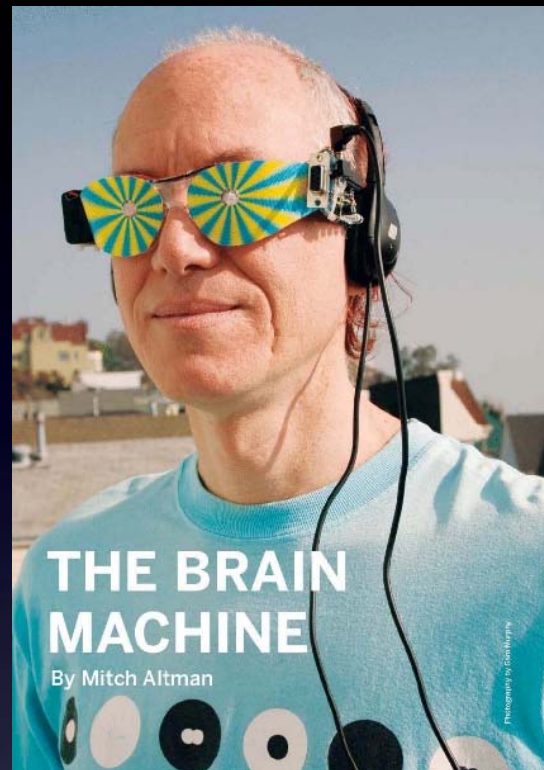
But why not try and see for yourself?

Cautionary Note:



Light and Sound Machines, such as this one, can be fun for many of us, but may be seriously dangerous for those prone to seizures or who are photosensitive.

Brief history (cont'd)



2007:

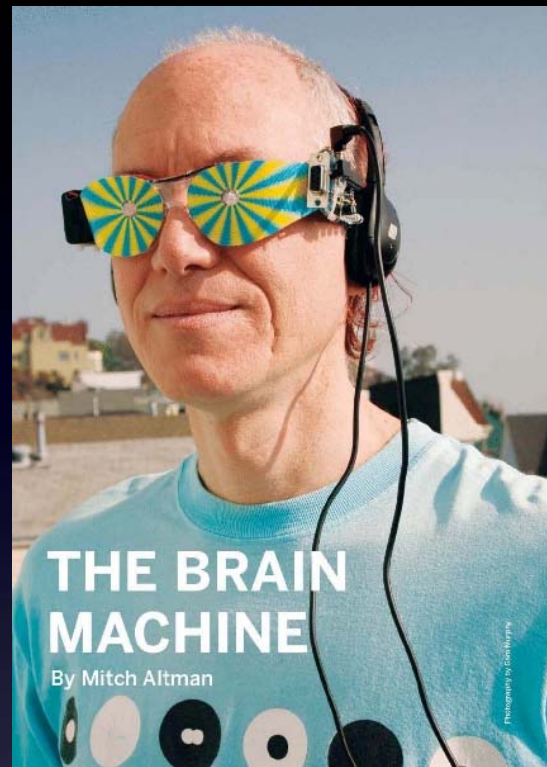
Make your own Brain Machine
article in MAKE #10

Brief history (cont'd)



“Weekend Projects” video by Bre Pettis, 2007

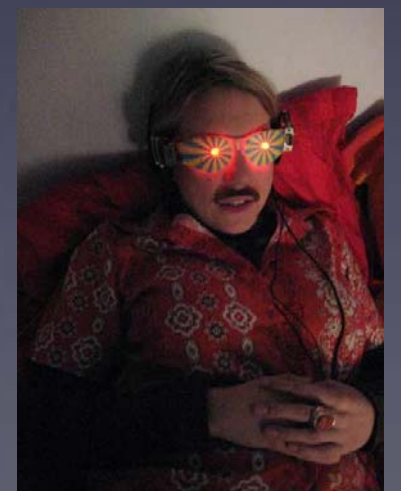
Brief history (cont'd)



2007:

Make your own Brain Machine
article in MAKE #10

Popular at parties



Motivation for MAKE Brain Machine

- Cheap (commercial “Mind Machines” cost \$\$\$)
- Beginner’s project
- Show how fun microcontrollers are
- Hallucinate wildly without side-effects
- Trick people into meditating



Hack of
Ladyada's
MiniPOV kit

New Version of the Brain Machine kit



- Way easier to solder
- Uses Arduino – way easy to re-program and hack on
- Very well documented – easy to modify, great to learn from
- Easily add Gamma waves to a Brainwave sequence
- Easily to add alternate blinking LEDs (left/right)
- Runs on one AAA battery – light-weight / more comfortable

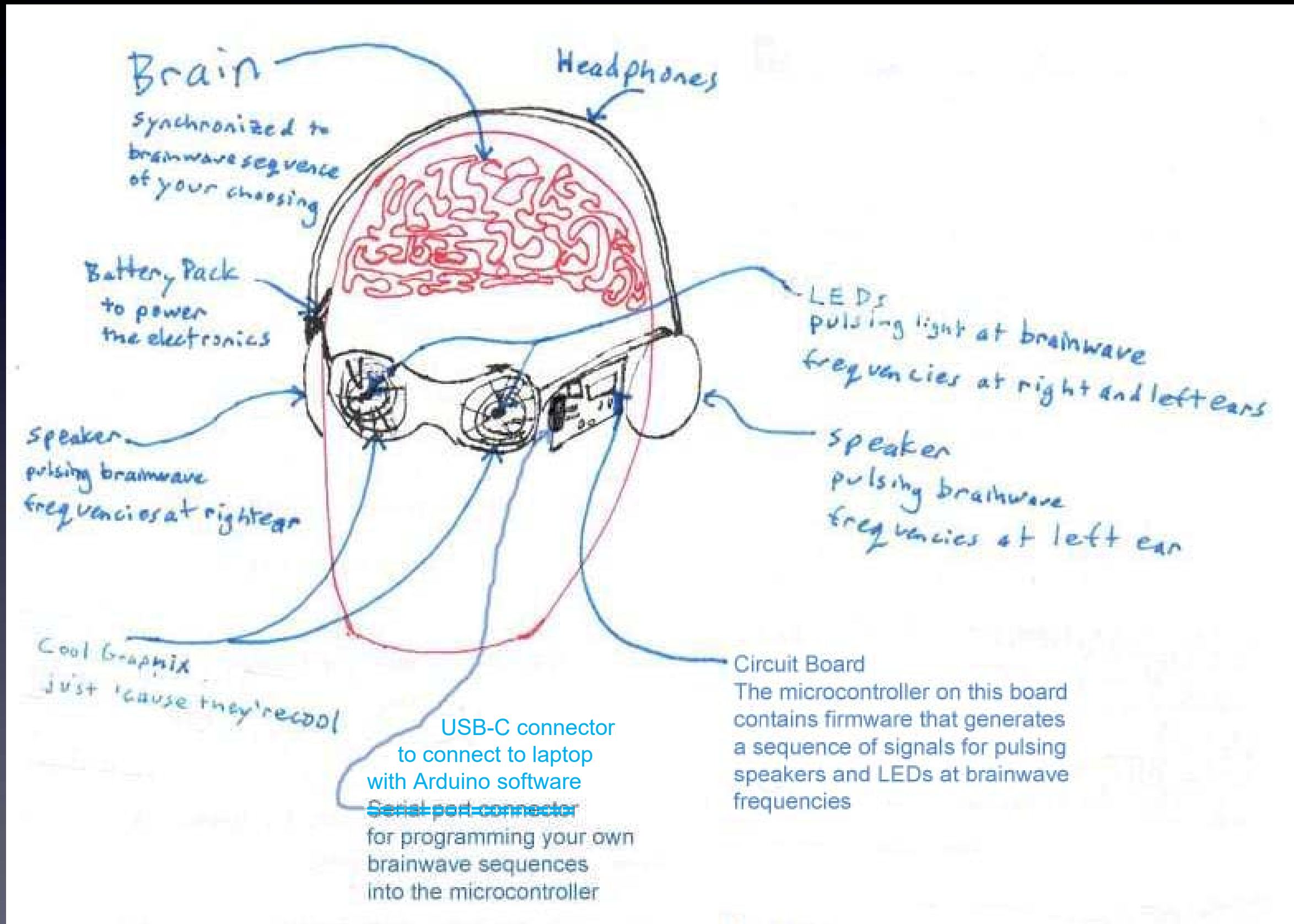
Brain Machine Theory

Sound & Light together
to entrain (non-invasively)
your brain to a brainwave sequence

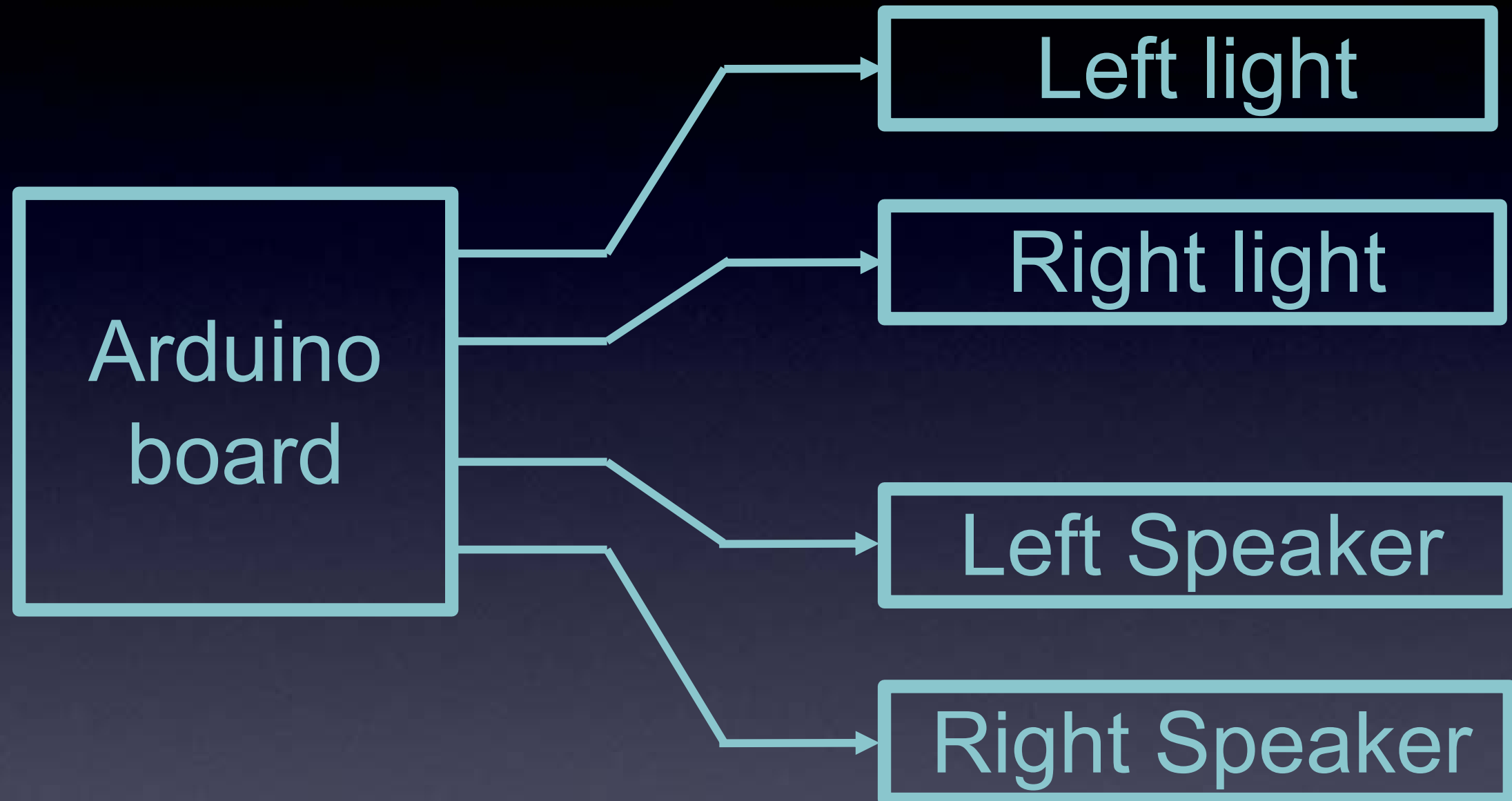
Simplified model for a brainwave sequence:
only one brainwave frequency at a time

Brain Hacking:

By pulsing sound & light at brainwave frequencies you can make your brain track any sequence you like



Hardware



Program / Firmware / “Sketch”

Brainwave Table

Play
each entry
in the
Brainwave Table

- Start with lots of Beta
(awake / conscious)
- Add Alpha
(dreamy / trancy)
- Reduce Beta
(less conscious)
- Start adding Theta
(more subconscious)
- Pulse in some Delta
(creativity)
- Then reverse
the above
(to come up refreshed)

Program / Firmware / “Sketch”

Brainwave Table (detailed)

```
} const brainwaveTab[] PROGMEM = {  
  { 'b', 600000 }, ← Beta waves for 60 seconds  
  { 'a', 100000 }, ← Alpha waves for 10 seconds  
  { 'b', 200000 },  
  { 'a', 150000 }, (divide by 10,000 to get seconds)  
  { 'b', 150000 },  
  { 'a', 200000 },  
  { 'b', 100000 },  
  { 'a', 300000 },  
  { 'b', 50000 },  
  { 'a', 600000 },  
  { 't', 100000 },  
  { 'a', 300000 },  
  { 't', 200000 },  
  { 'a', 300000 },  
  { 't', 300000 },  
  { 'a', 150000 },  
  { 't', 600000 },  
  { 'a', 150000 },  
  { 'b', 10000 },  
  { 'a', 150000 },  
  { 't', 600000 },  
  { 'd', 10000 },
```

```
  { 't', 100000 },  
  { 'd', 10000 },  
  { 't', 100000 },  
  { 'd', 10000 },  
  { 't', 300000 },  
  { 'a', 150000 },  
  { 'b', 10000 },  
  { 'a', 150000 },  
  { 't', 300000 },  
  { 'a', 150000 },  
  { 'b', 10000 },  
  { 'a', 200000 },  
  { 'b', 50000 },  
  { 'a', 200000 },  
  { 'b', 150000 },  
  { 'a', 150000 },  
  { 'b', 200000 },  
  { 'a', 100000 },  
  { 'b', 250000 },  
  { 'a', 50000 },  
  { 'b', 600000 },  
  { '0', 0 } ← last entry is always {'0', 0}  
};
```

- use Upper-Case for alternating blinking Left/Right (instead of simultaneous blinking in both eyes)
example: { 'B', 600000 }, -- Blink lights alternately at Beta for 60 seconds
- use 'g' or 'G' for Gamma waves
example: { 'g', 6000000 }, -- Blink lights at Gamma for 600 seconds (10 minutes)

Binaural Beats

An effective means for entraining
your brain to sound

Somewhat like beat frequencies:



Base tone



Alpha Offset tone



Alpha Beat Frequency

Binaural Beats

An effective means for entraining
your brain to sound

Somewhat like beat frequencies:



Base tone



Alpha Offset tone



Alpha Beat Frequency

Except it's just in your head!
(not physical – only perceived)

Meditation

Here are just a few different ways to meditate:

- breathe
- follow thoughts
- ignore thoughts
- focus on an intention (like a problem)
- make up your own way

What's It Like?

What's It Like?

A few photos

from my

Brain Machine workshop

at Chaos Communications Camp 2007:

What's It Like?



What's It Like?



What's It Like?



What's It Like?



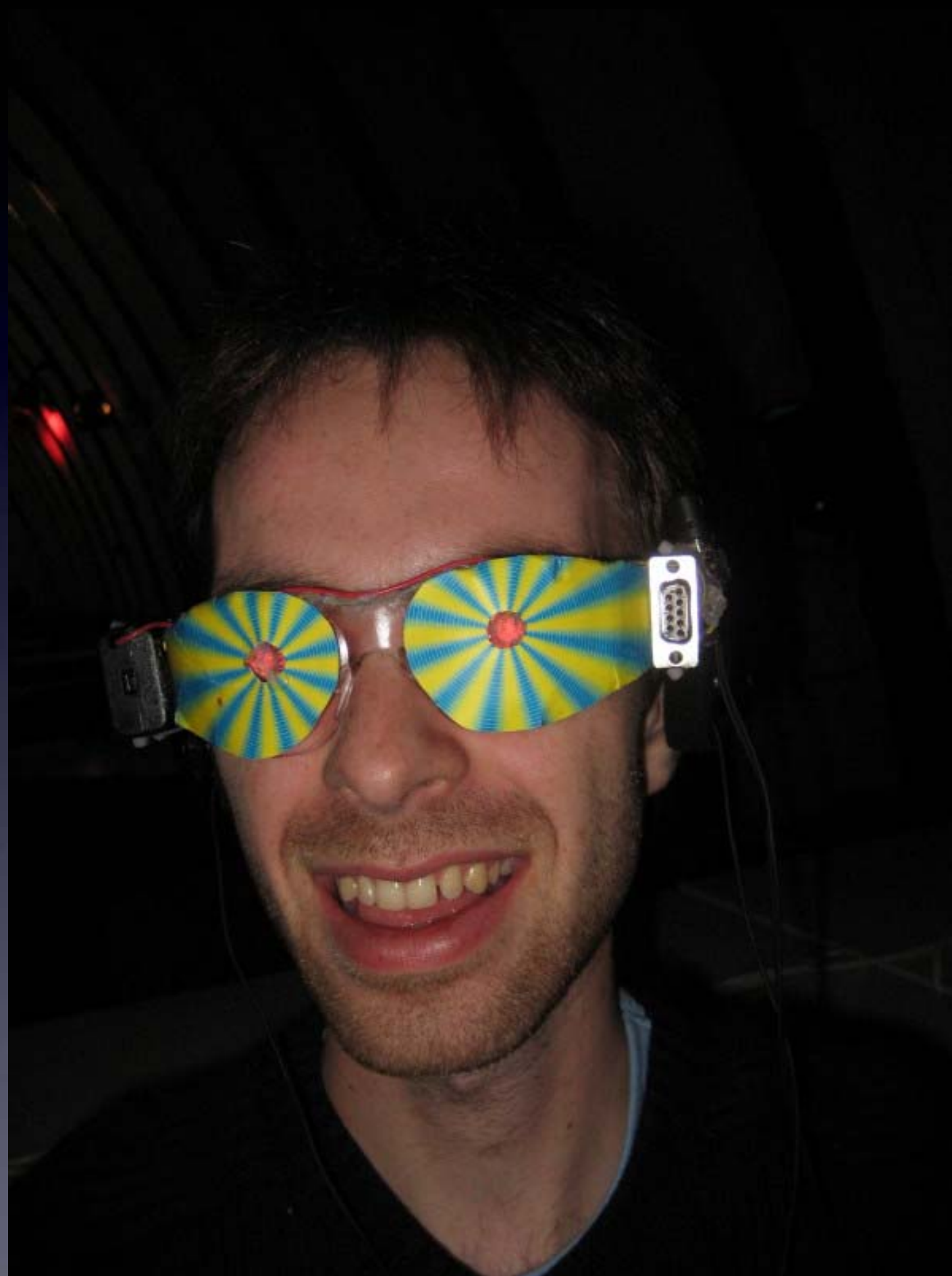
What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



What's It Like?



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What's It Like?



What's It Like?



Further Study

Books:

“Megabrain Power: New Tools and Techniques for Brain Growth and Mind Expansion.” by Michael Hutchison, Ballantine Books, 1996

“The High-Performance Mind” by Anna Wise, Tarcher, 1997

“Dreamachine Plans” by Brion Gysin, Temple Press, 2006

“The Living Brain” by W. Grey Walter, Penguin, 1967

Websites:

Anna Wise:

<http://www.annawise.com>

– *Unfortunately, Anna Wise died in 2010, and since then not much has happened with her technology*

“Clinical Guide to Light and Sound” by Thomas Budzynski, PhD:

<http://sica.stanford.edu/events/brainwaves/theclinicalguidetosoundandlight.pdf>

– *Unfortunately, this link no longer works, and the PDF seems to have disappeared from the internet*

Seymour Charas’ 1974 patent (first SLM patent):

<https://ppubs.uspto.gov/pubwebapp/static/pages/ppubsbasic.html>

Quick lookup: 3838417

The Monroe Institute:

<http://www.monroeinstitute.com/>

– *Unfortunately, the founder, Robert Monroe, died in 1995, and since then the website has lost its repository of useful information*

Wikipedia has some interesting pages. A good starting place is the “Mind Machine” page:

http://en.wikipedia.org/wiki/Mind_machine

Questions?

(Don't bring these home)

Tools

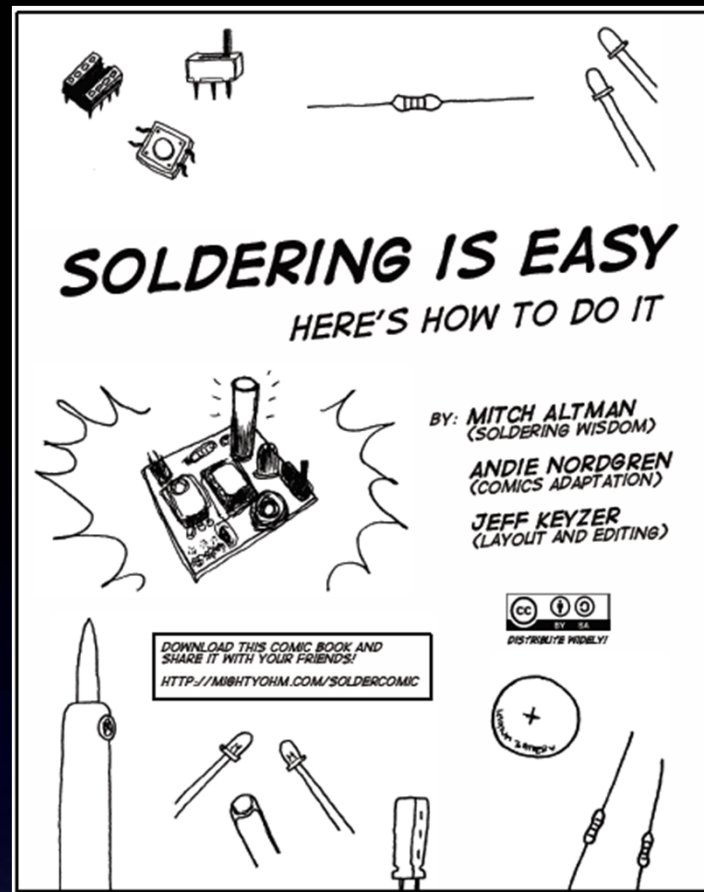


Your Brain Machine

Yours to bring home !



Learn To Solder



The following photos will show you how to solder.

But feel free to download the “Soldering Is Easy” comic book for free!

(In many different languages.)

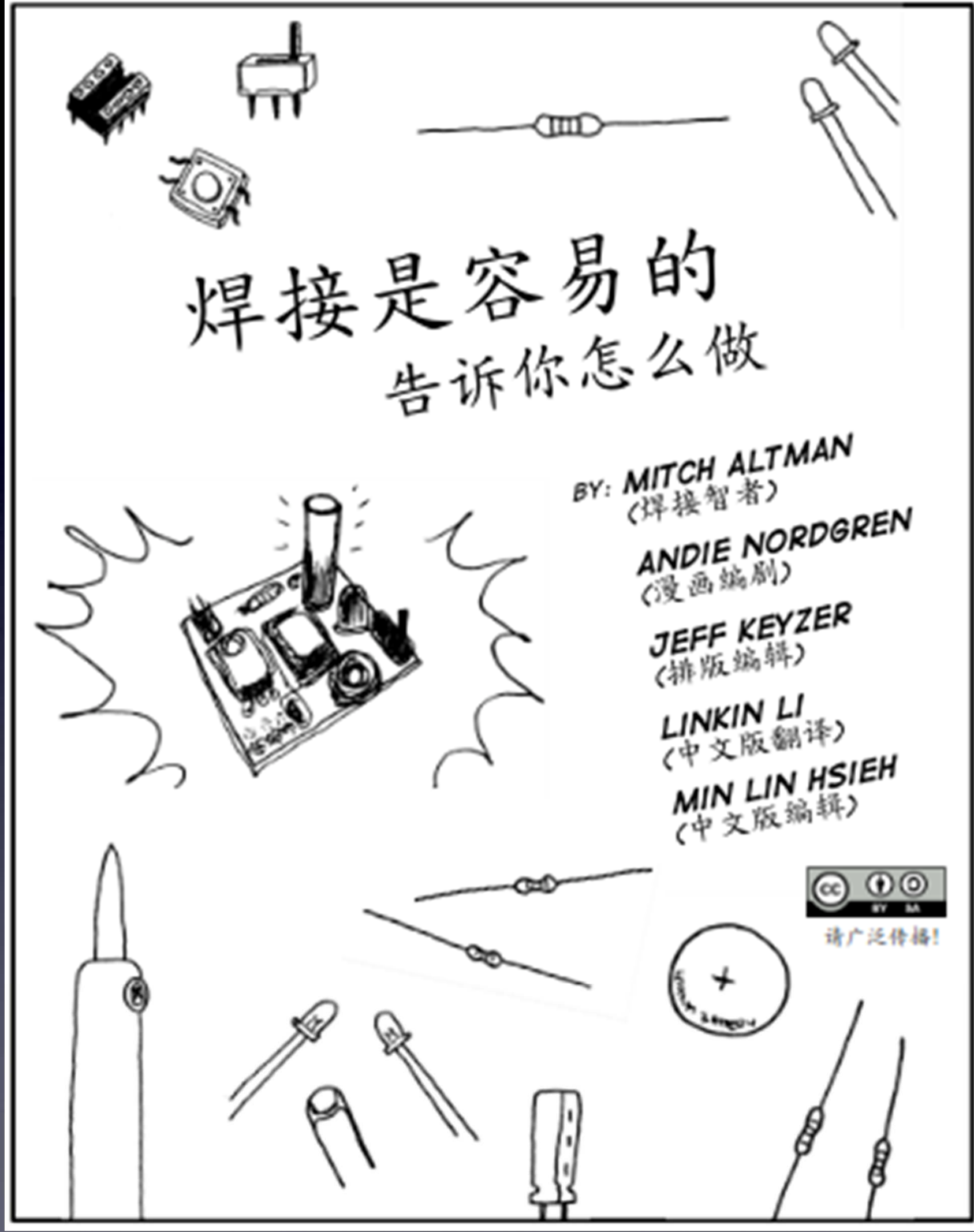
download for free at:
<http://mightyohm.com/soldercomic>

Learn To Solder



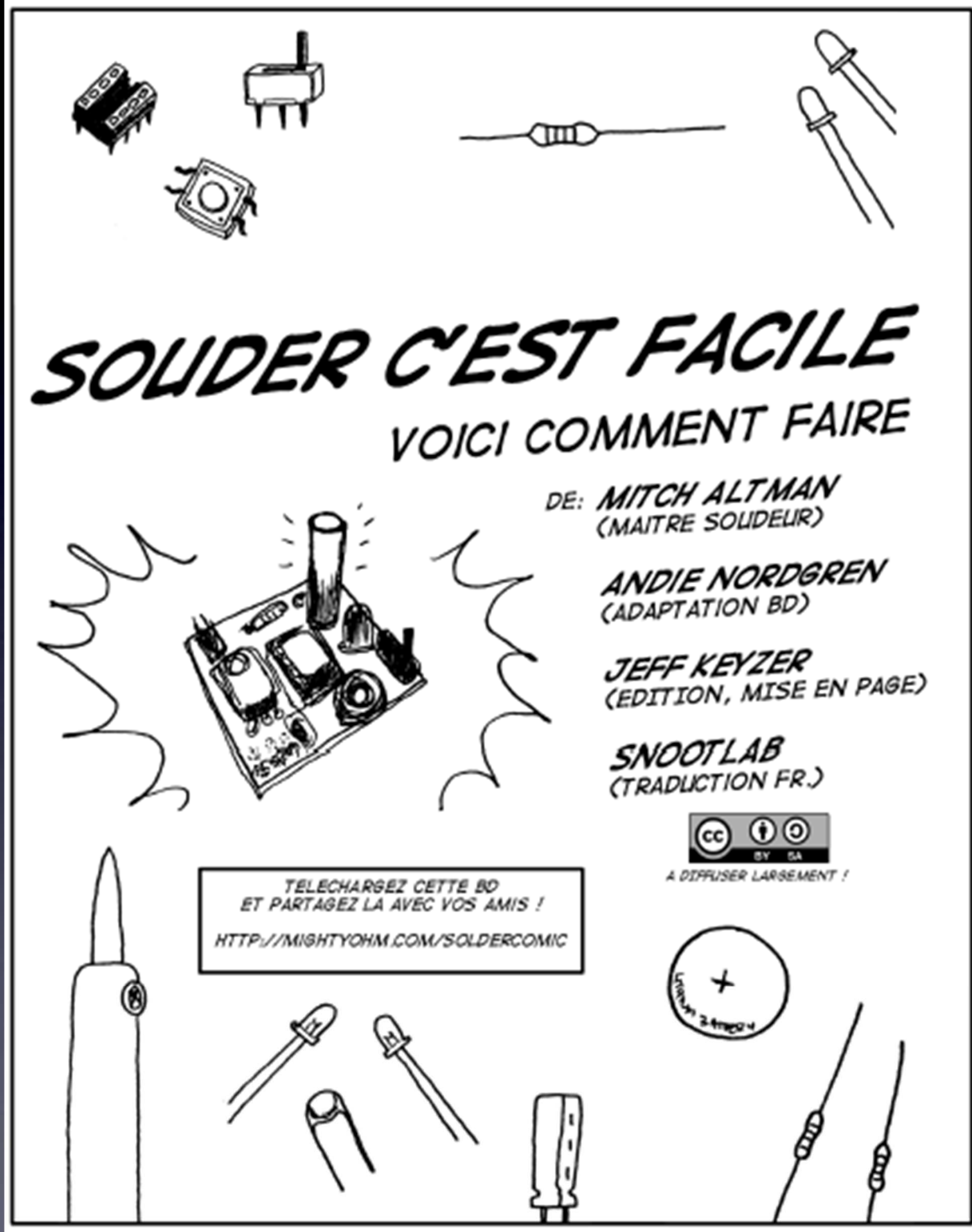
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(In many different languages.)

Learn To Solder



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Learn To Solder



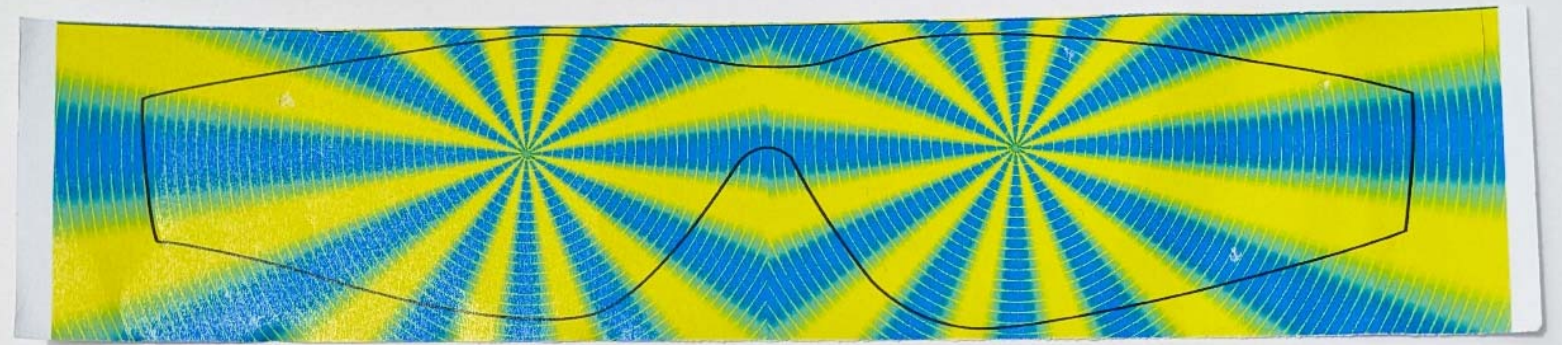
download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Learn To Solder

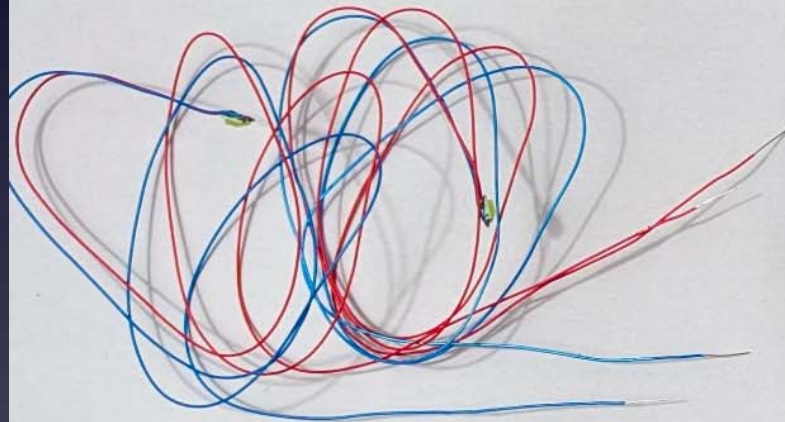


download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Trippy Graphix



LED1, LED2



Arduino Nano



Power Supply

R1, R2 (4.7K) Yellow, Violet, Red, Gold



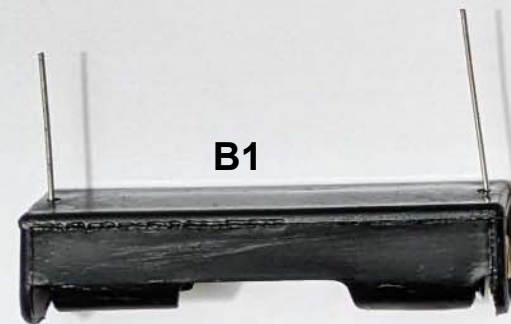
R3, R4 (47) Yellow, Violet, Black, Gold



J1



C1, C2



B1



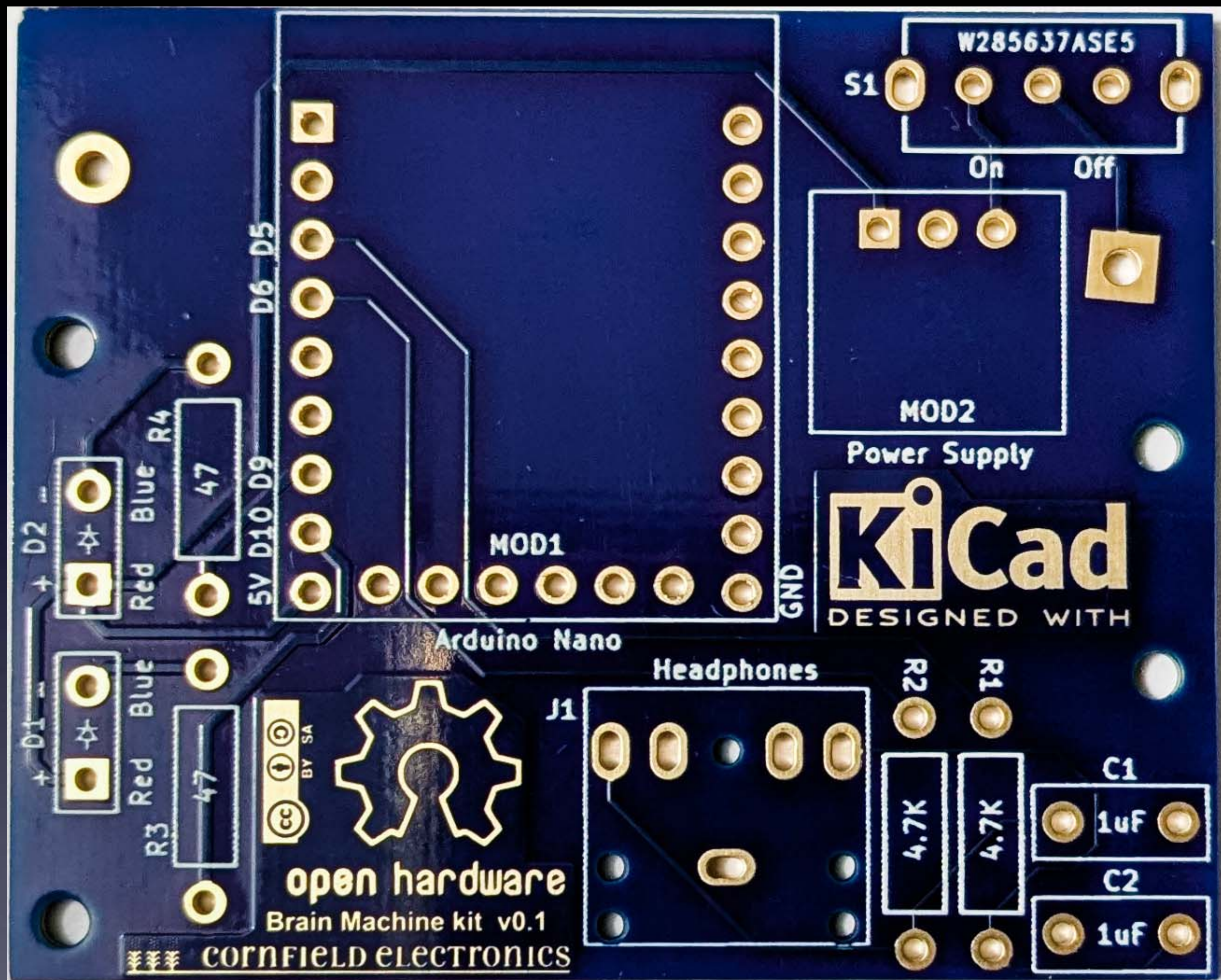
S1



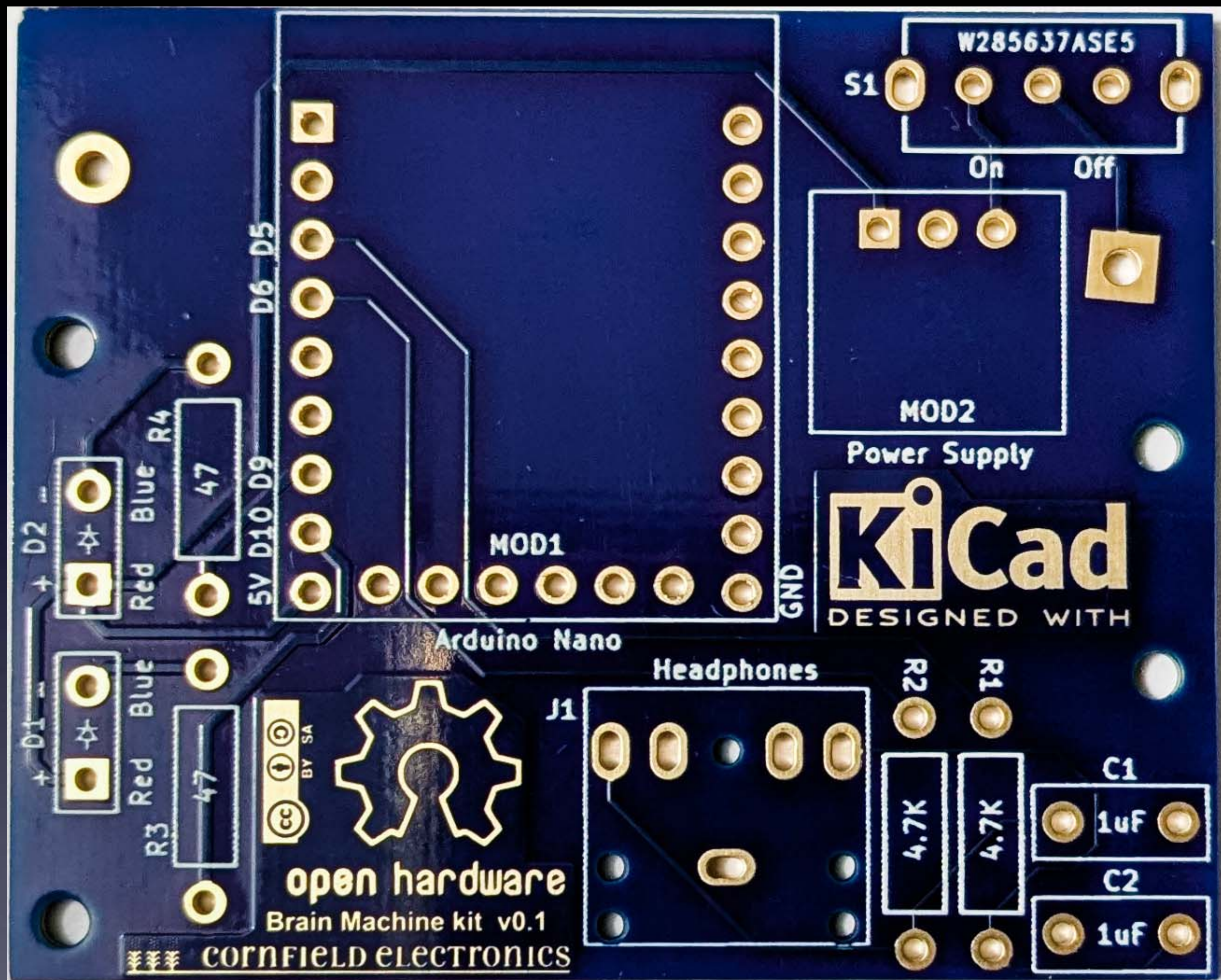
Header pins

Zip ties

All of the parts



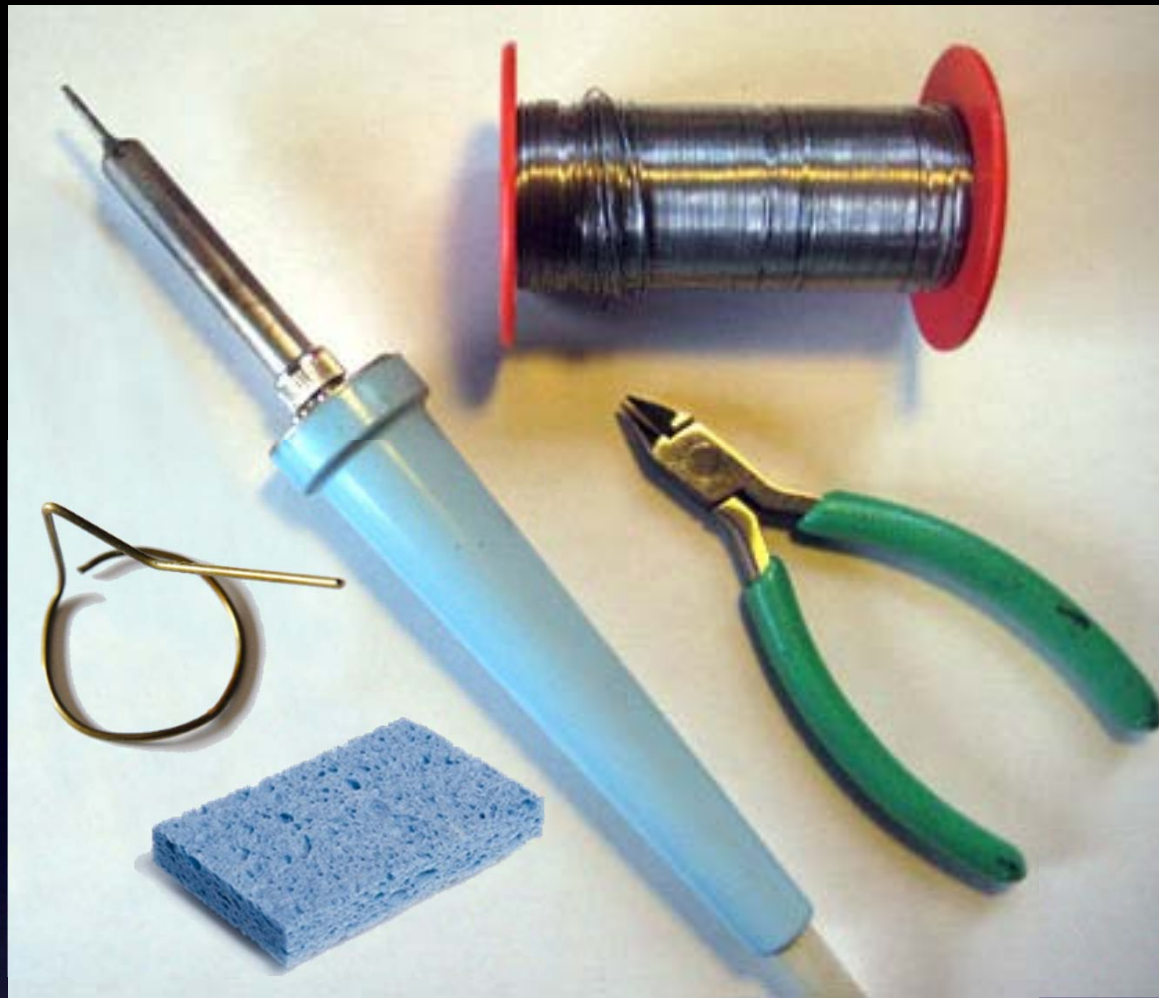
The board we'll solder the parts to



Front/Top of board



Back/Bottom of board



Note:
Since we will use
Lead-Free solder
it is very helpful
to also have
flux paste in a syringe
And Isopropyl Alcohol



The tools you'll need:

- soldering Iron (35W or less)
- solder (*more details coming*)
- soldering iron stand
- cellulose kitchen sponge (*not plastic!*)
- *small* wire cutter
- tape
- felt-tip pen
- scissors

Our first part



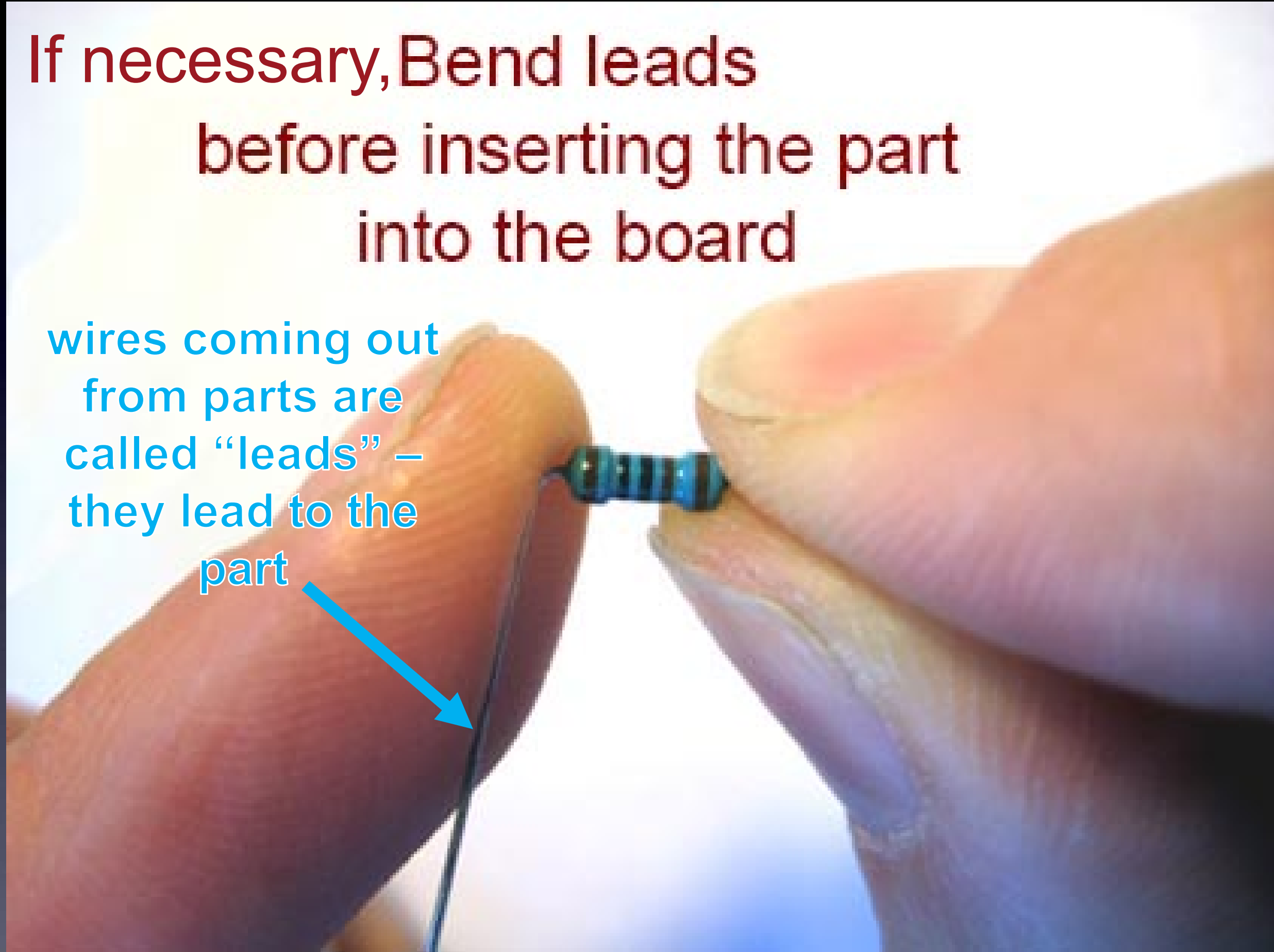
R1: Yellow, Violet, Red

(not: Yellow, Violet, ~~Black~~)

Some parts, such as resistors, need their leads bent first

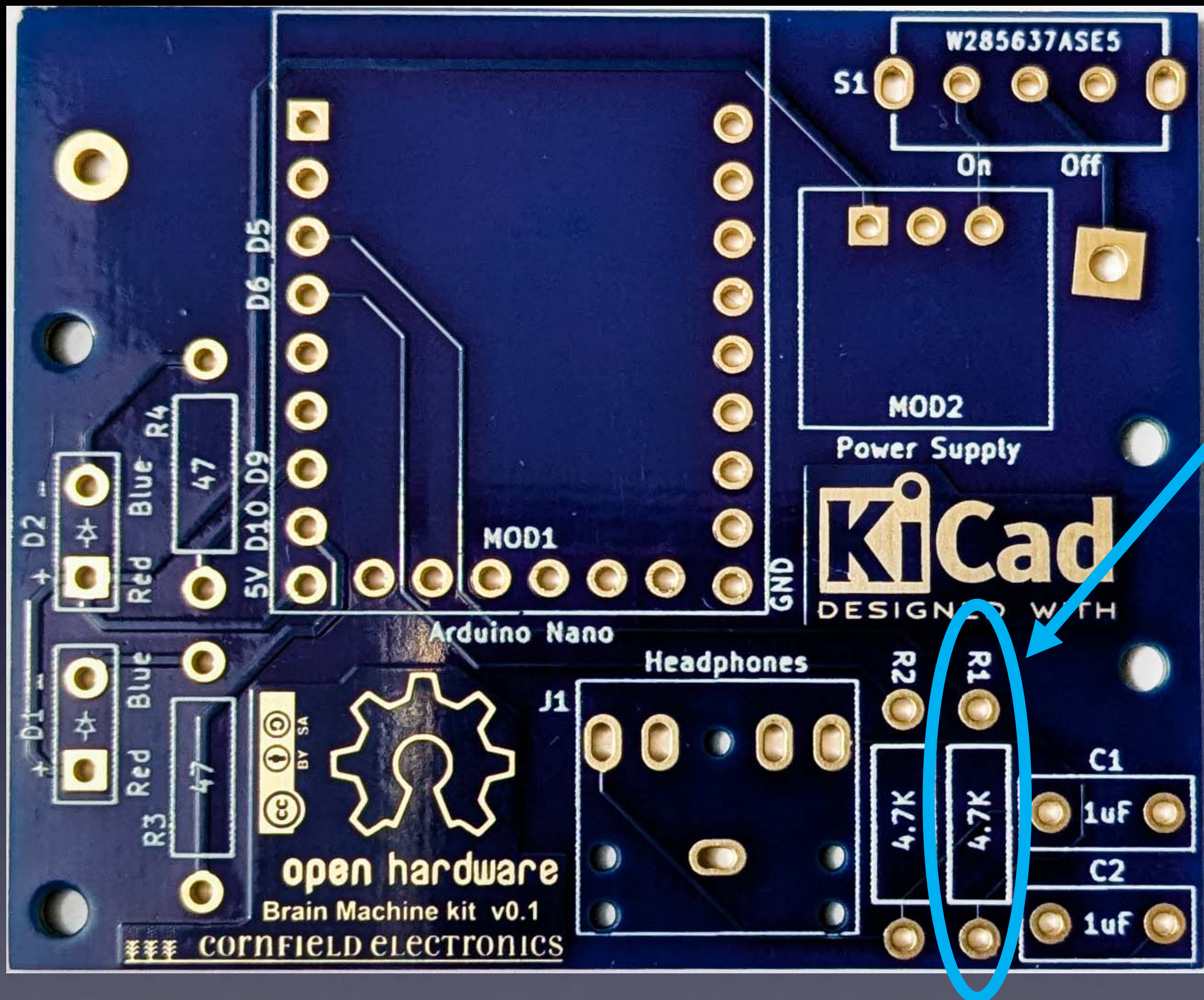
If necessary, Bend leads
before inserting the part
into the board

wires coming out
from parts are
called “leads” –
they lead to the
part





R1 – this is how it will look *before* inserting it into the board



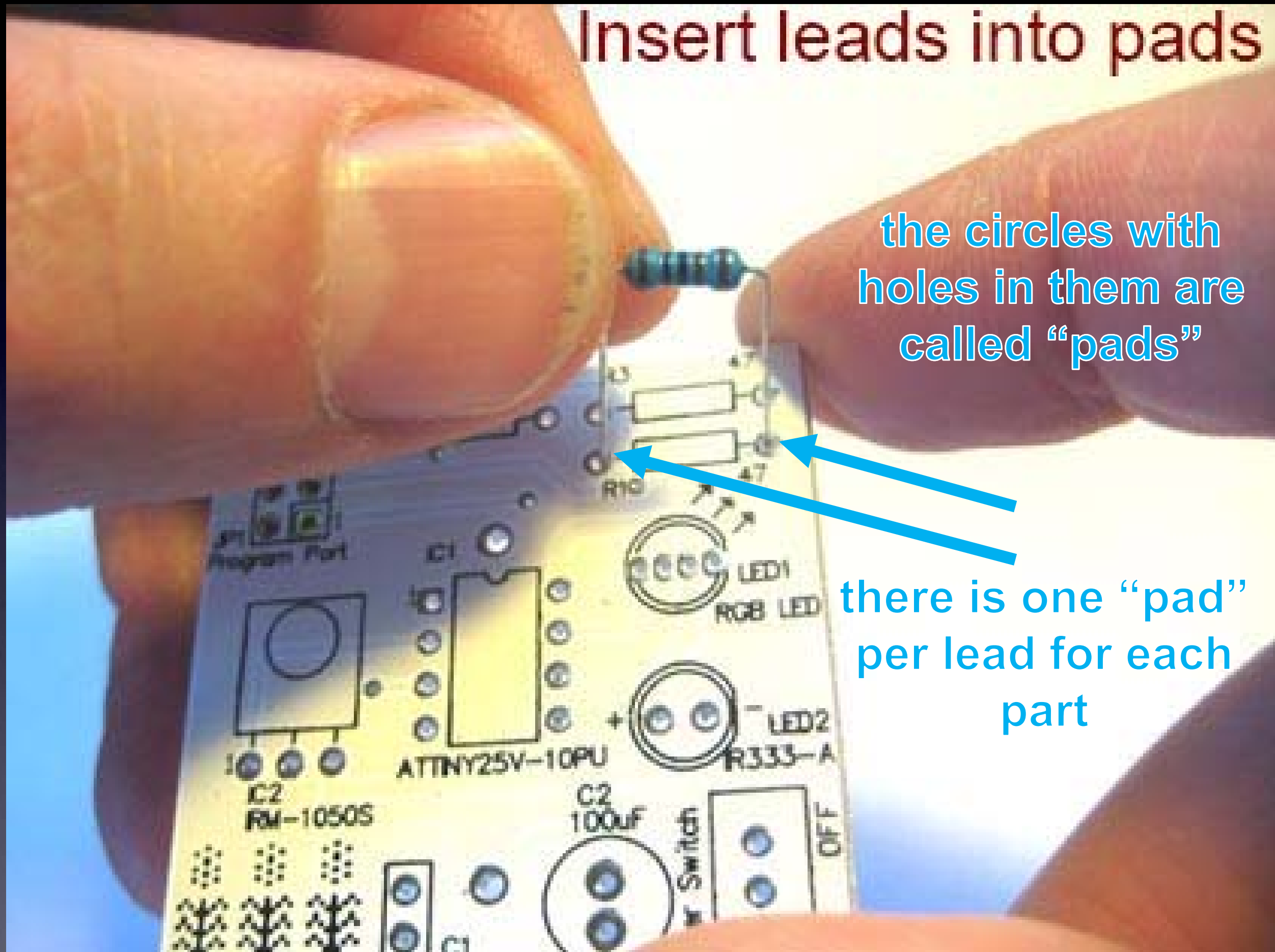
R1

R1 – this is where it goes

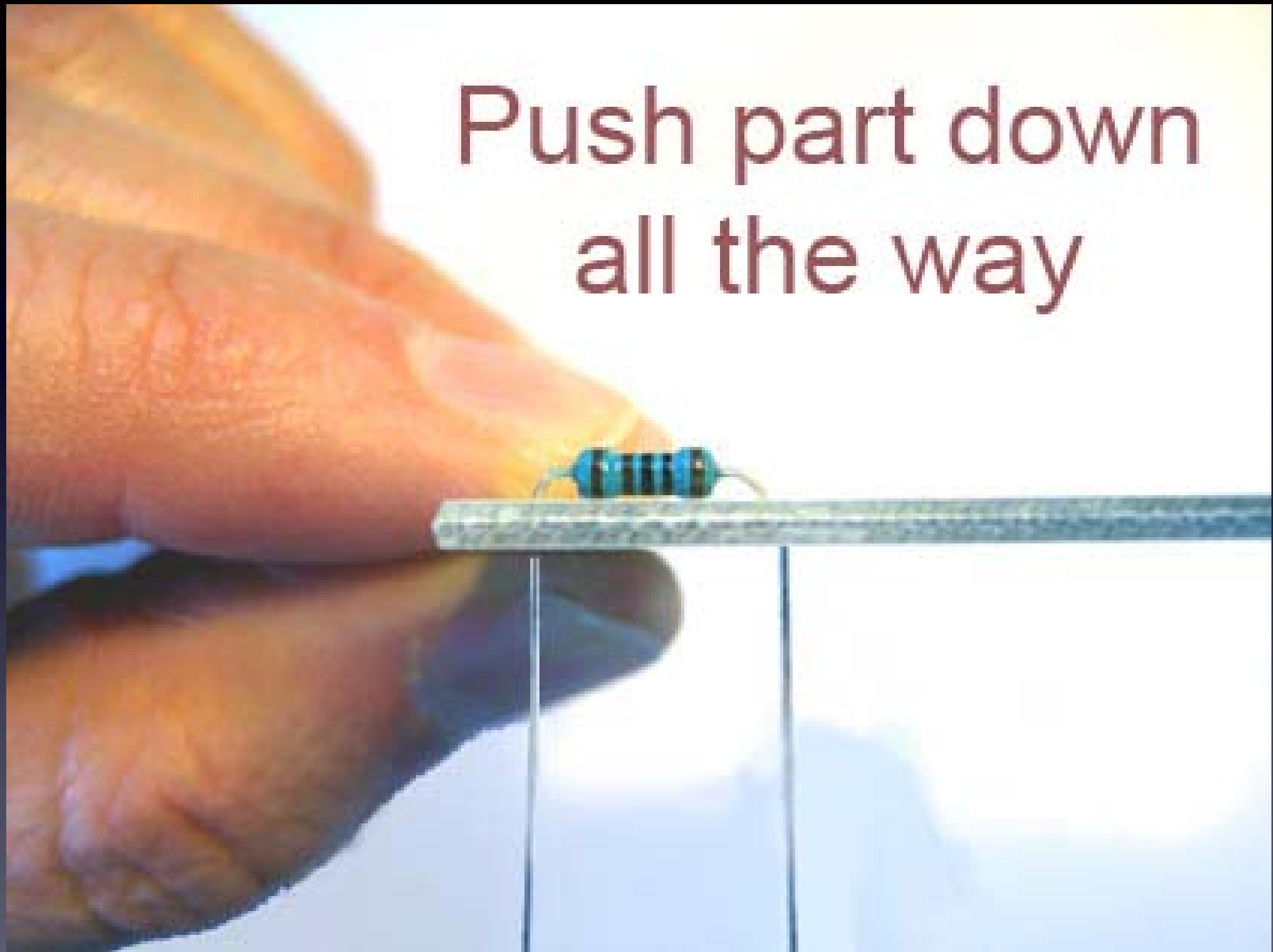
Insert leads into pads

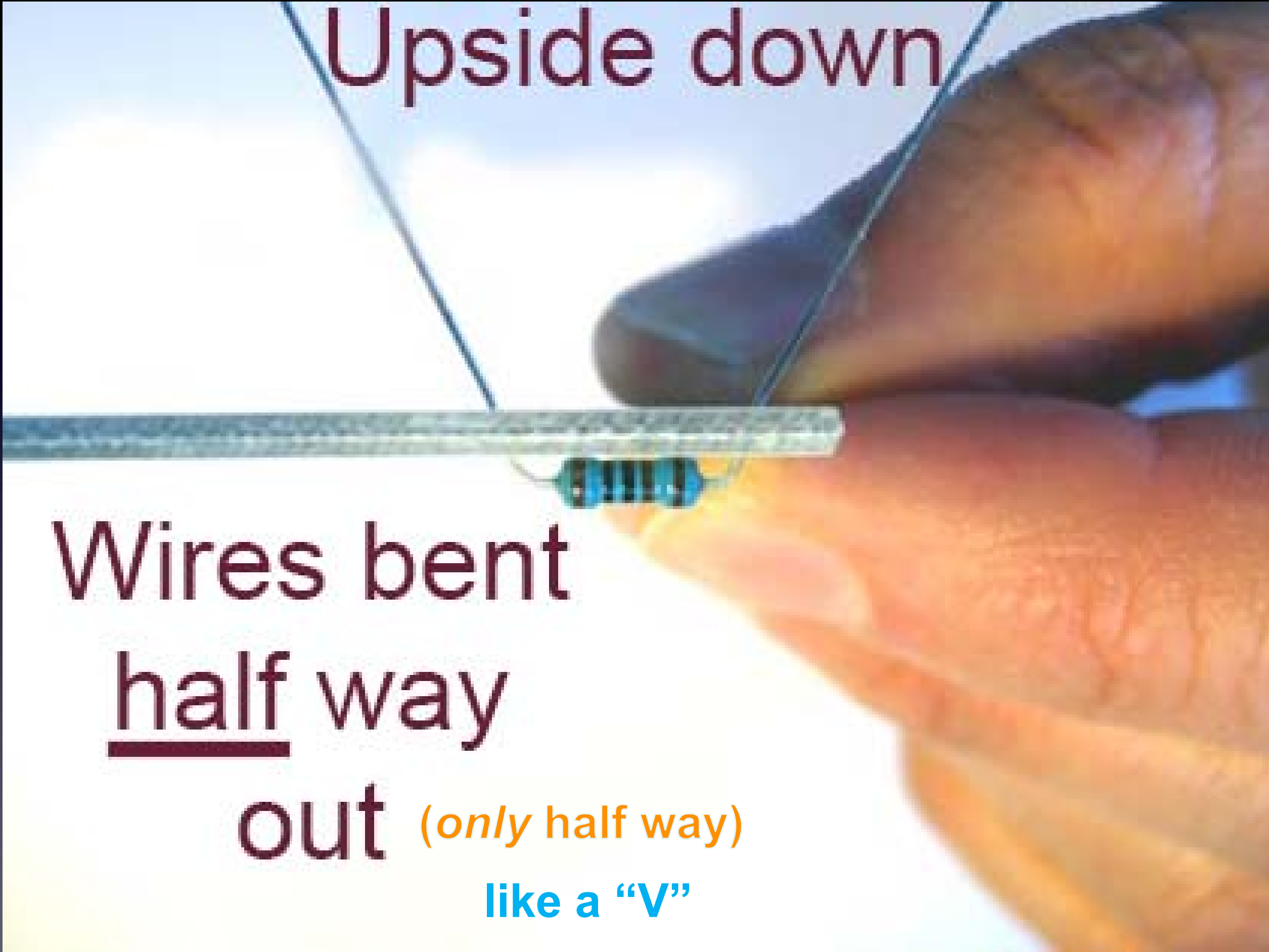
the circles with
holes in them are
called "pads"

there is one "pad"
per lead for each
part



Push part down
all the way

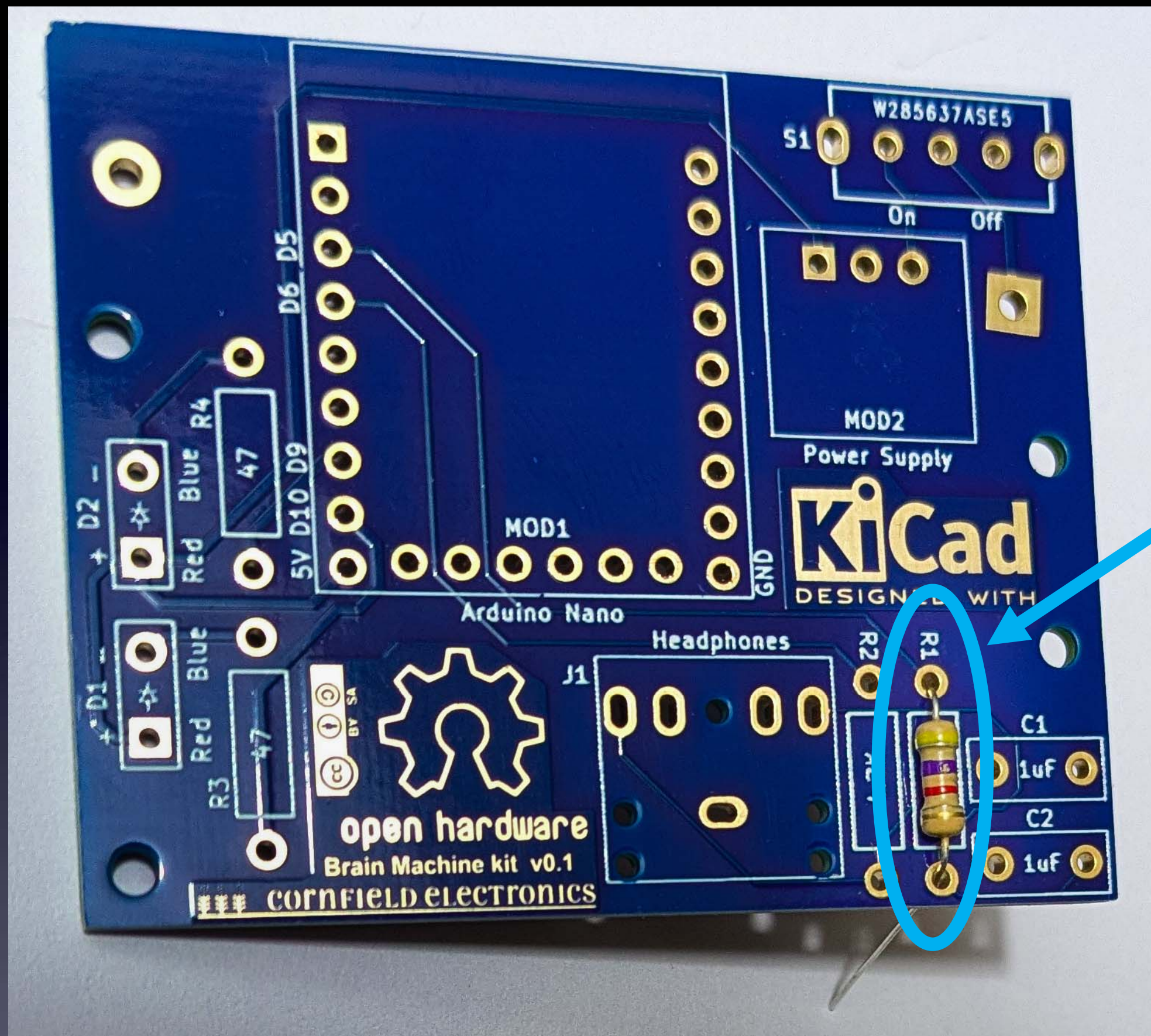


A close-up photograph of a person's hand holding a thin metal wire. A small, cylindrical electronic component, likely a resistor, is attached to the wire. The wire is bent into a V-shape at the point where the component is attached. The background is a plain, light-colored surface.

Upside down

Wires bent
half way
out *(only half way)*
like a “V”

so that the part won't fall out while soldering it



Direction does not matter

R1 – inserted into the board



How to hold a soldering iron

(Like a pencil – held from underneath)

Important

The best kind of solder for DIY electronics:

(Sn – Tin / Pb – Lead)

63/37 rosin core,

0.031" (0.8mm) diameter (or smaller)

(60/40 is also good)

Note:

Most

***Lead-Free* solder**

has poisonous fumes!

This is what we will use:

A good kind of solder for DIY
electronics:

*This is the only good **Lead-Free** solder I have found!*
(after years of searching)



Kester
K100LD Rosin
(not "No Clean")
0.031" diameter (0.8mm)

This is what we will use:

A good kind of solder for DIY electronics:

*This is the only good **Lead-Free** solder I have found!*
(after years of searching)



Kester **K100LD Rosin** Solder

0.031" diameter (0.8mm)

Note:

Since we will use **Lead-Free** solder
it is *helpful*
to also have
flux paste in a syringe
And Isopropyl Alcohol



99%



Another good kind of solder for DIY electronics:

*This is another good **Lead-Free** solder I have found!*



**Duratool
D01685 Rosin**

0.7mm diameter

*(as good as the
Kester K100LD Rosin)*

Another good kind of solder for DIY electronics:

*This is another good **Lead-Free** solder I have found!*



**MG Chemicals
4900 Rosin (112g, 227g, 454g)**

0.8mm diameter

*(as good as the
Kester K100LD Rosin)*

3 Safety Tips...

Safety Tip #1:

Hot !!

(When you touch the tip,
you will let go quickly every time!)

Safety Tip #2:

Soldering chemicals
are toxic

But they easily wash off your hands
with soap and water

Safety Tip #3:

(coming soon)

2 secrets
to good soldering...

Secret #1:

Clean the tip!

(before every solder connection)

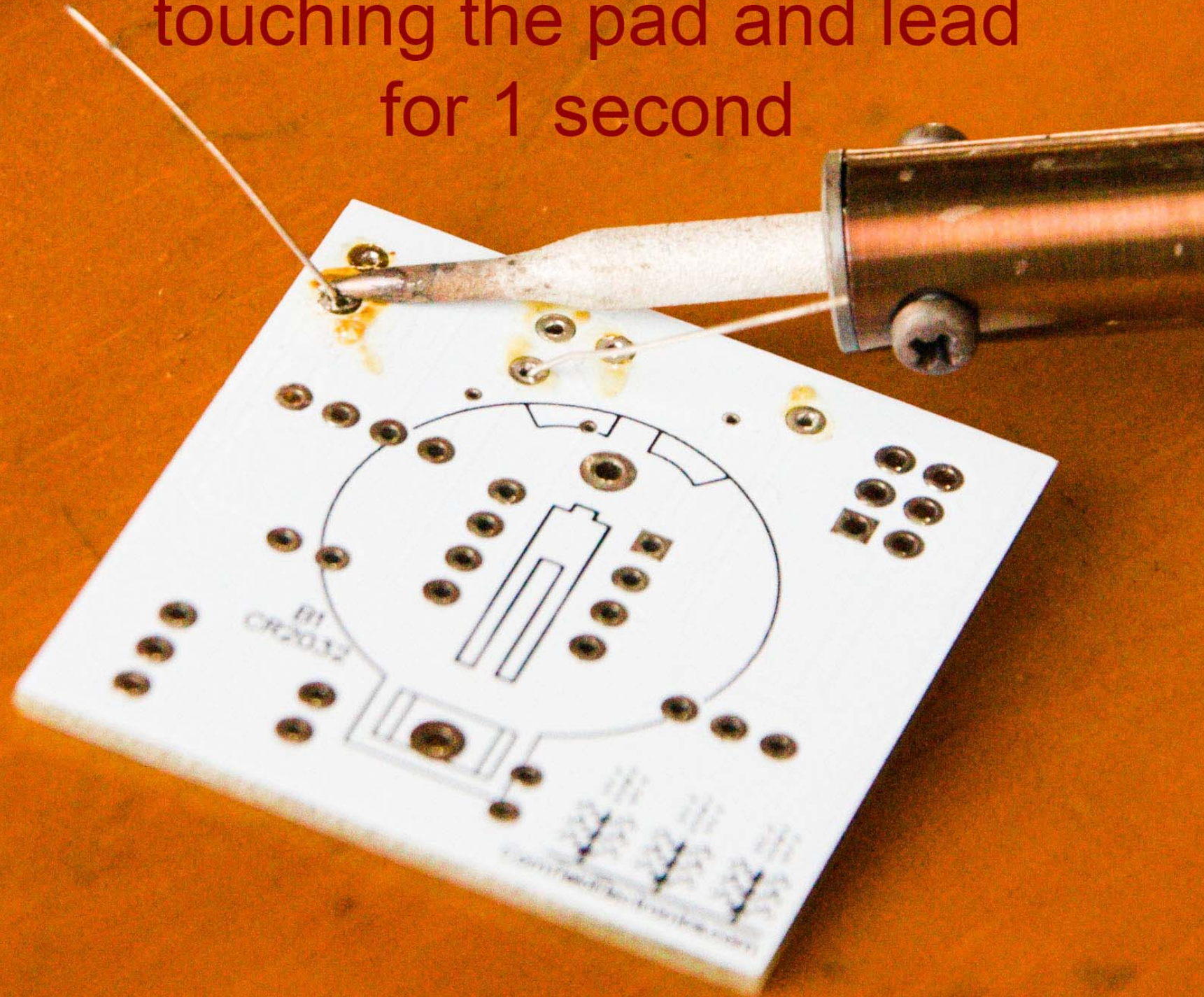
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

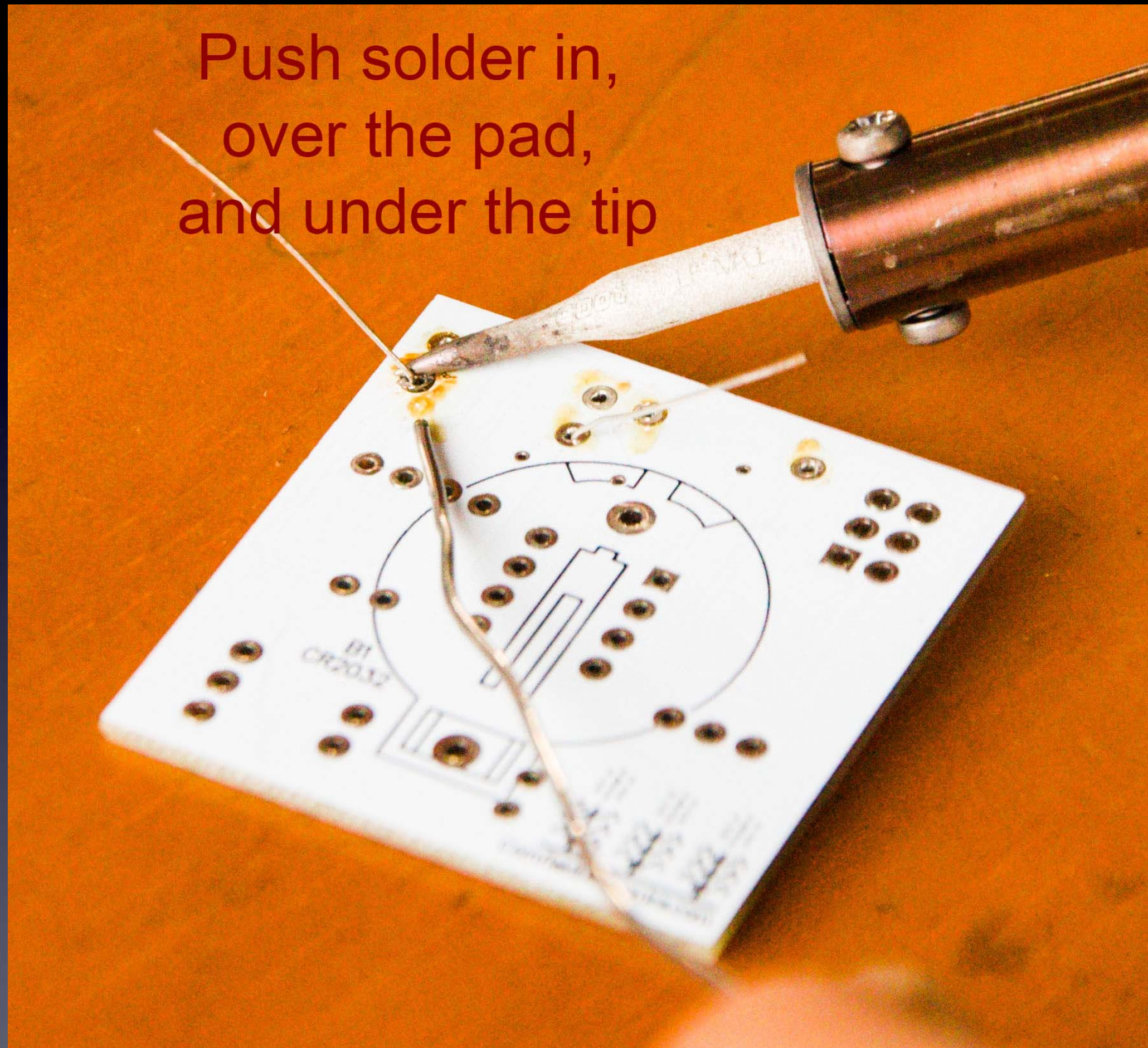
Keep the tip shiny silver!

knock solder off the tip

Lay clean tip across half of the pad,
touching the pad and lead
for 1 second

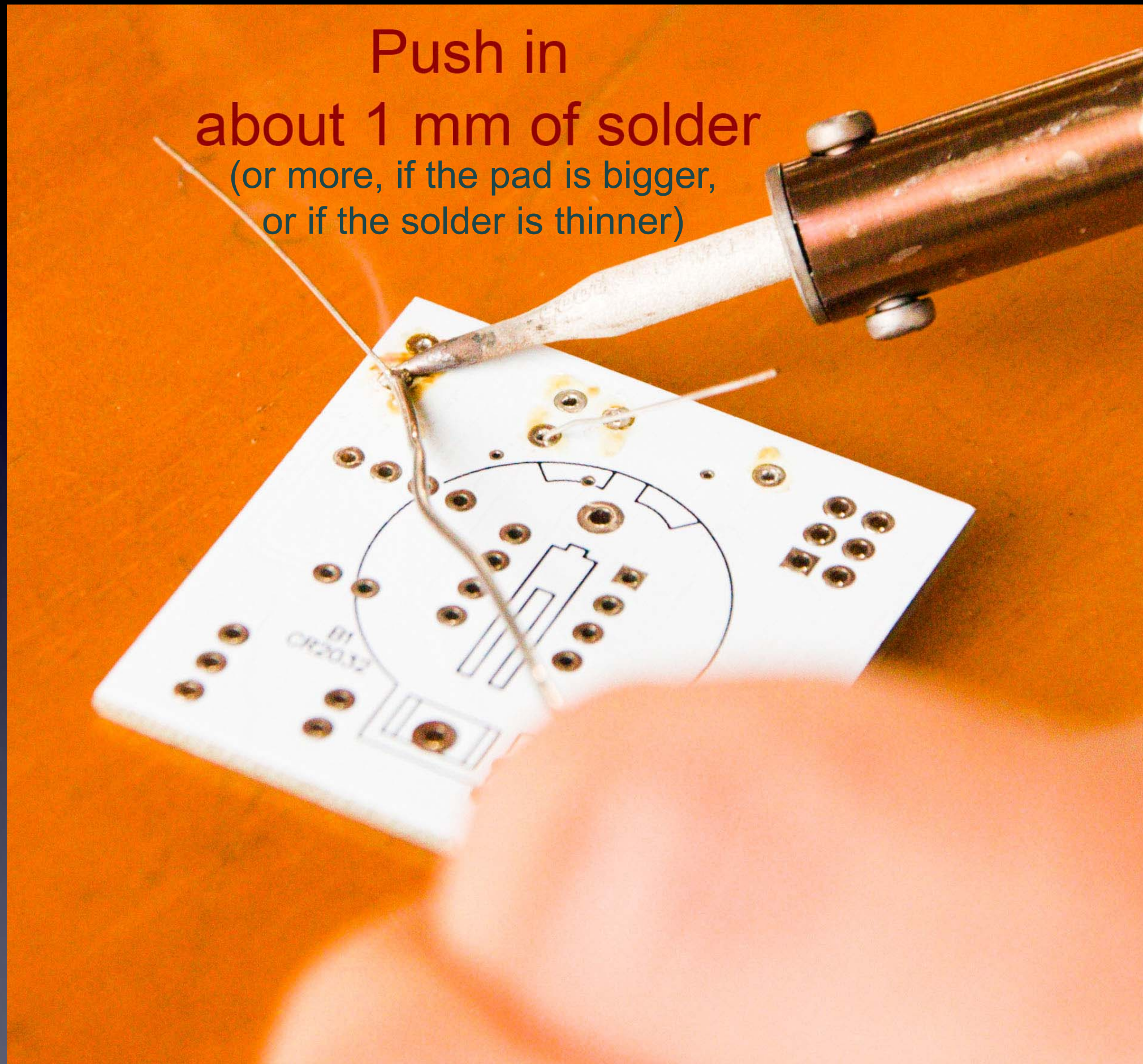


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second



Make sure solder melts on the underside of the soldering iron tip
(not the side or top of the soldering iron tip)!

Do this quickly (slowly doesn't work well) – solder in & out in about 1 second



Make sure solder melts on the underside of the soldering iron tip
(not the side or top of the soldering iron tip)!



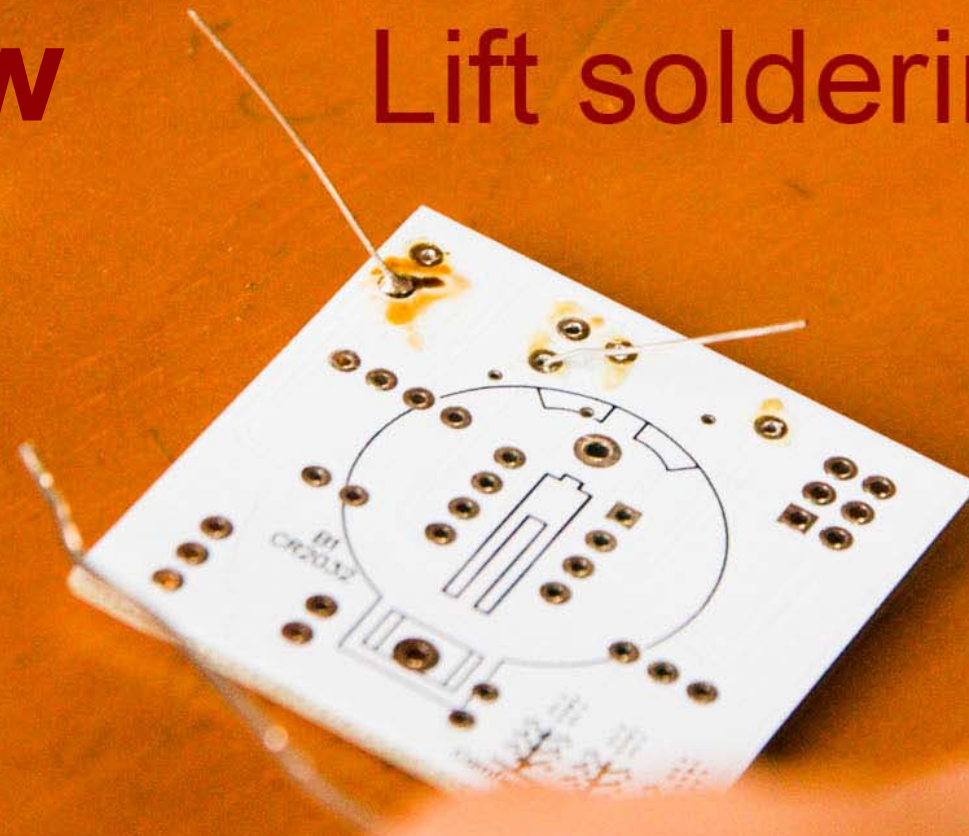
Pull solder away,
But keep holding soldering iron down
for 1 more second !!

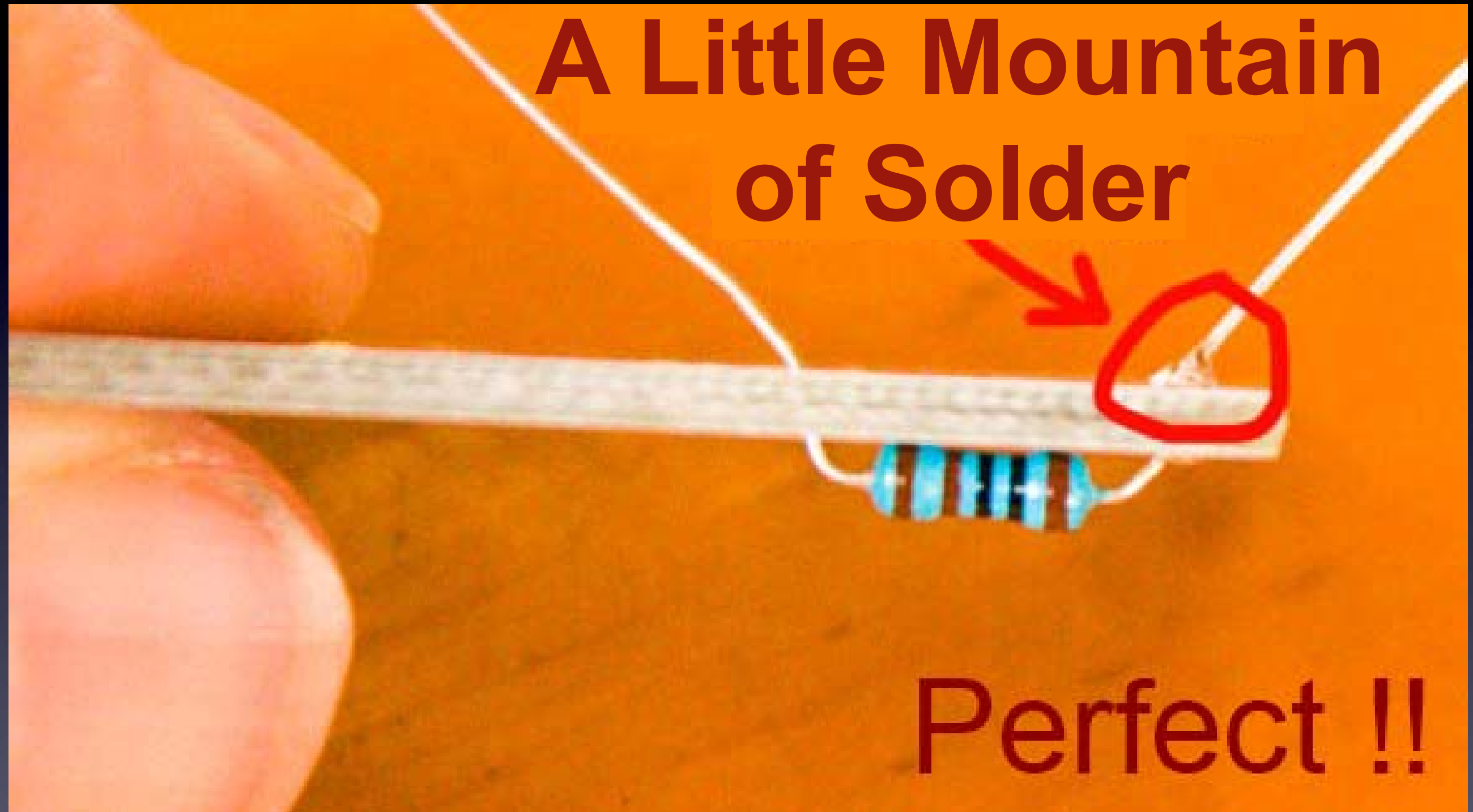
Secret #2:

Keep hot tip down
1 second
for solder to flow !!

Now

Lift soldering iron





If you can see any of the pad, or the hole, you need more solder
– so, just do all the steps again to make it perfect.

The Rhythm !

is just as important as the preceding steps!

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



The Rhythm !
and speed (about 1 second per step)



Tip **Down**

The Rhythm !
and speed (about 1 second per step)



Solder **In**

The Rhythm !
and speed (about 1 second per step)



Solder **Out**

The Rhythm !
and speed (about 1 second per step)



WAIT !

The Rhythm !
and speed (about 1 second per step)



Lift Tip

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



The Rhythm !
and speed (about 1 second per step)



Tip **Down**

The Rhythm !
and speed (about 1 second per step)



Solder **In**

The Rhythm !
and speed (about 1 second per step)



Solder **Out**

The Rhythm !
and speed (about 1 second per step)



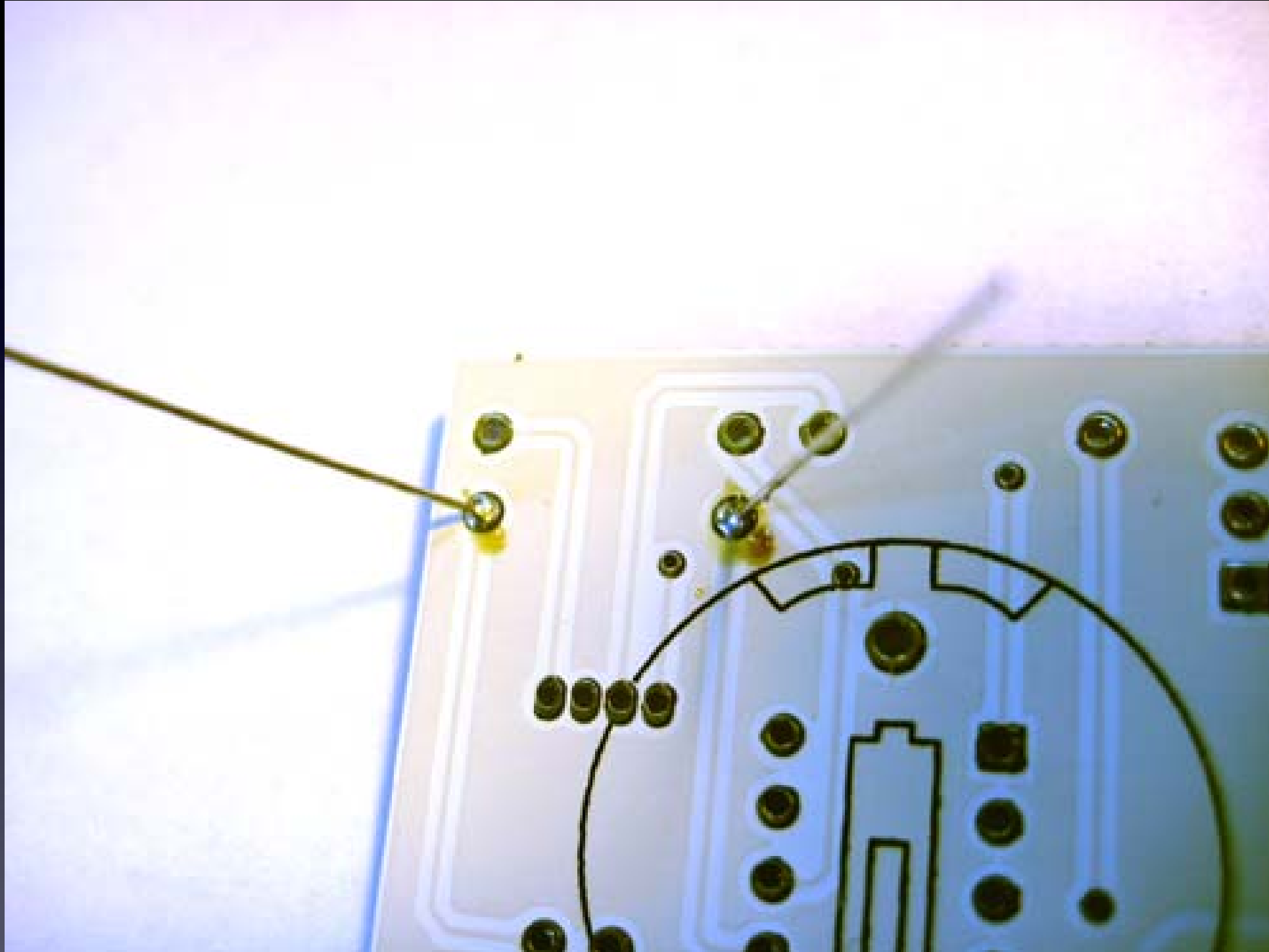
WAIT !

The Rhythm !
and speed (about 1 second per step)



Lift Tip

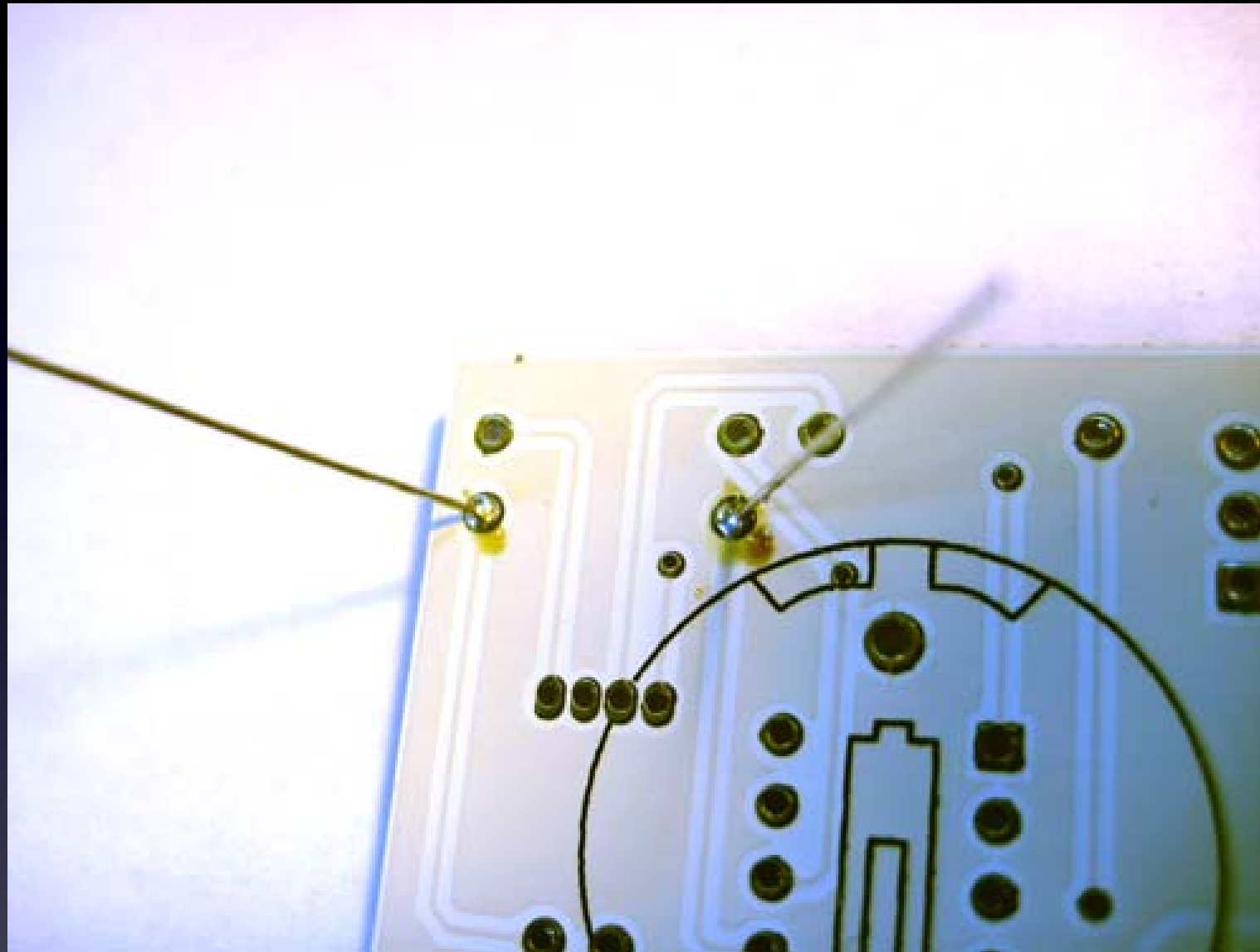
Solder all of the leads of the part to the board



For this part, there are two leads

Here you can see two good solder connections

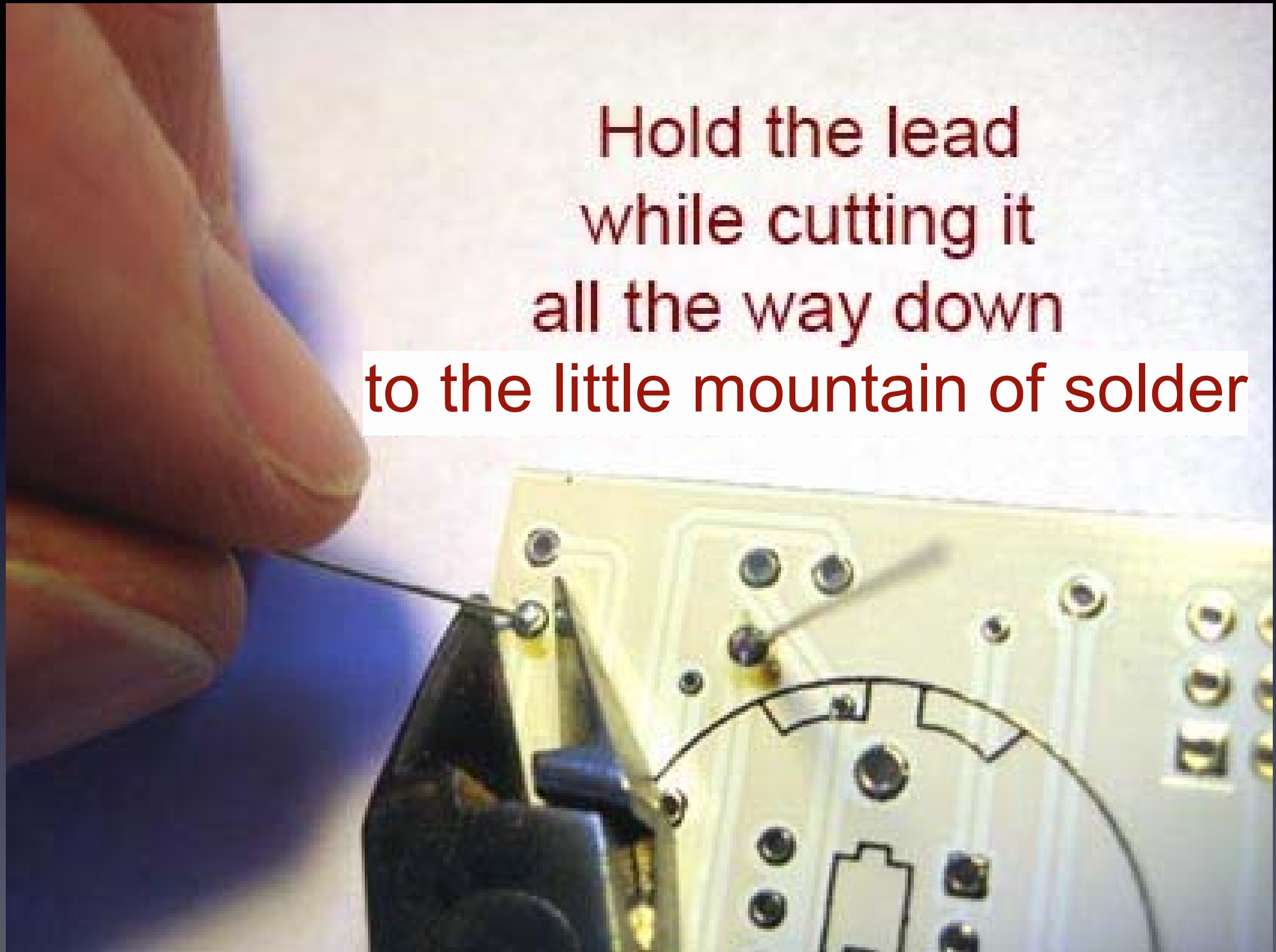
Two good solder connections



- Little mountains (not flat)
- Pads totally covered in solder
- Can't see the hole
- No connections to other pads

Now cut the leads short

Hold the lead
while cutting it
all the way down
to the little mountain of solder



Cutting with the tip of the wire cutter gives you more control

Safety Tip #3:

Hold or cover the lead !

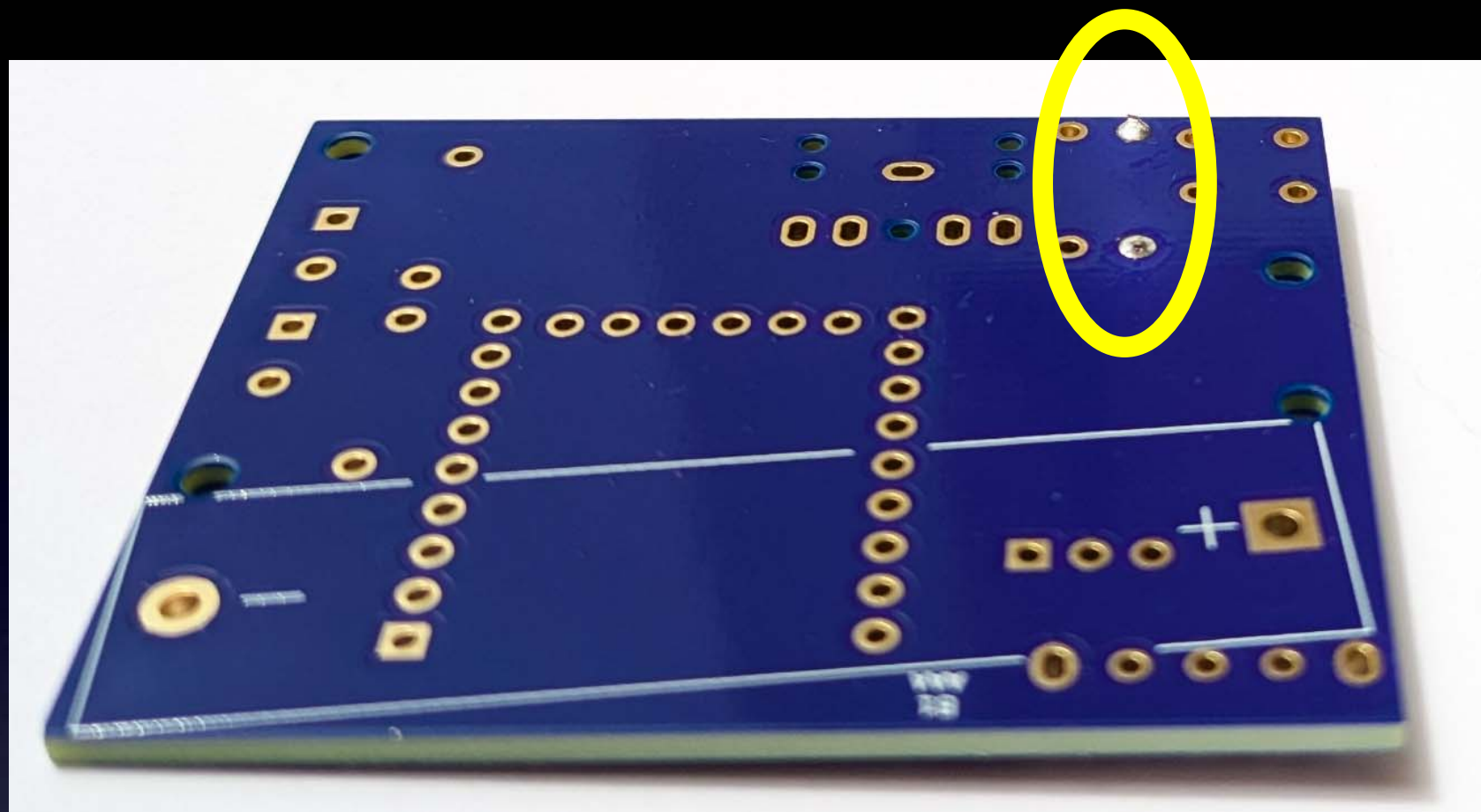
(or it will fly into your eye!)

(They like doing that – so please hold or cover the lead when you cut.)



All done !

No wires sticking out



2 good solder connections

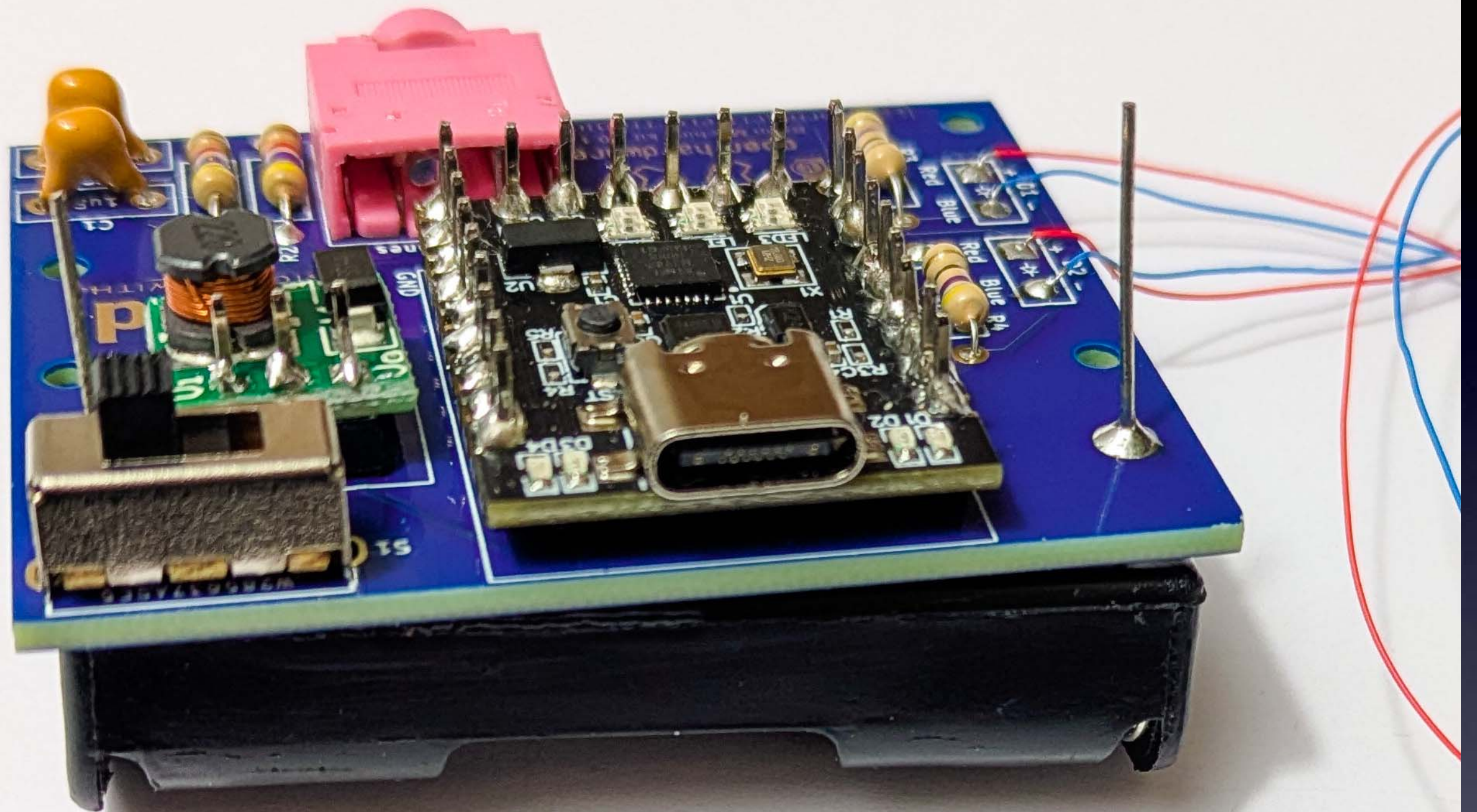
R1 soldered to the board

Notice that:

- Each connection is a small mountain (not flat)
- You cannot see any pad (they're totally covered with solder)
- You cannot see the holes (they're totally covered with solder)
- No connections to other pads

One part at a time

Till all the parts are soldered

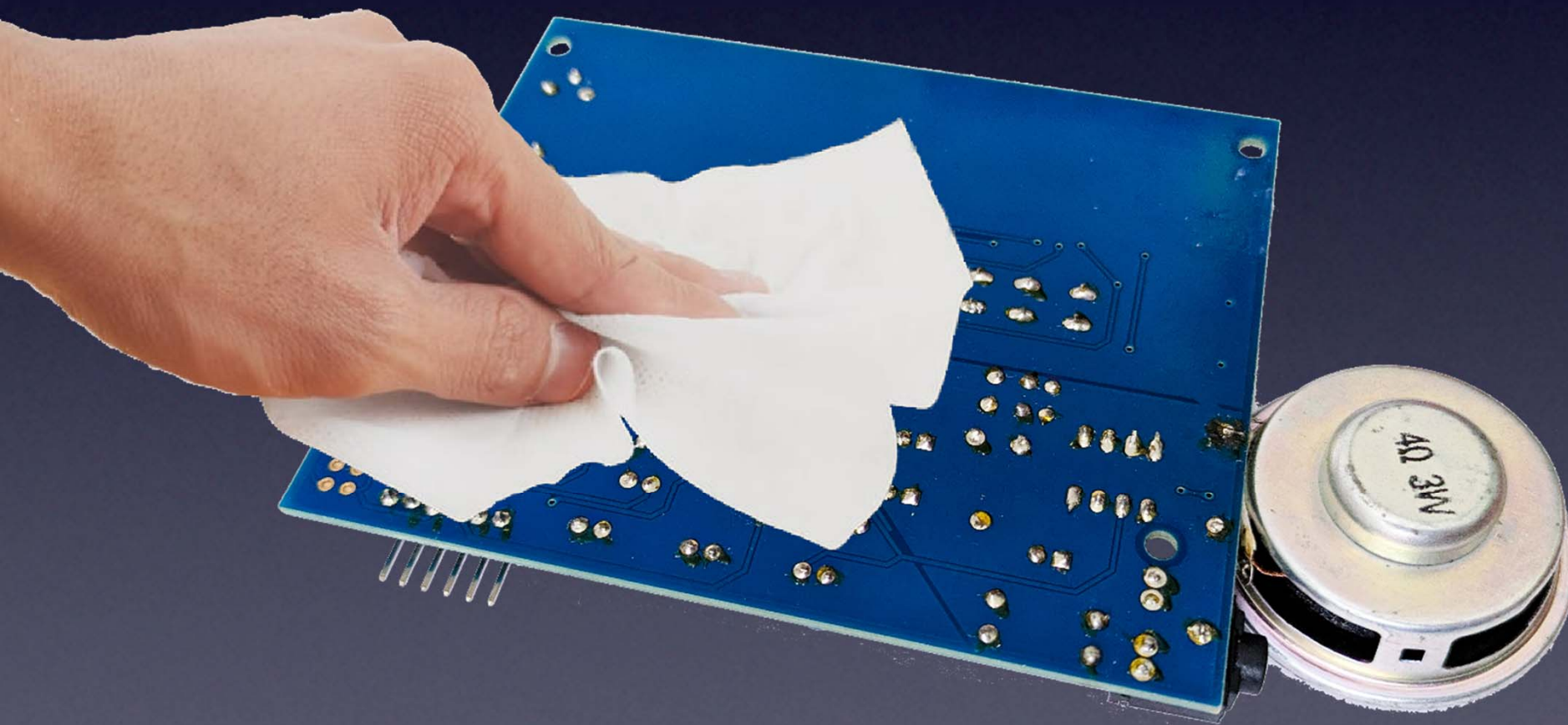


And it will look like this when you're done soldering.

If you used any *flux paste* for re-working problems



The bottom of the PCB will be sticky from the flux



You can clean it with a cloth wet with *Isopropyl Alcohol*

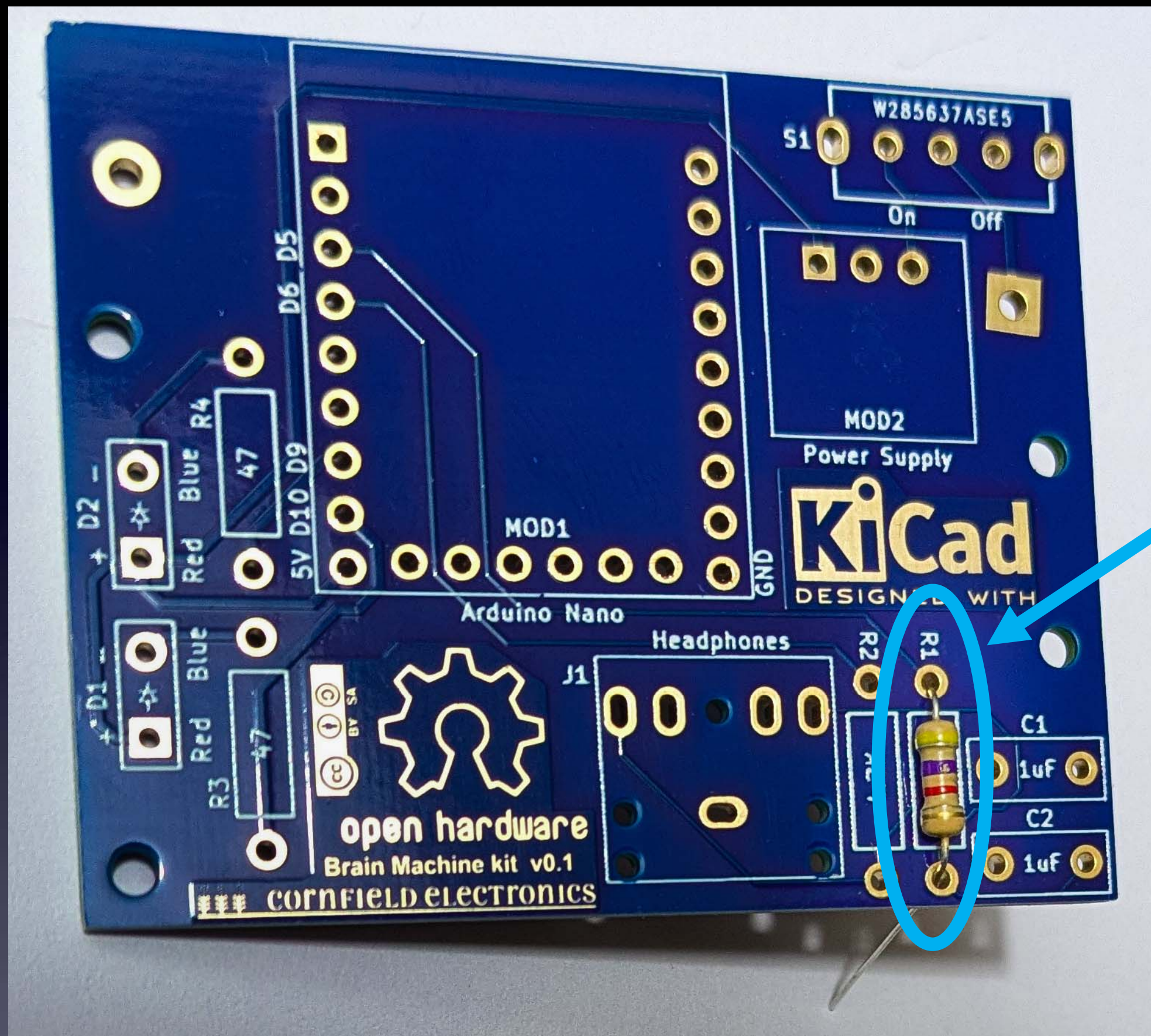
Then put in the battery,

Turn it on,

And it works!

(Or you start debugging.)

Let's start!



Direction does not matter

If you haven't done so already, solder R1: Yellow, Violet, Red

R1, R2:

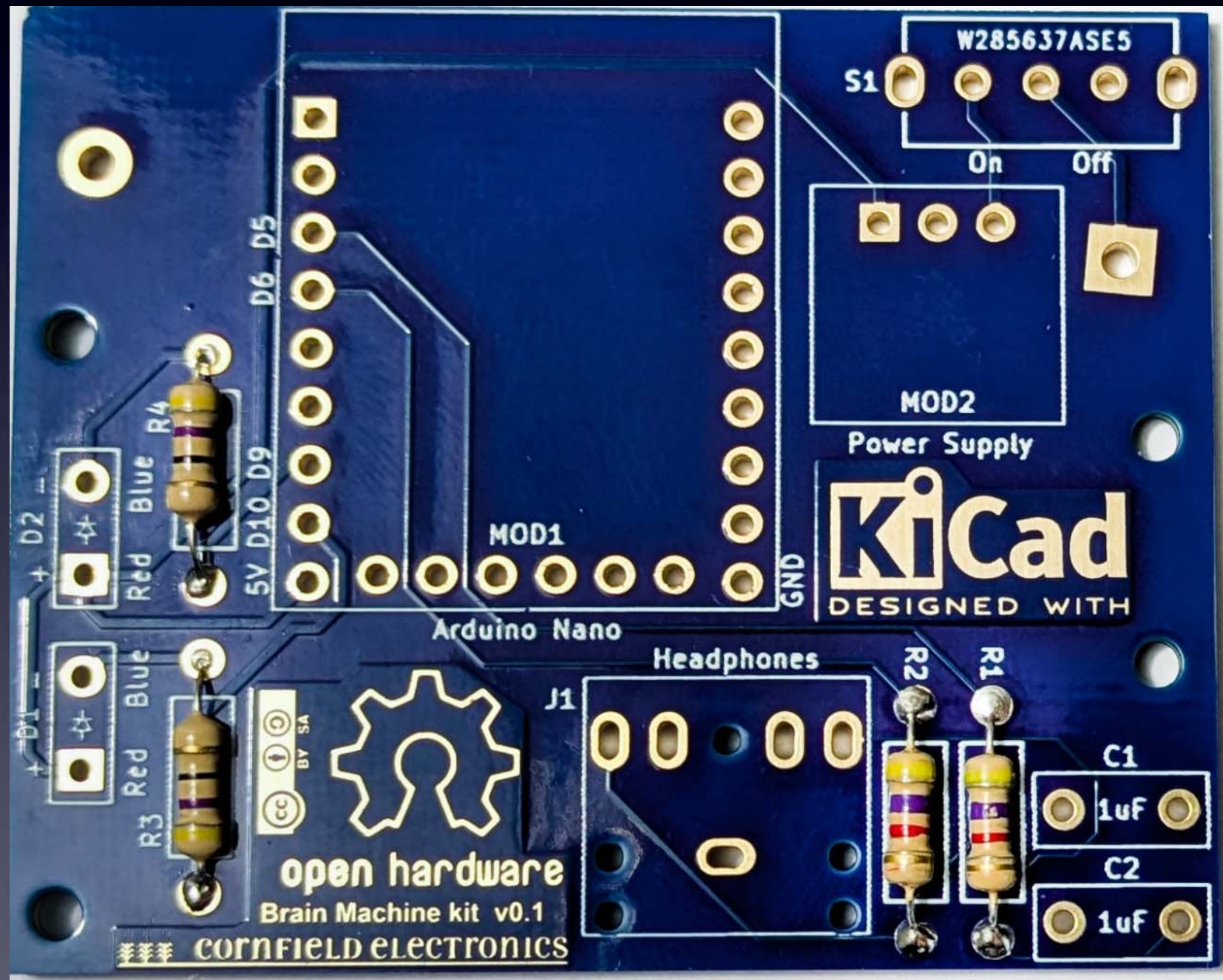


4.7K: Yellow, Violet, Red

R3, R4:



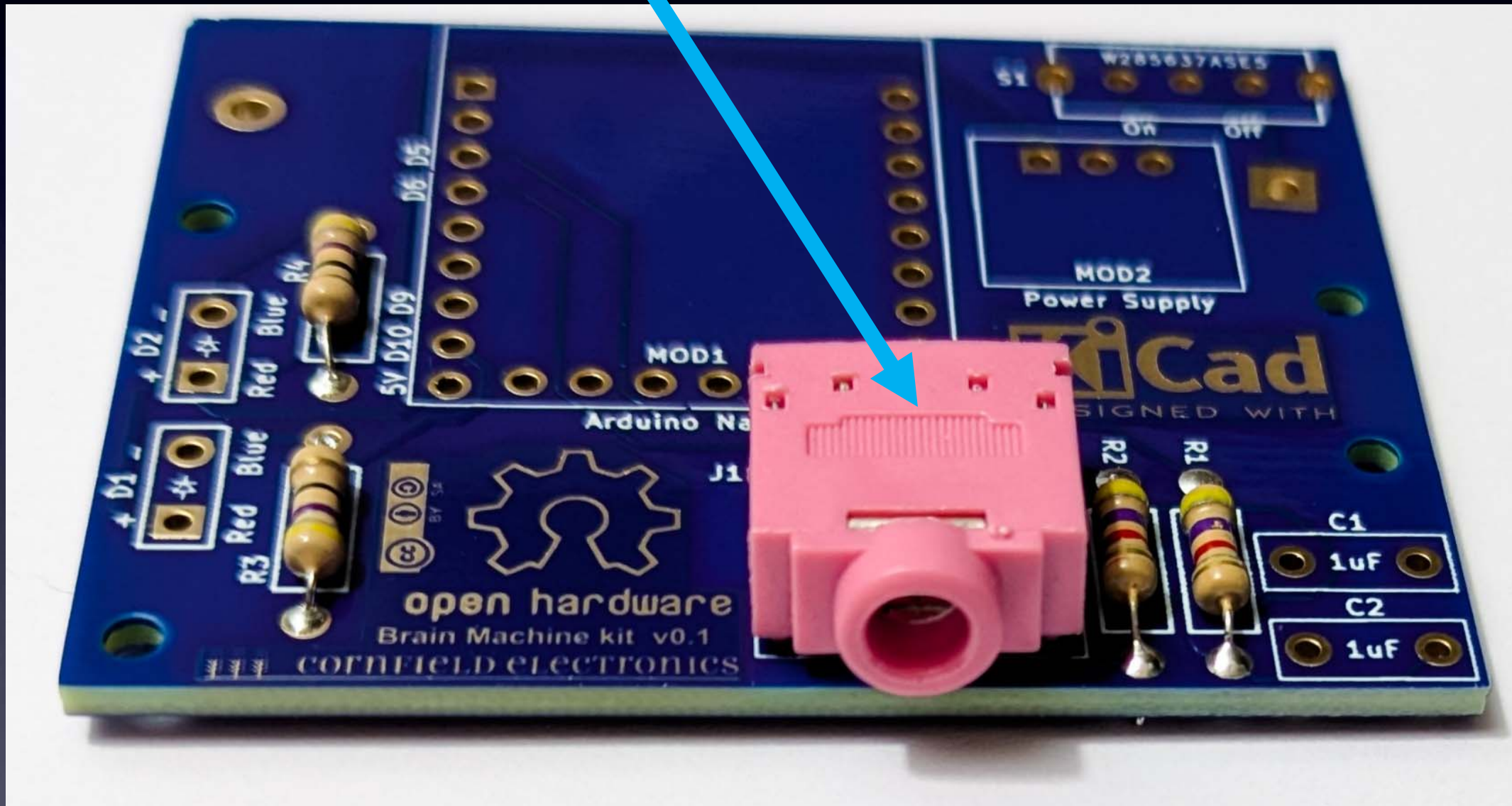
47: Yellow, Violet, Black



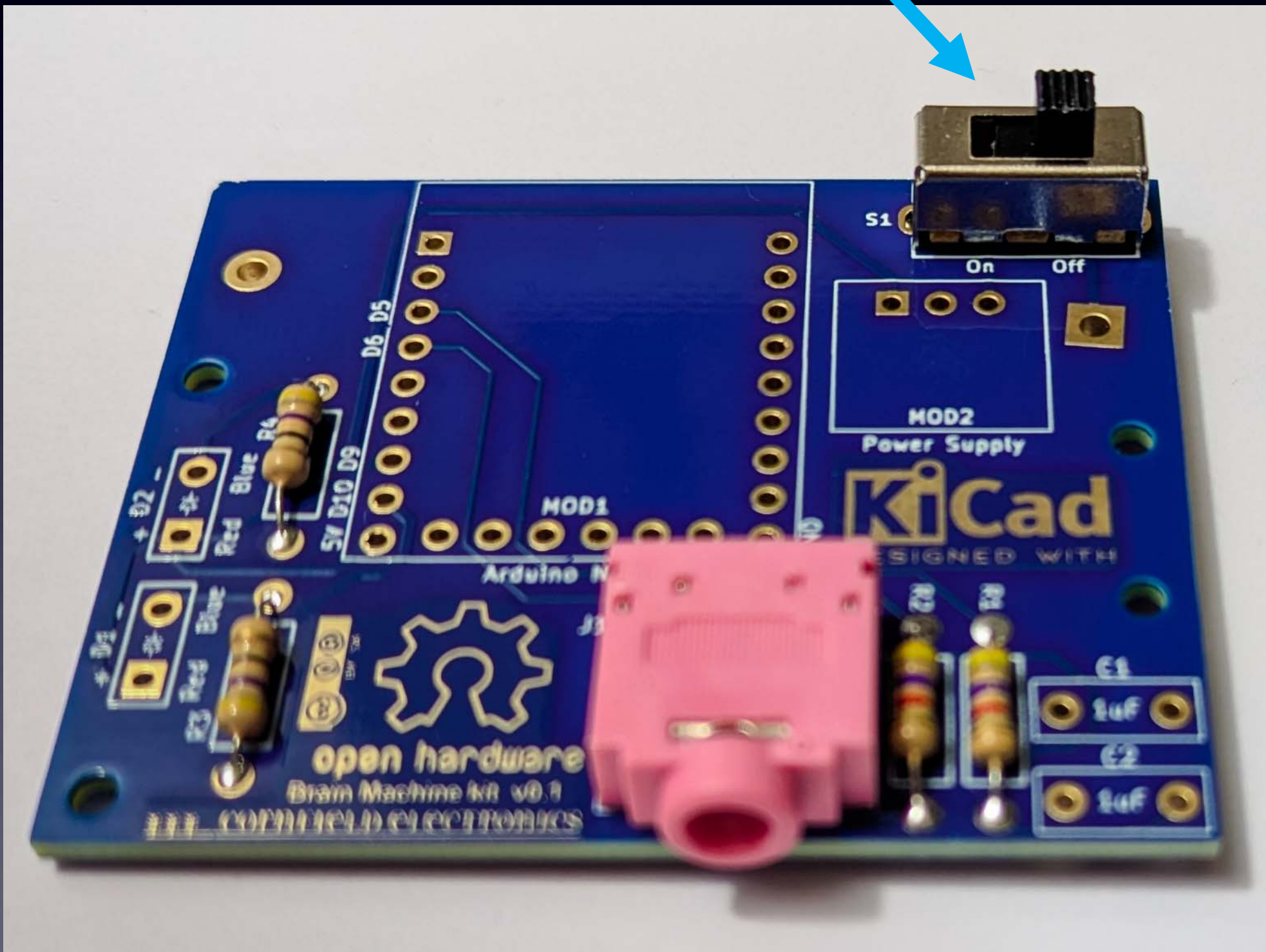
Direction does not matter

All 4 resistors

J1: Headphone Jack



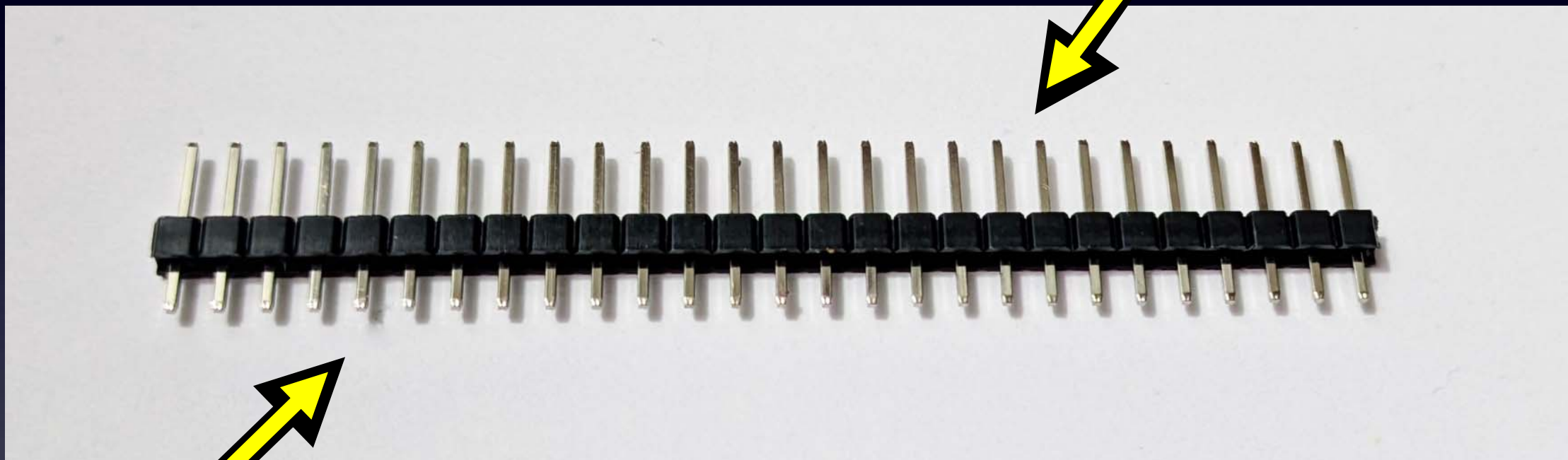
S1: On/Off switch



Direction does not matter

Pin Headers

long pins



27 pins

short pins

Pin Headers

long pins

short pins

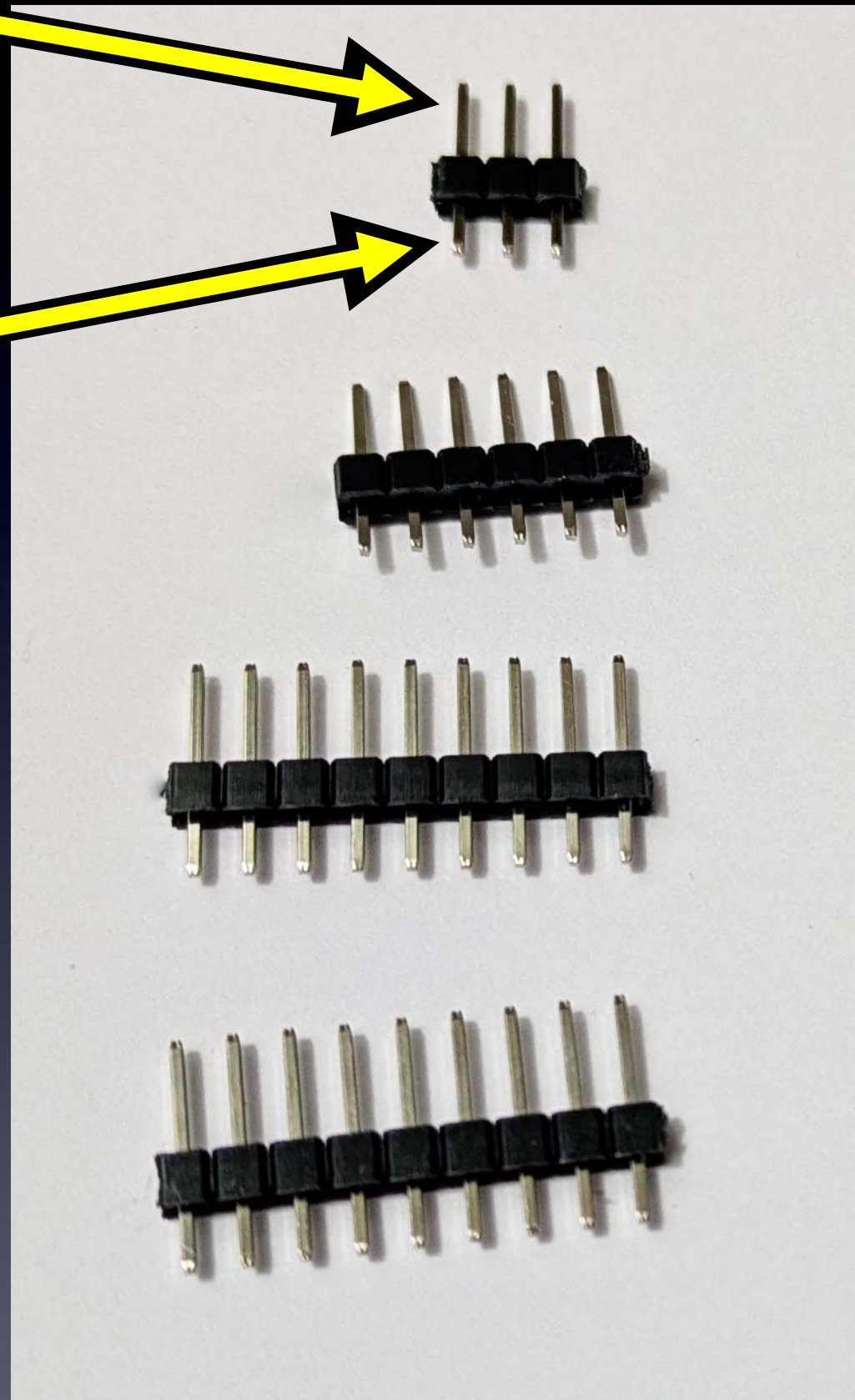
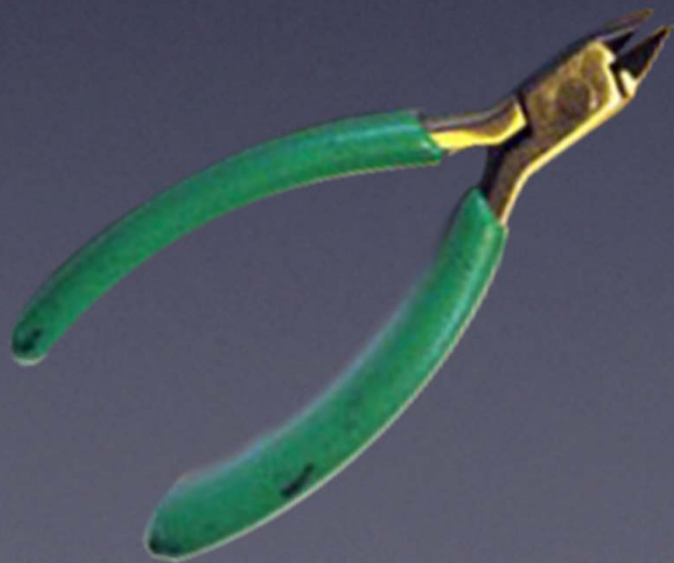
3 pins

6 pins

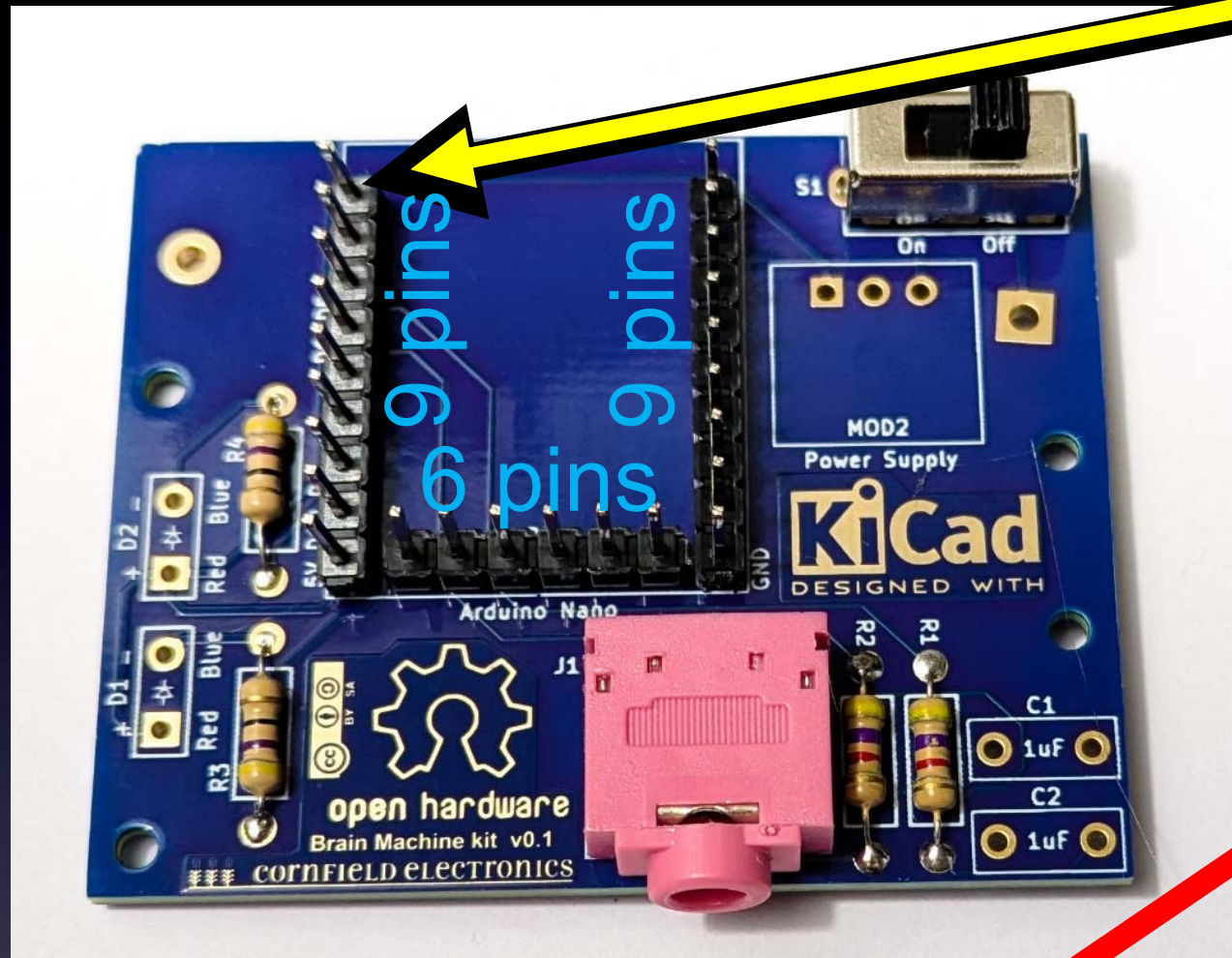
9 pins

9 pins

Use wire cutters



Pin Headers for Arduino Nano



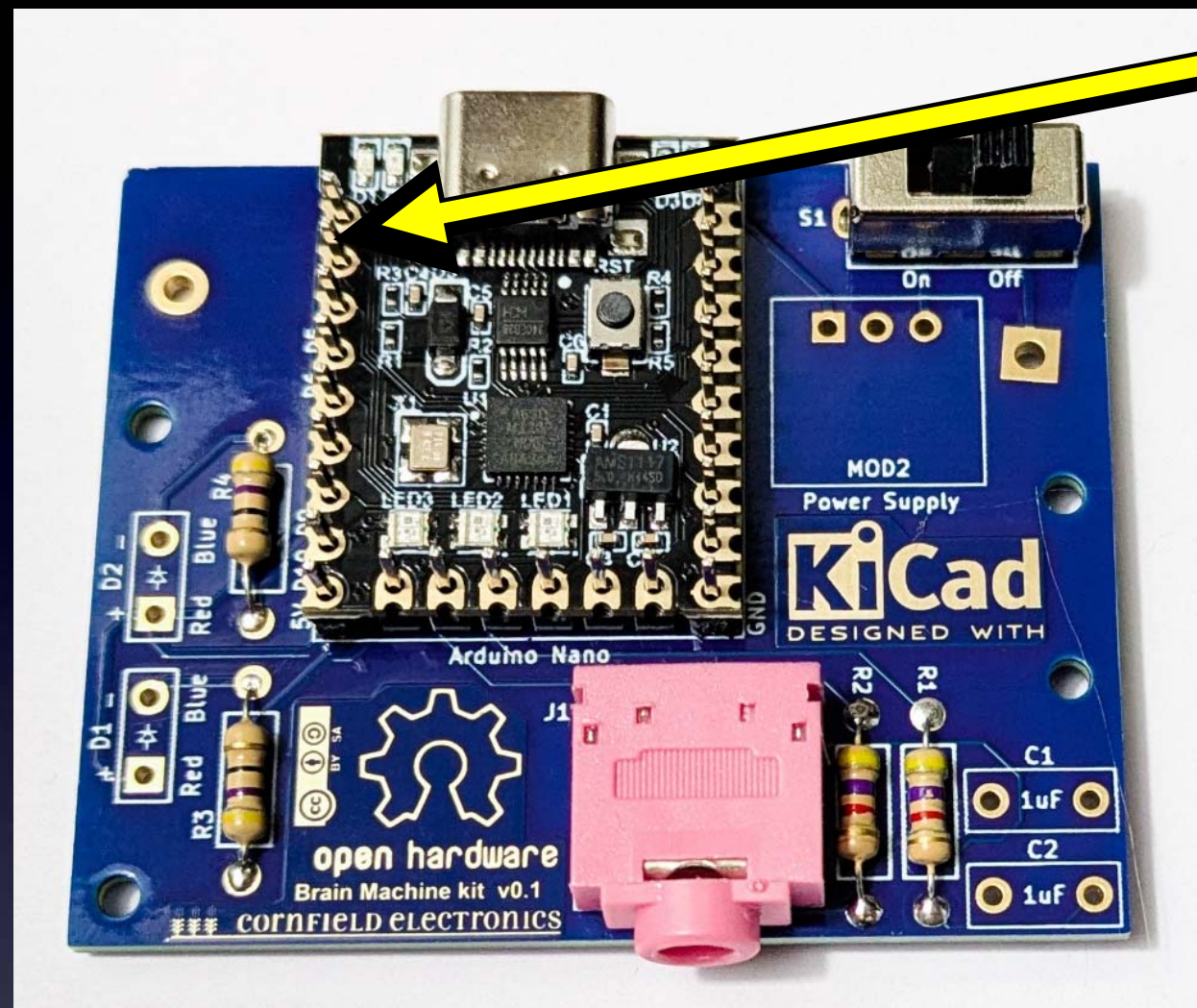
long pins sticking up

IMPORTANT!

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

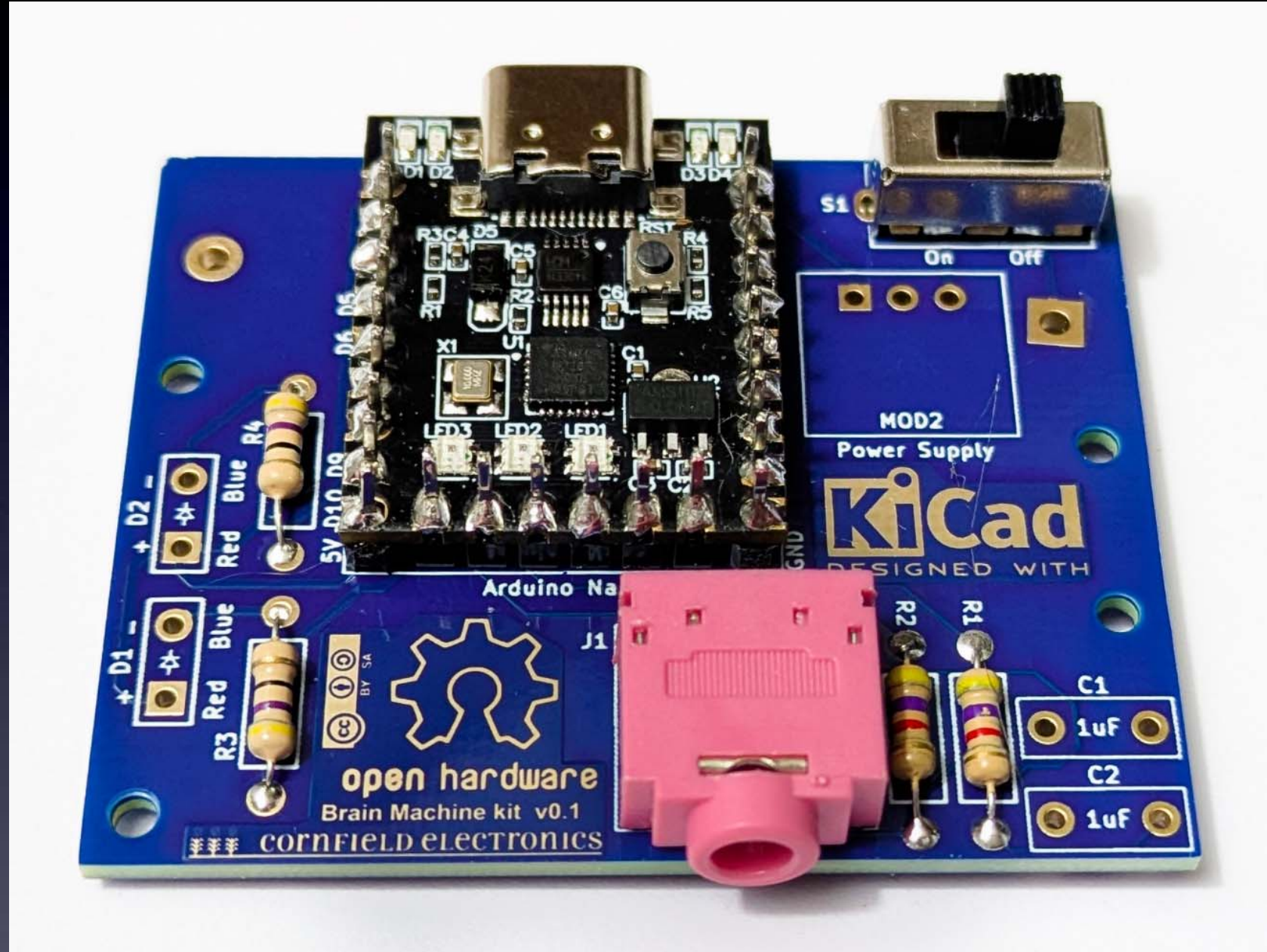
Arduino Nano placed on its pins



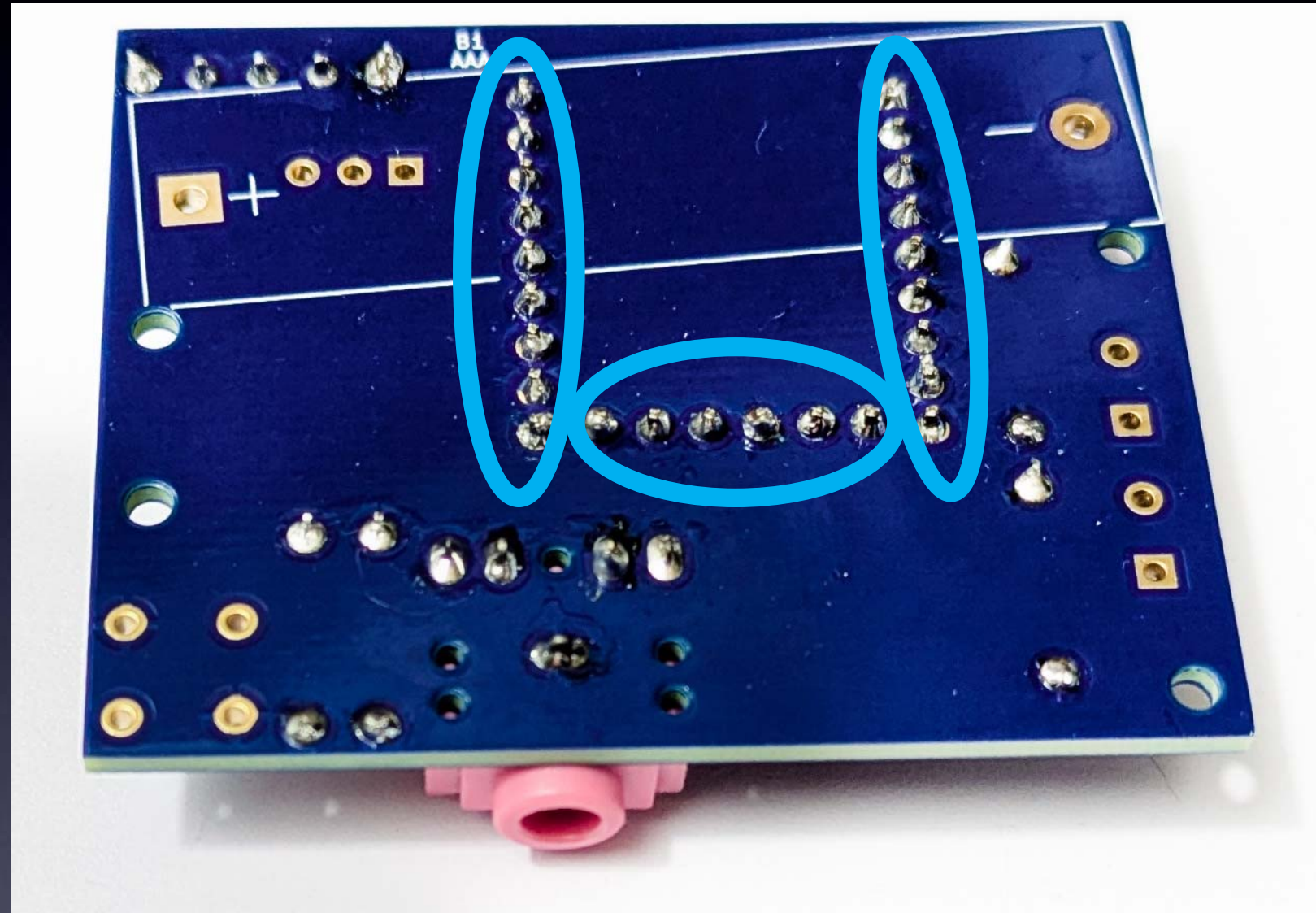
long pins sticking up

→ Short pins go into the board ! ←

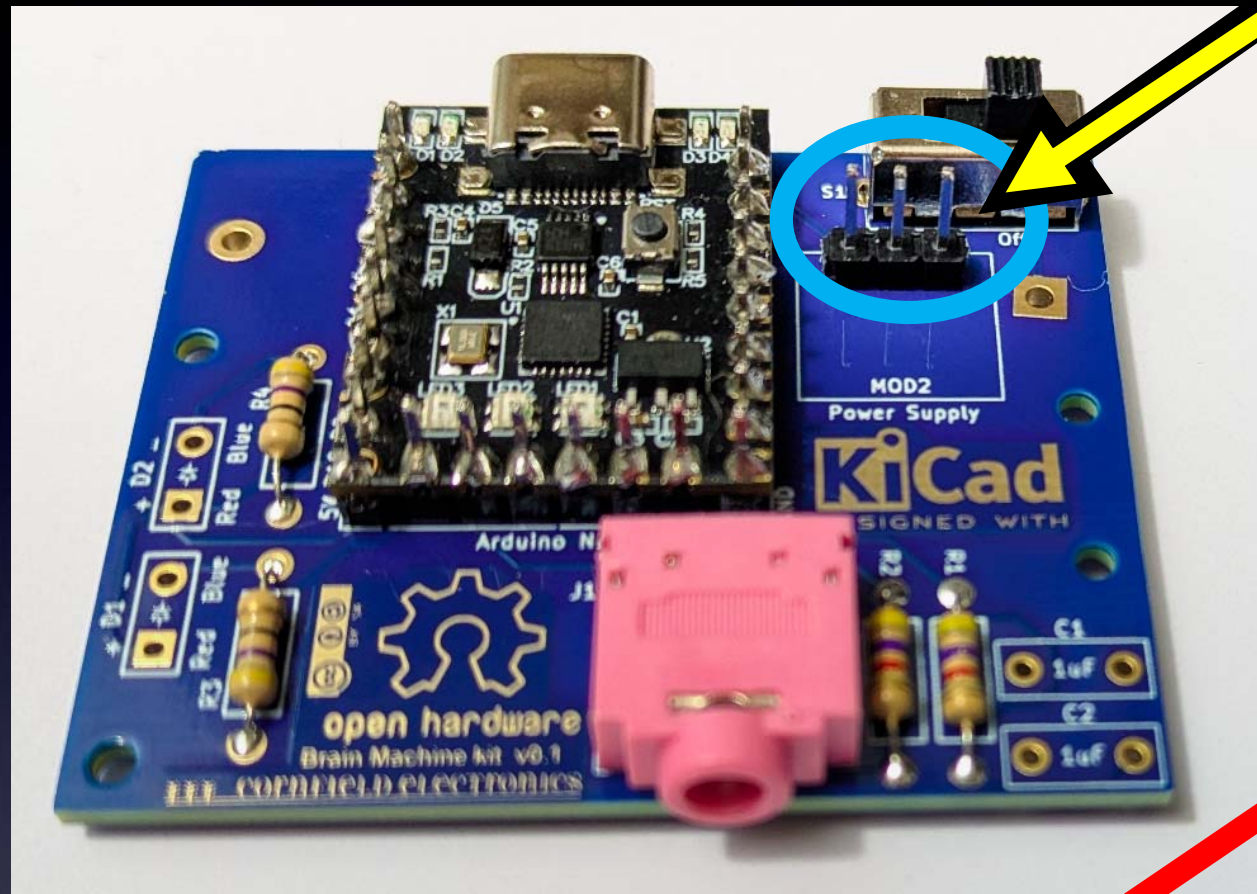
Arduino Nano soldered to its pins



Arduino Nano soldered to board



Pin Headers for Power Supply



long pins sticking up

3 pins

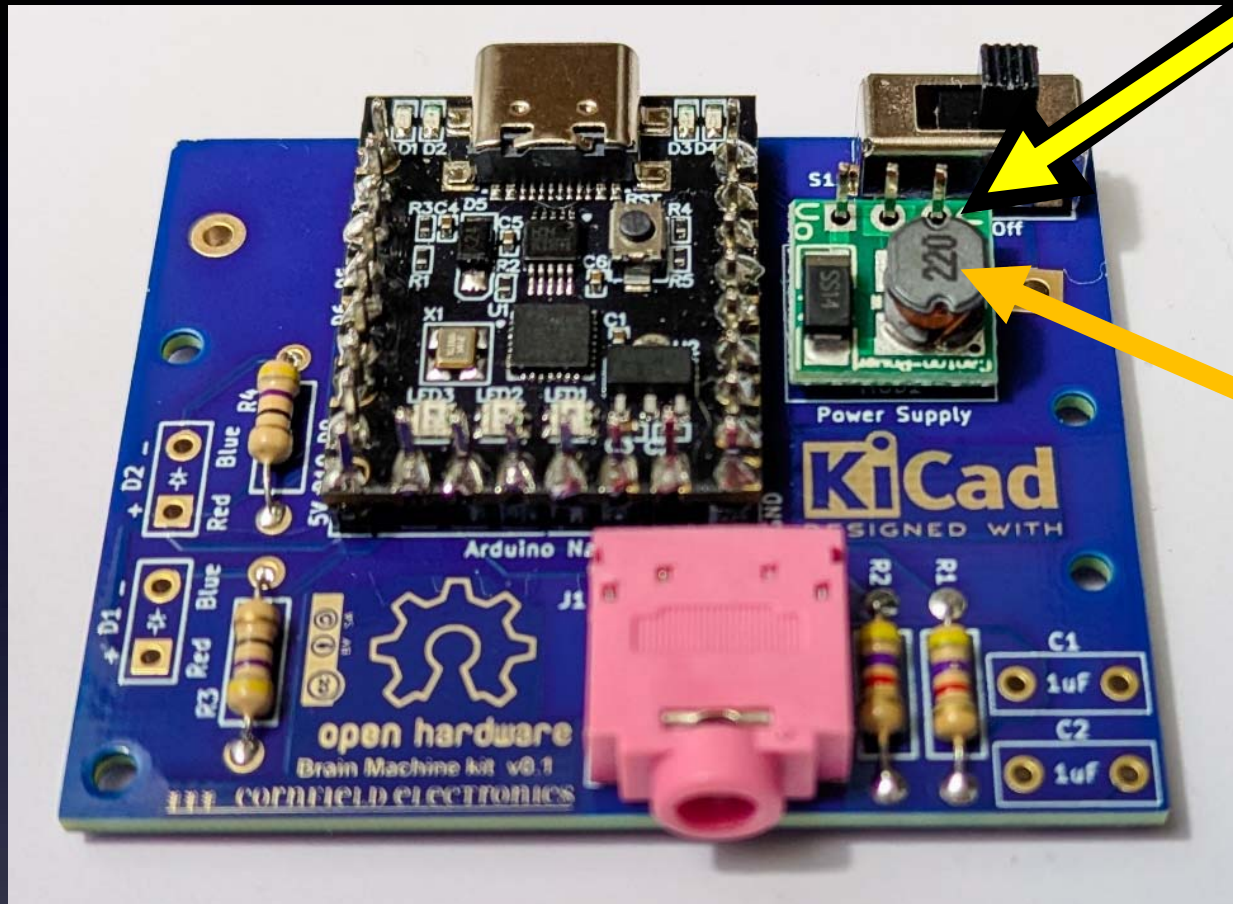
IMPORTANT!

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

Power Supply placed on its pins

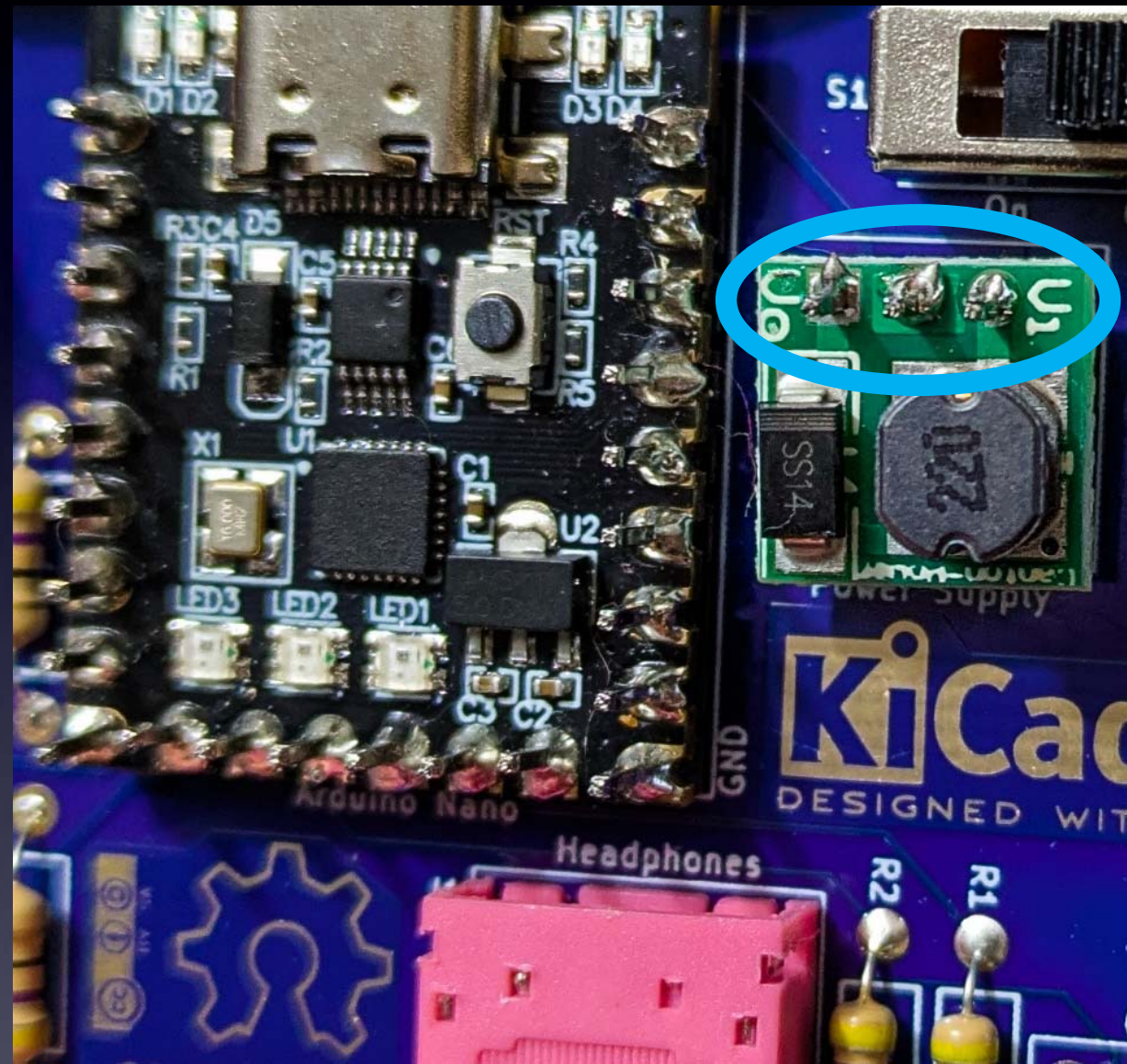
long pins sticking up



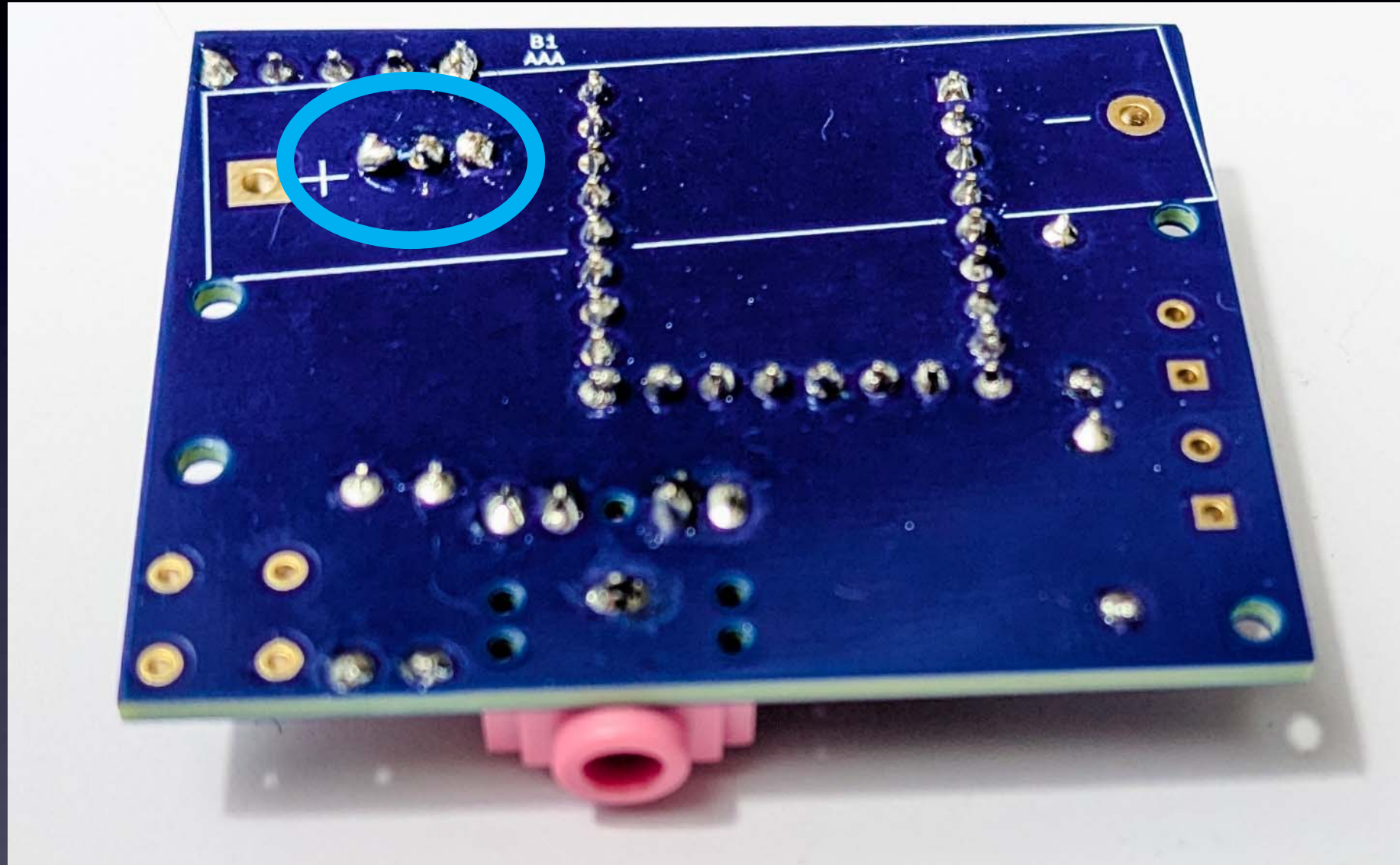
coil

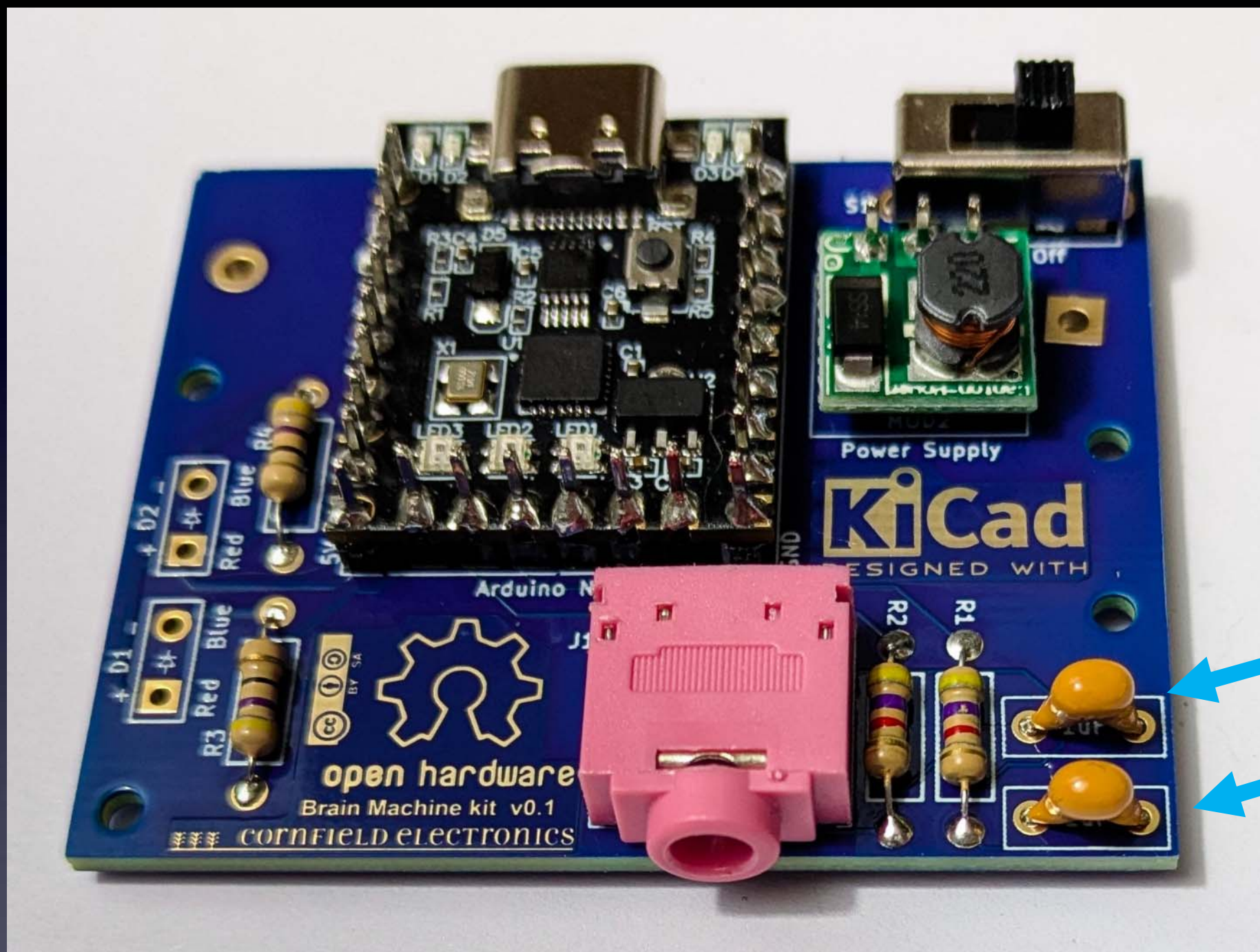
→ IMPORTANT: Power Supply must go in this way ! ←
(coil is facing up)

Power Supply soldered to its pins



Power Supply soldered to board



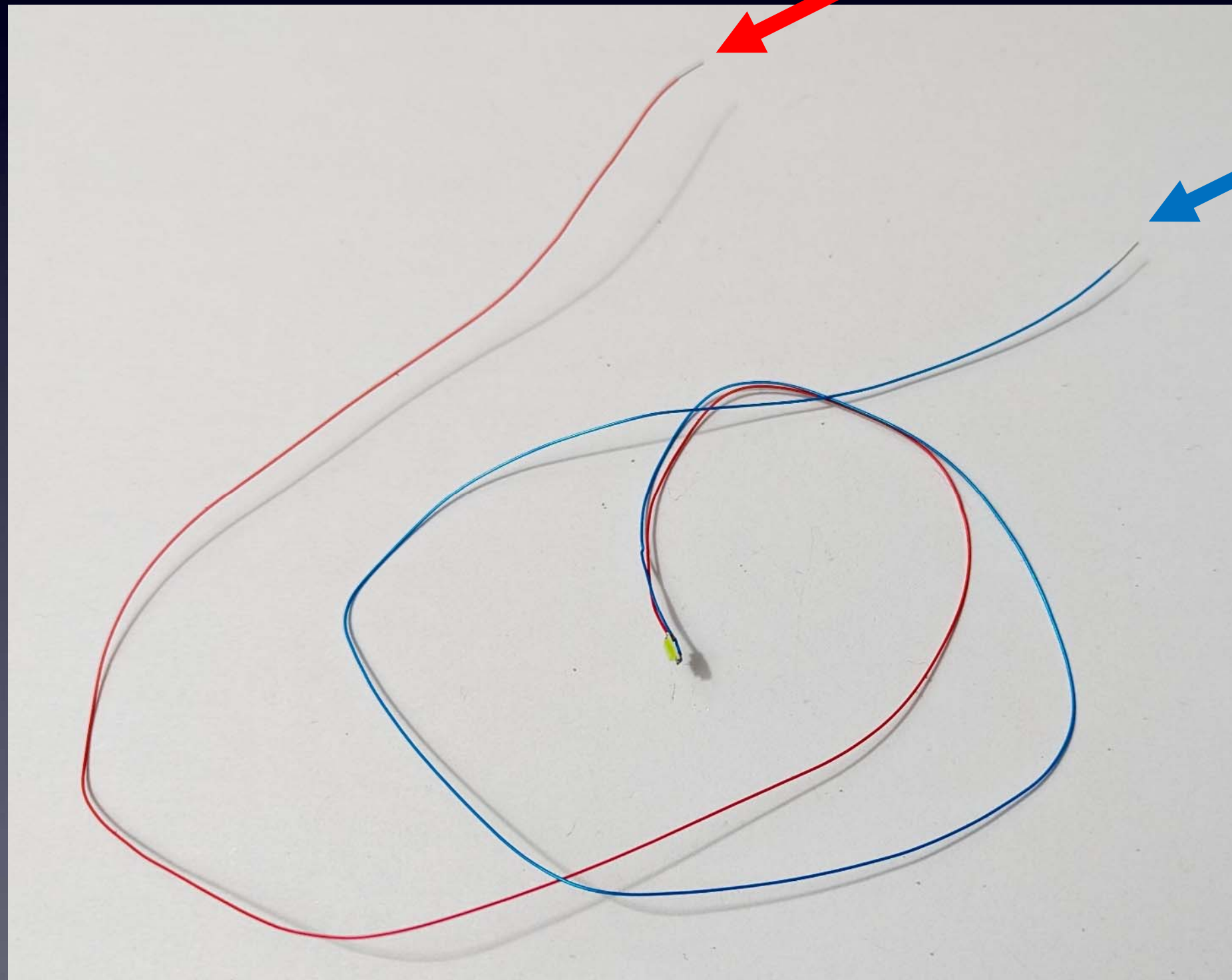


C1, C2

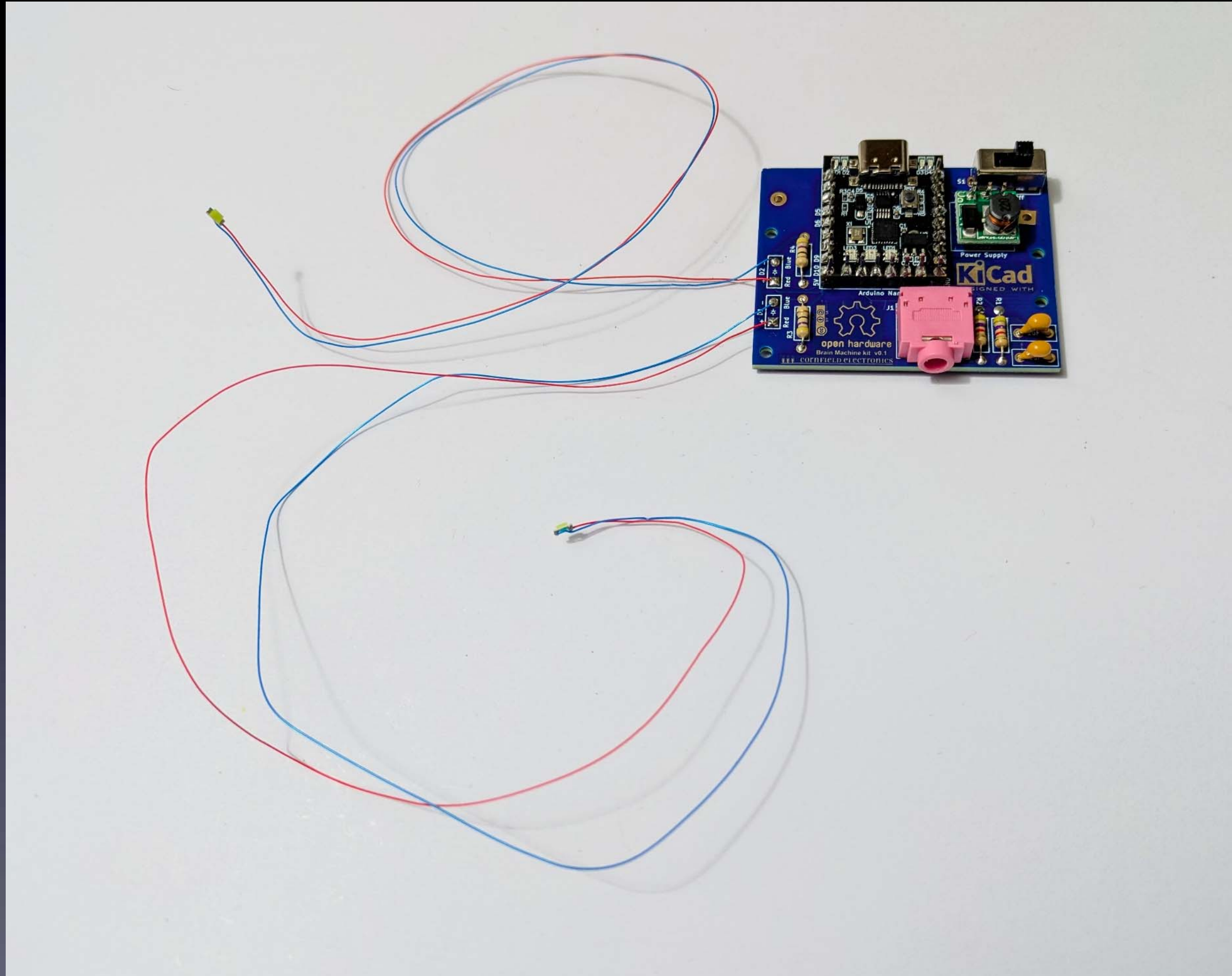
Direction does not matter

LED1 and LED2:

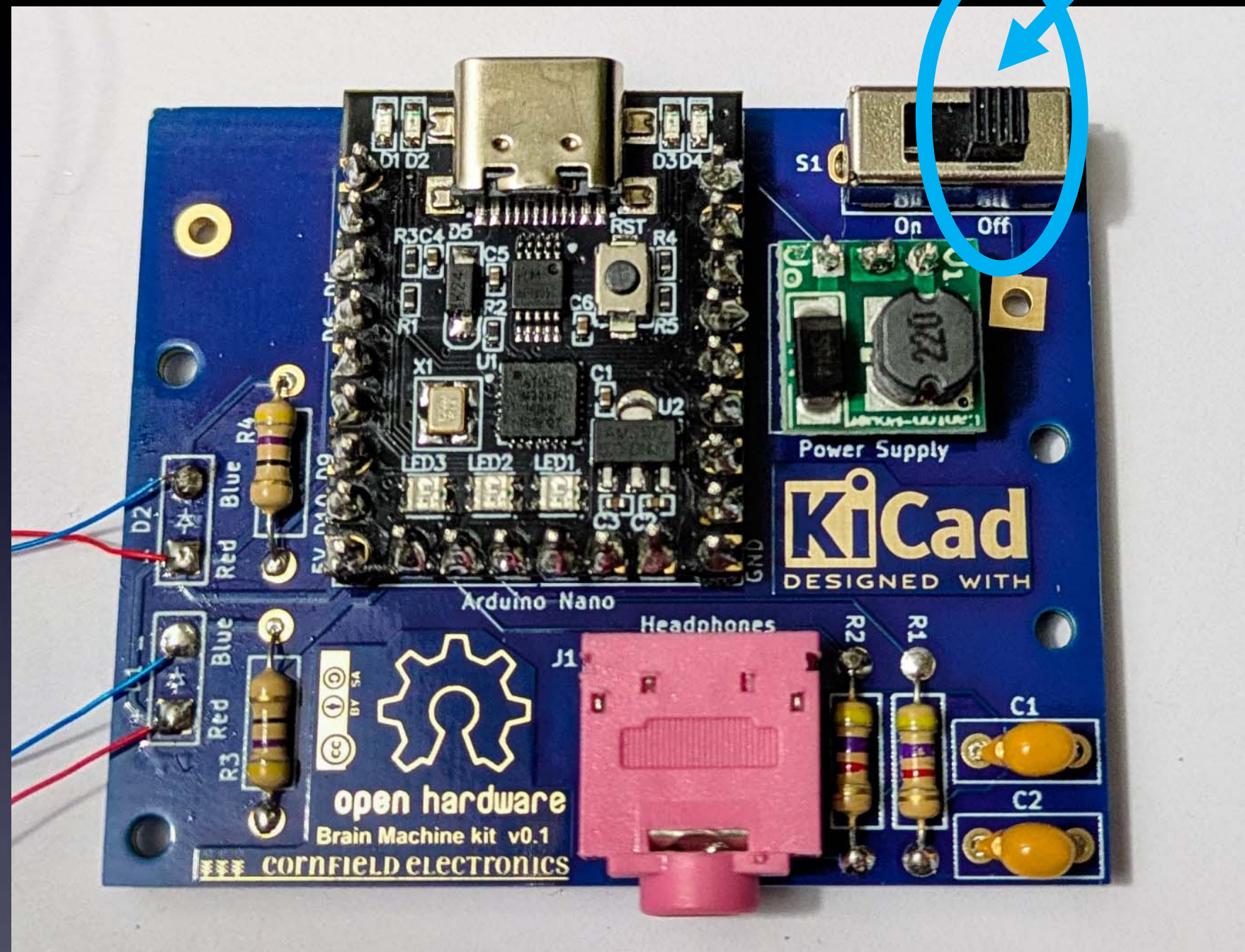
**Red wire
and
Blue wire**



LED1, LED2 soldered to board



Let's Test !



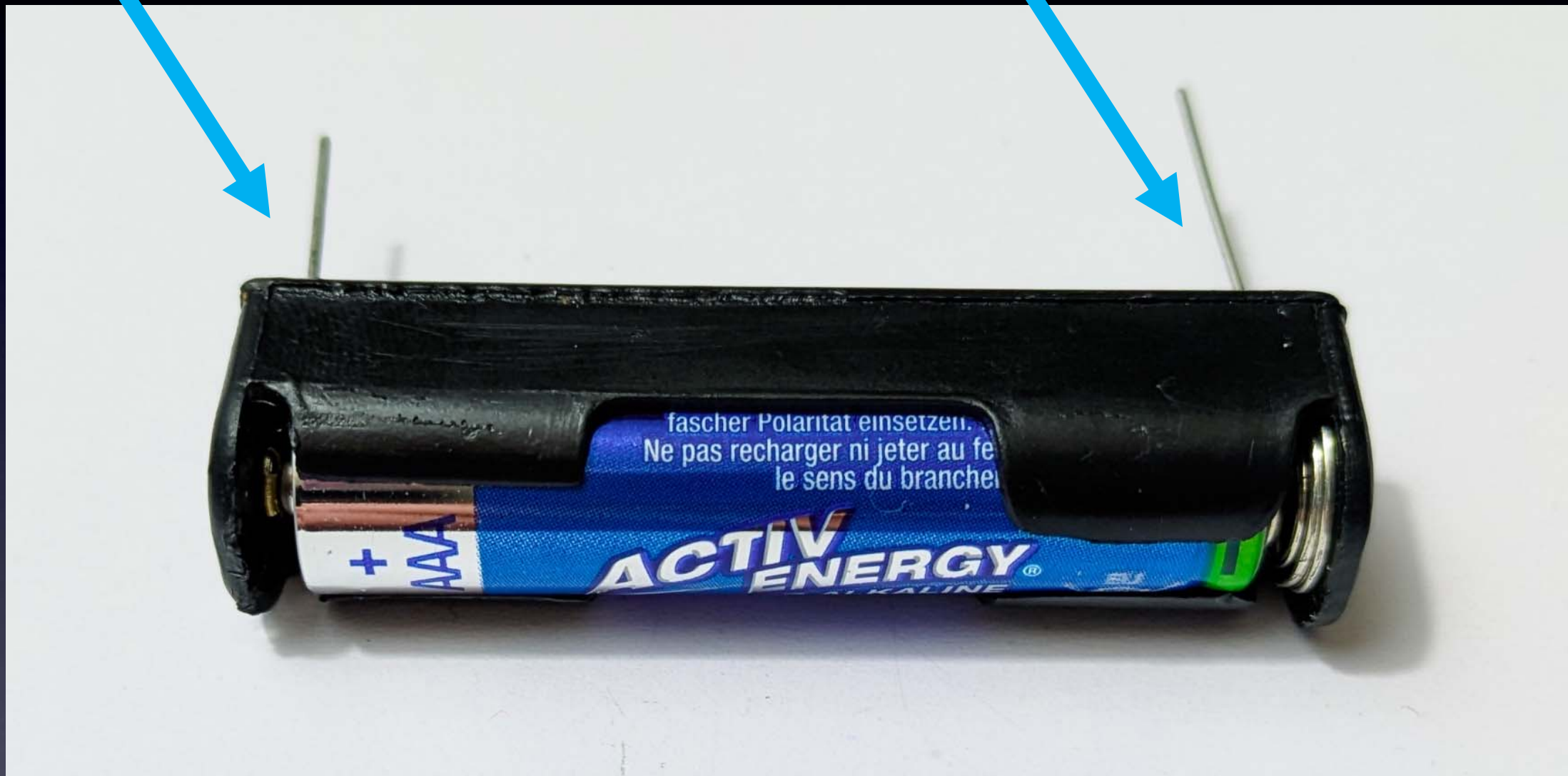
S1 in OFF position

Let's Test !

“+”

“-”

(spring)



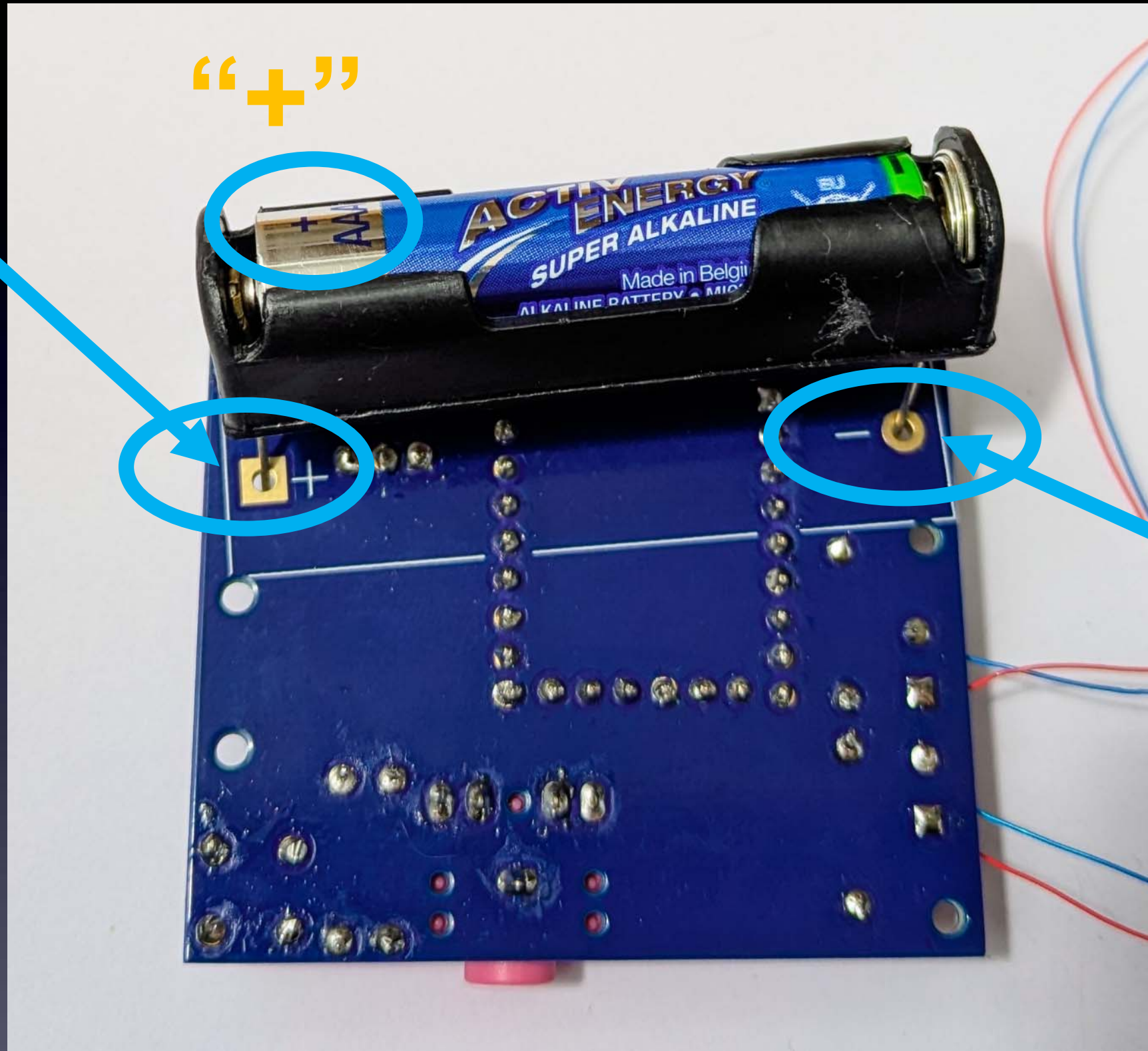
AAA Battery in its holder

Let's Test !

“+”

“+”

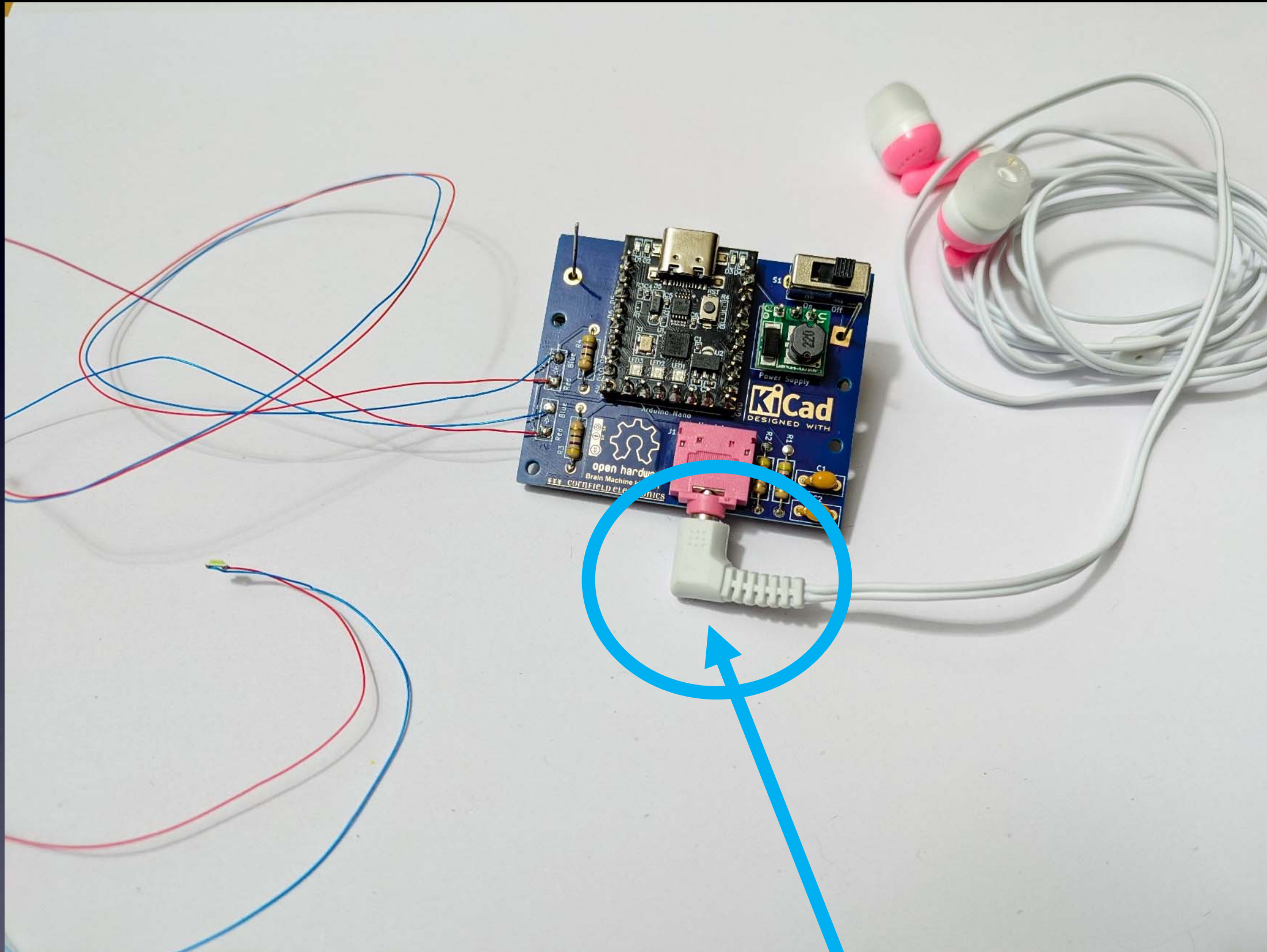
“-”



Place AAA Battery holder in place

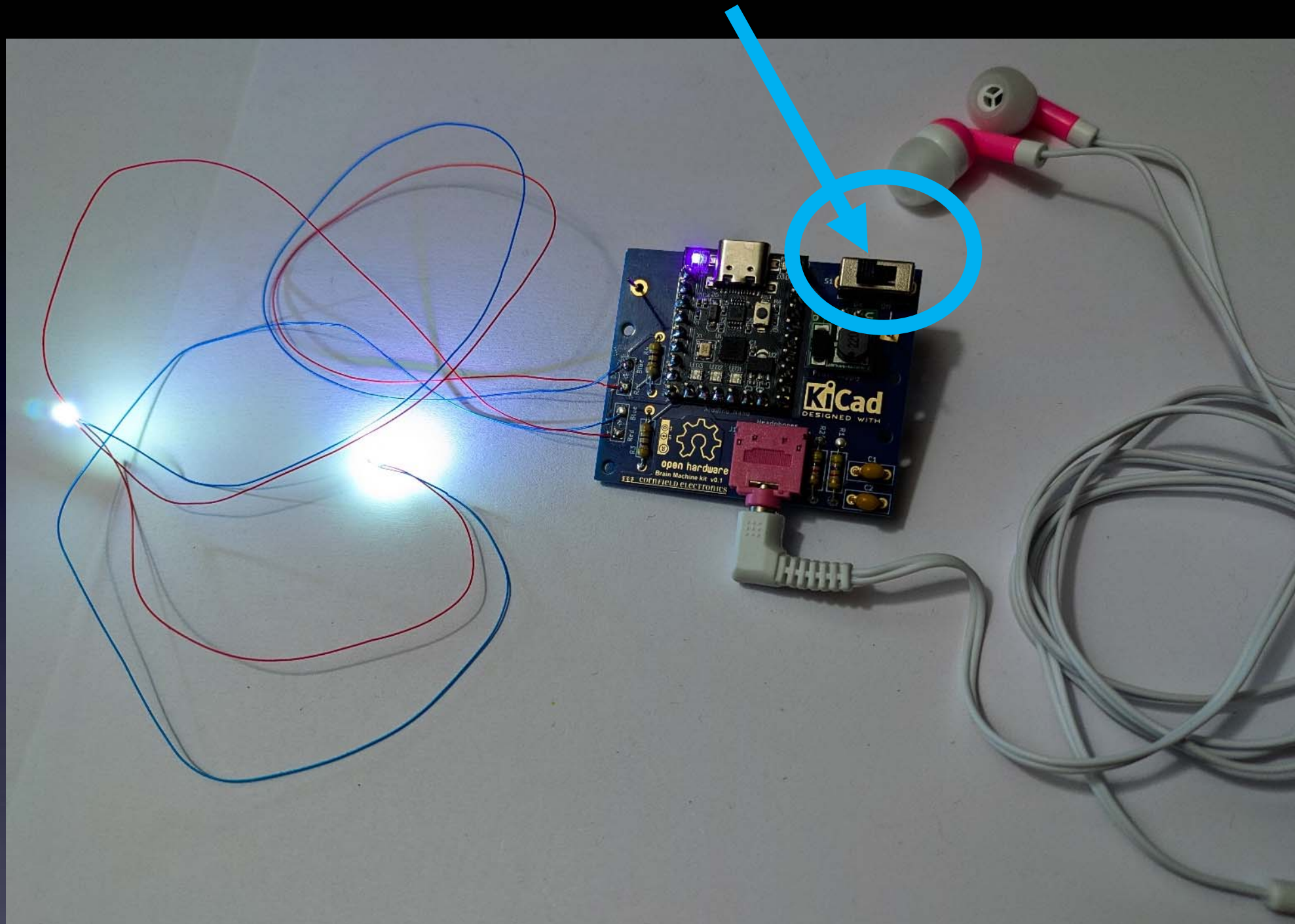
→ Do Not solder, yet ←

Let's Test !



Insert Earbuds

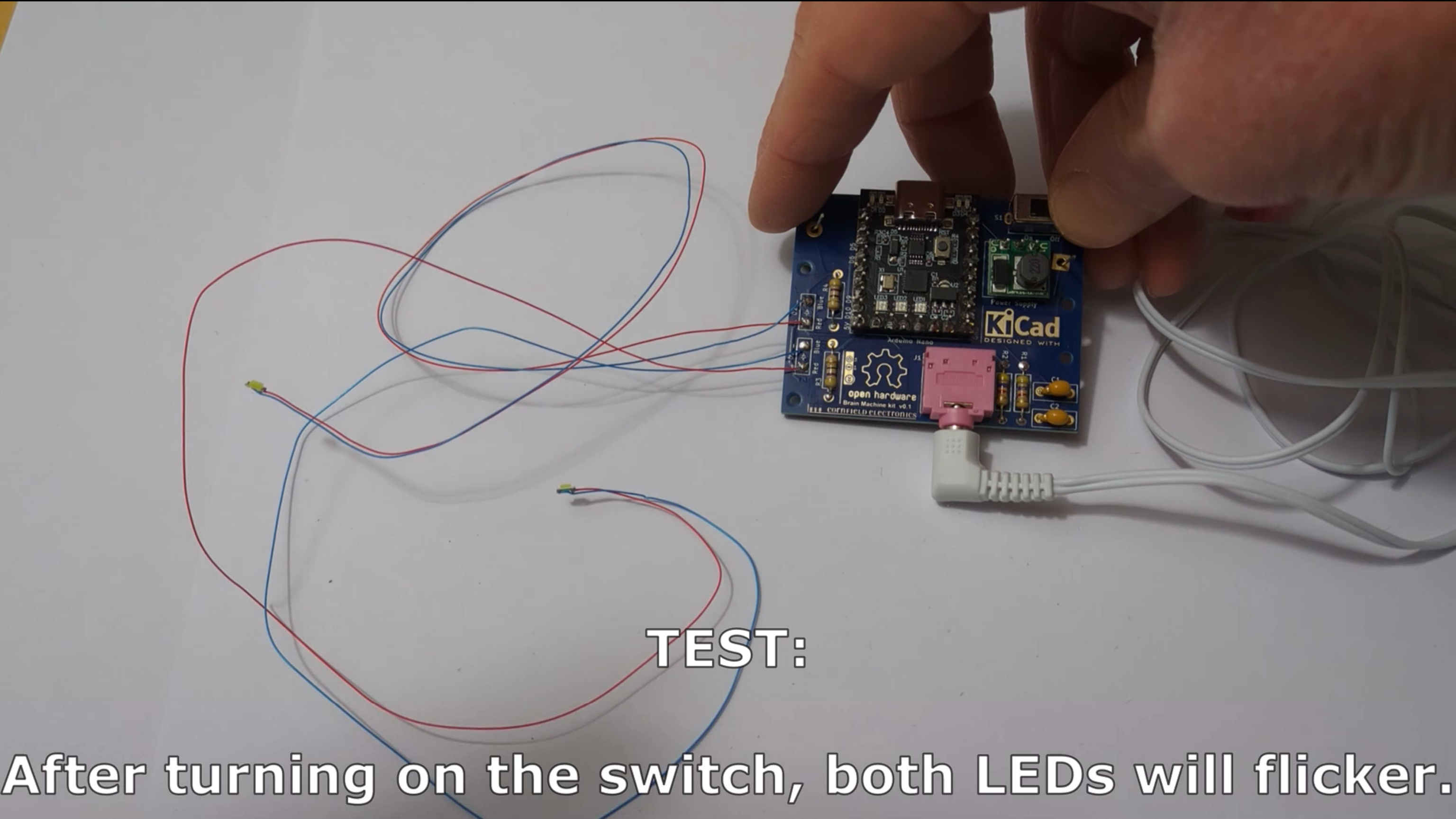
Let's Test !



Turn ON

- ❖ LEDs flicker
- ❖ Each ear has a different pitch

Let's Test !



TEST:

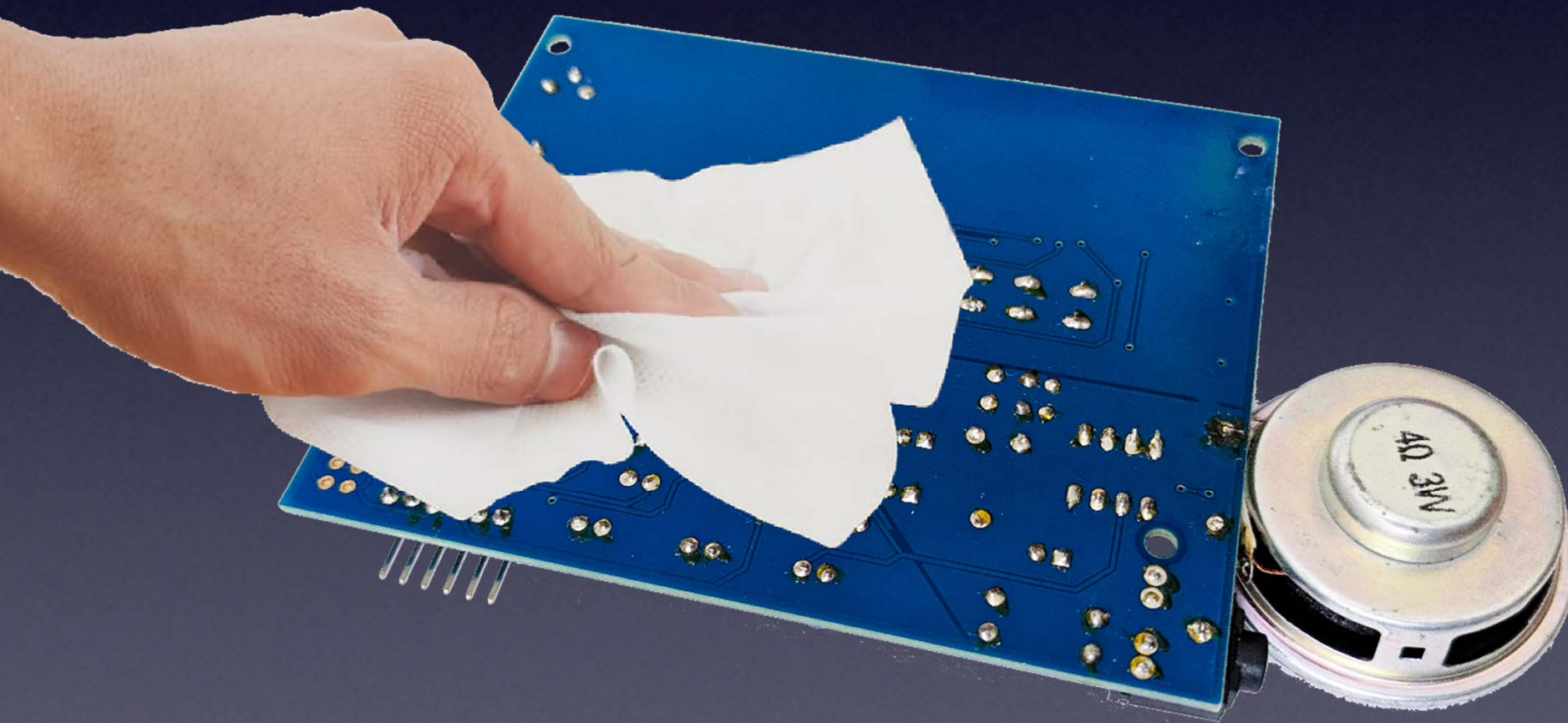
After turning on the switch, both LEDs will flicker.

Video

If you used any *flux paste* for re-working problems

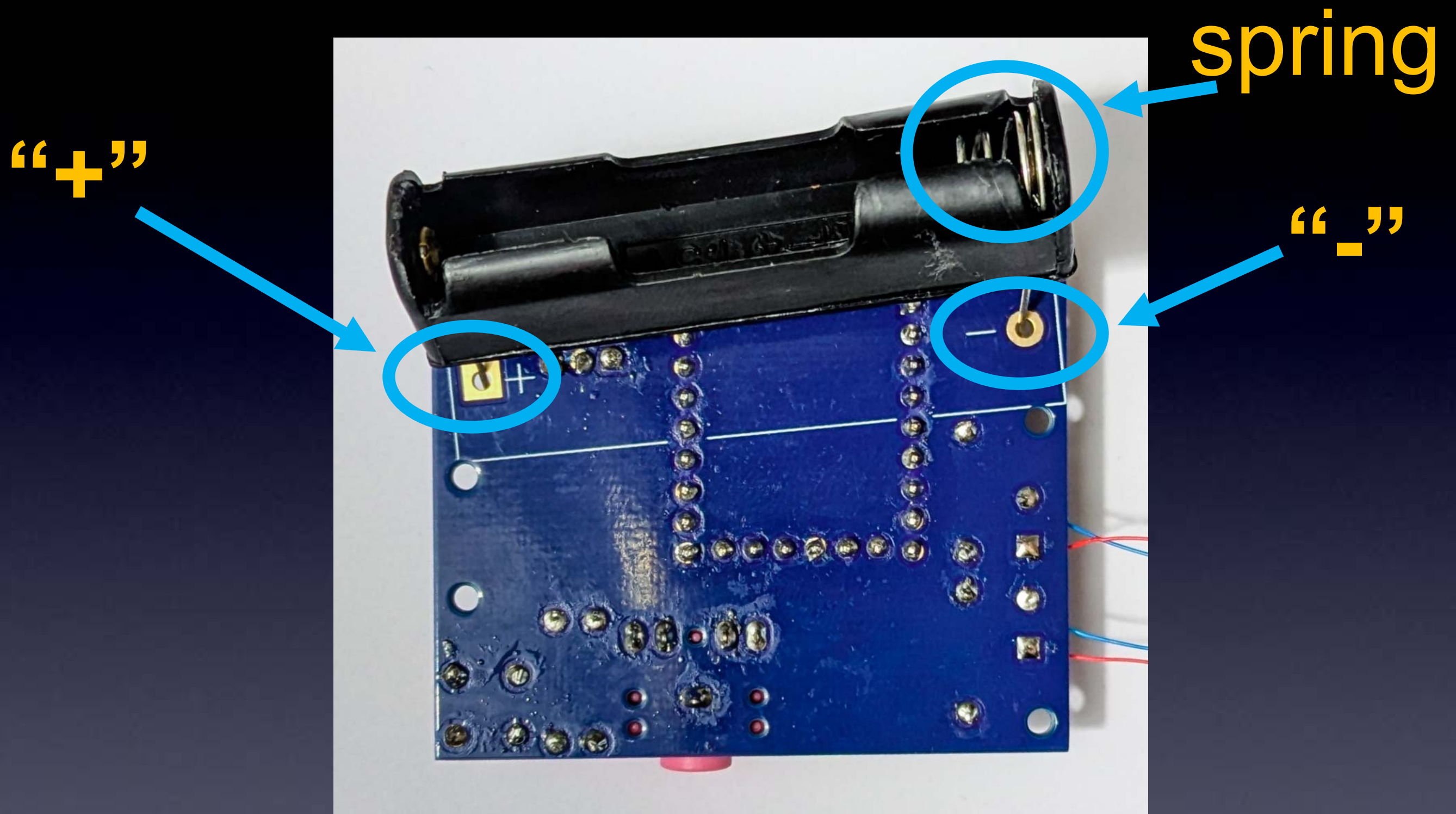


The bottom of the PCB will be sticky from the flux

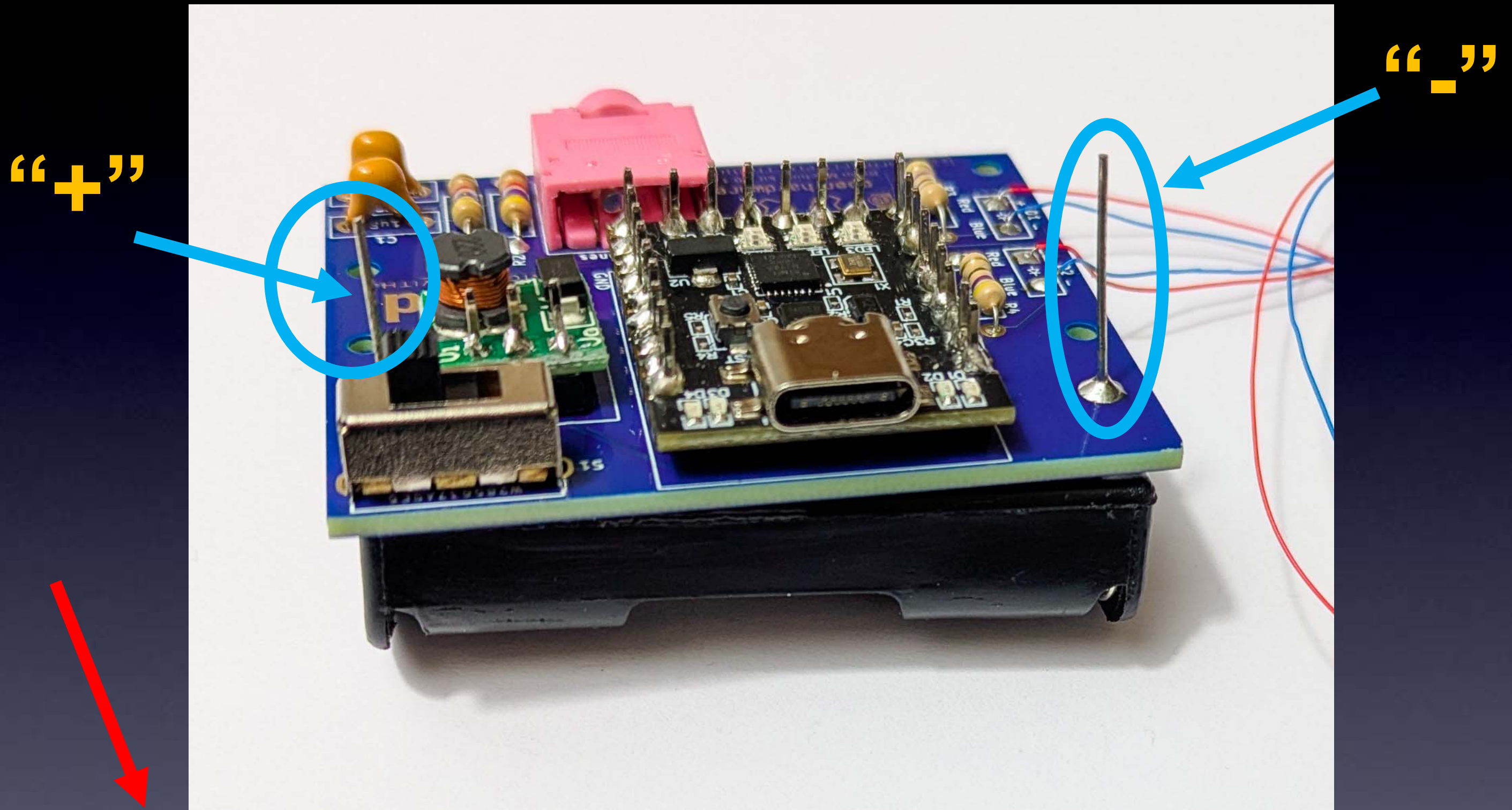


You can clean it with a cloth wet with *Isopropyl Alcohol*

Insert Battery Holder



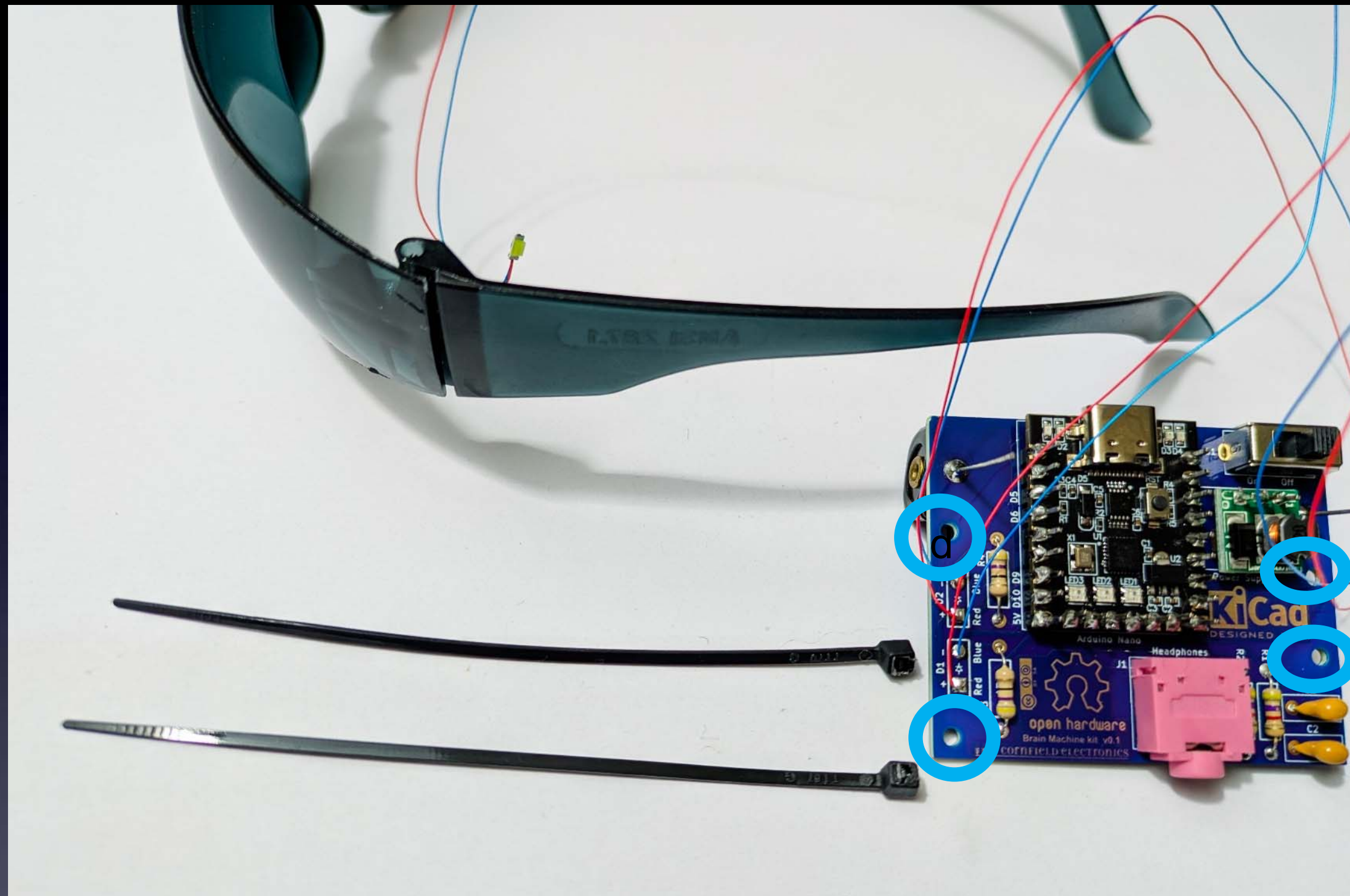
Battery Holder Soldered



→ **DO NOT** cut battery holder leads ! ←

(That will destroy the wire cutters)

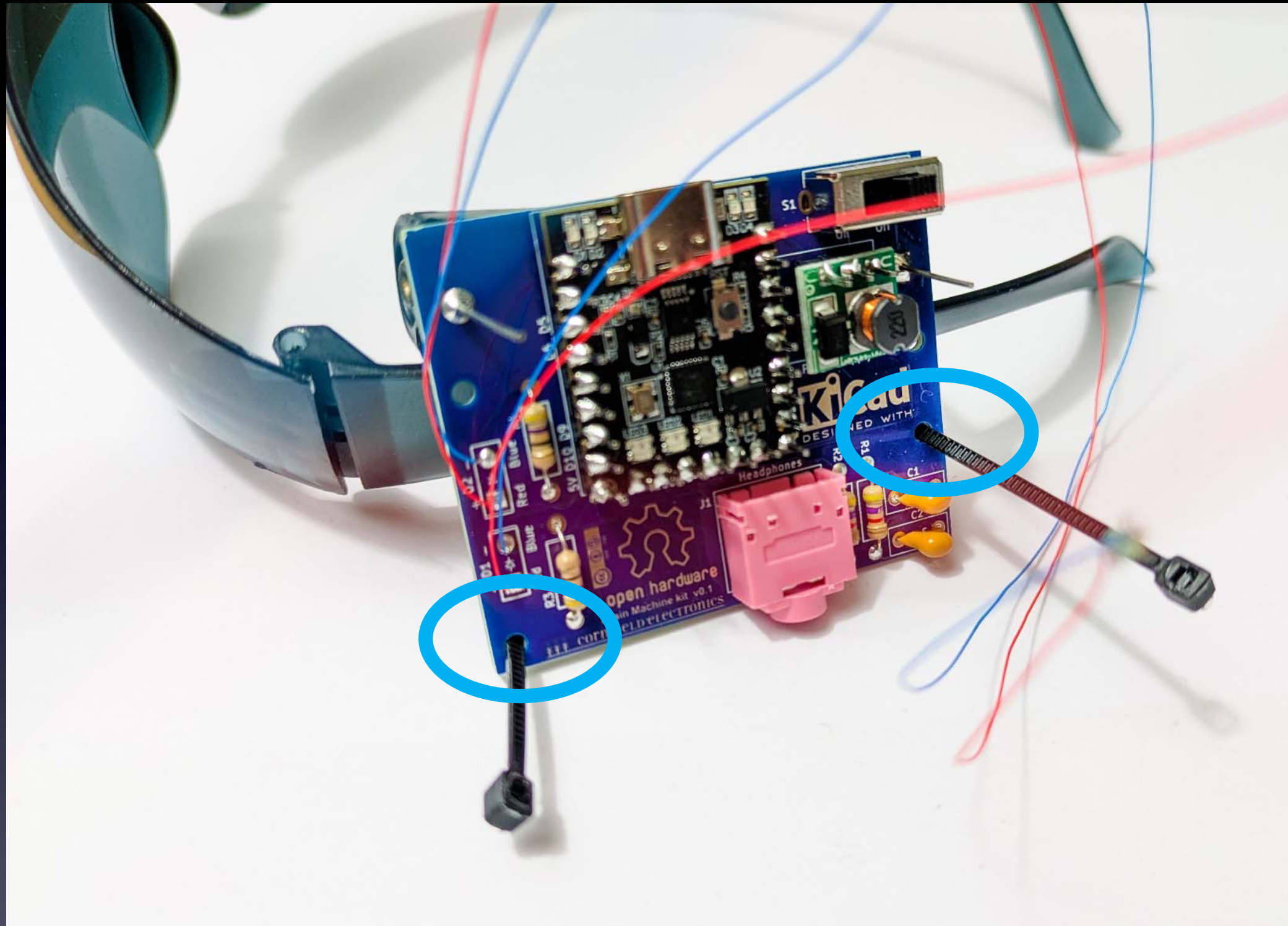
Attach Board to Glasses



Notice the 4 holes in the board
for the zip ties

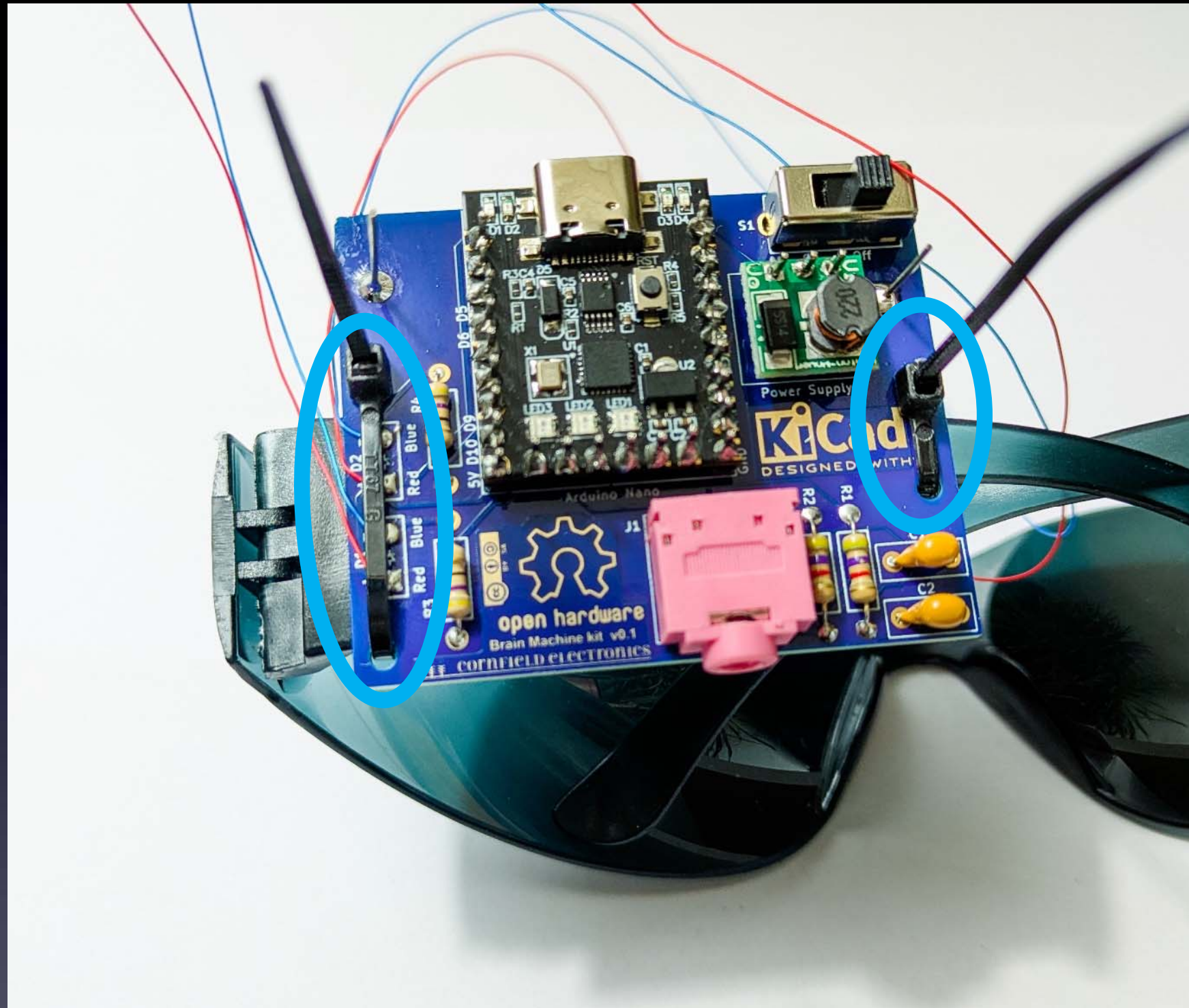
→ Use left side of glasses ←

Attach Board to Glasses



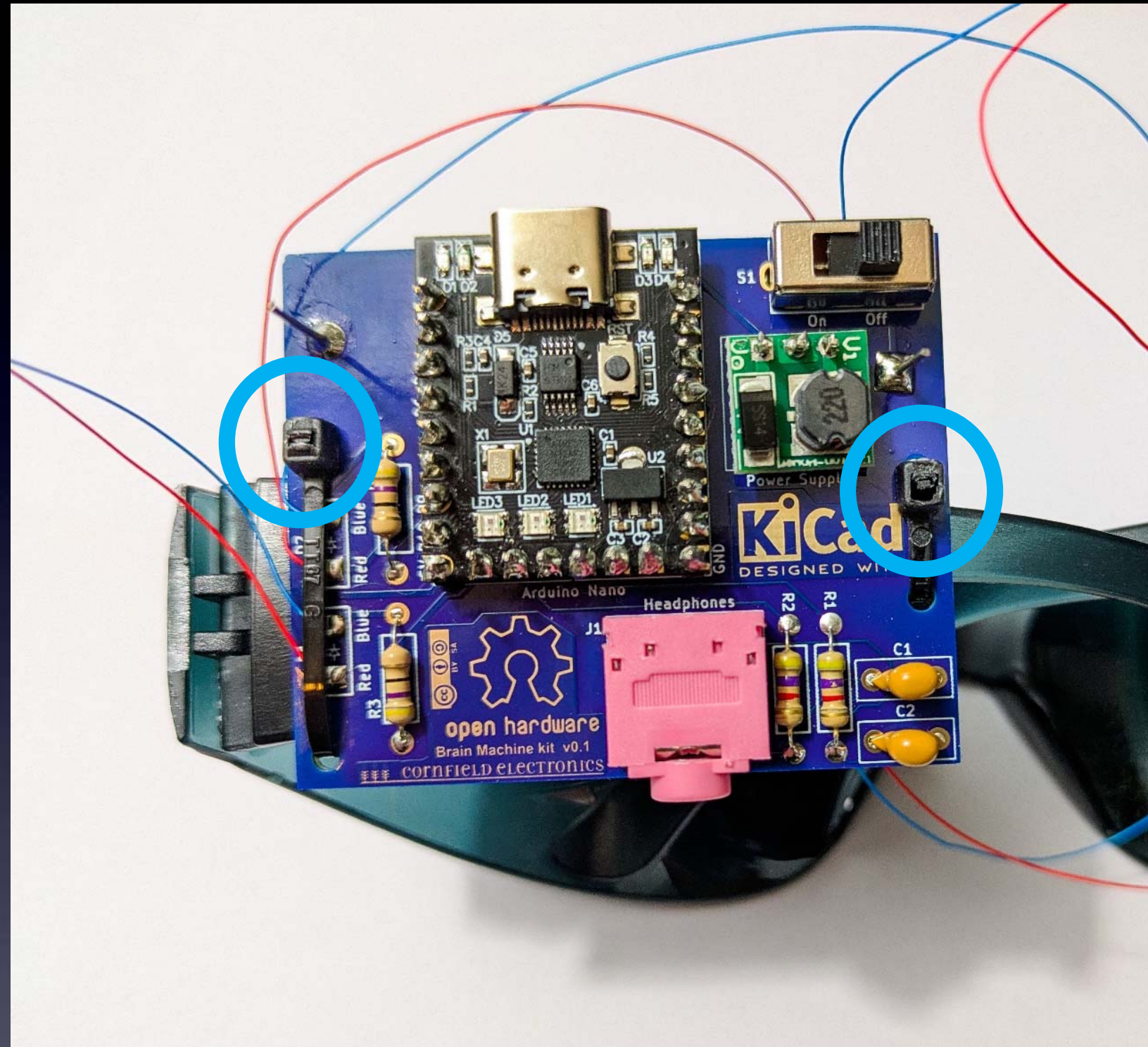
Insert zip-ties into lower mounting holes

Attach Board to Glasses



Wrap zip-ties around, and secure

Attach Board to Glasses



Cut zip-ties short

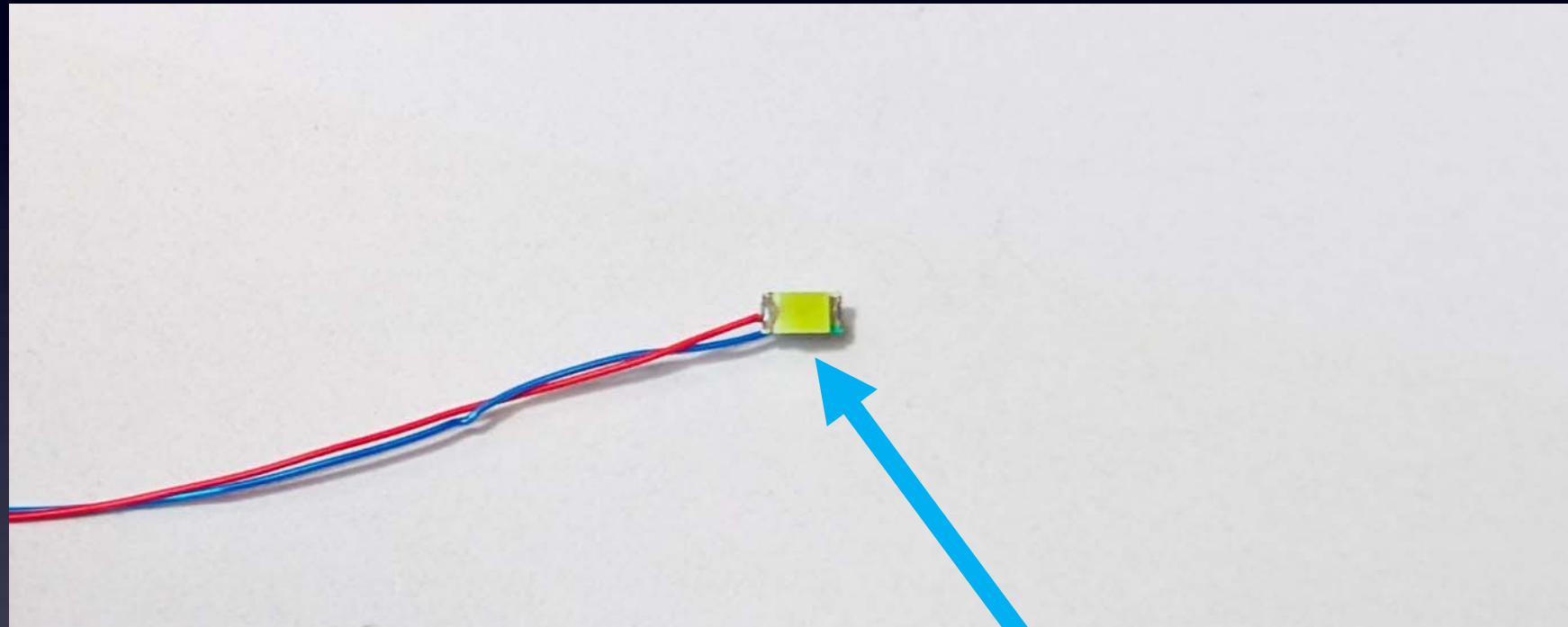
Mark where LEDs will go



For each eye:

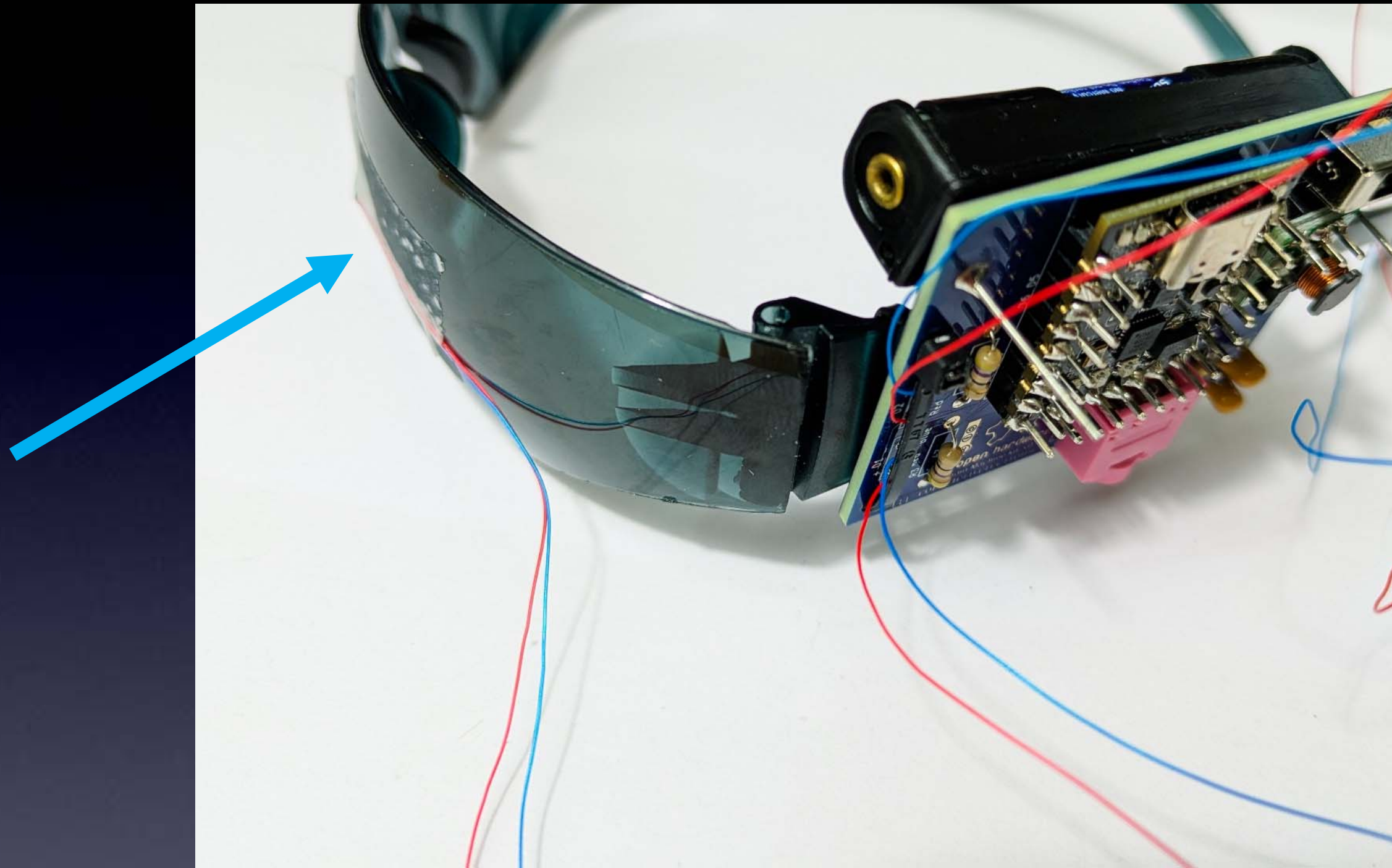
Slowly move the marker toward your eye to make a mark directly in front of your eye.

LEDs light up on one side



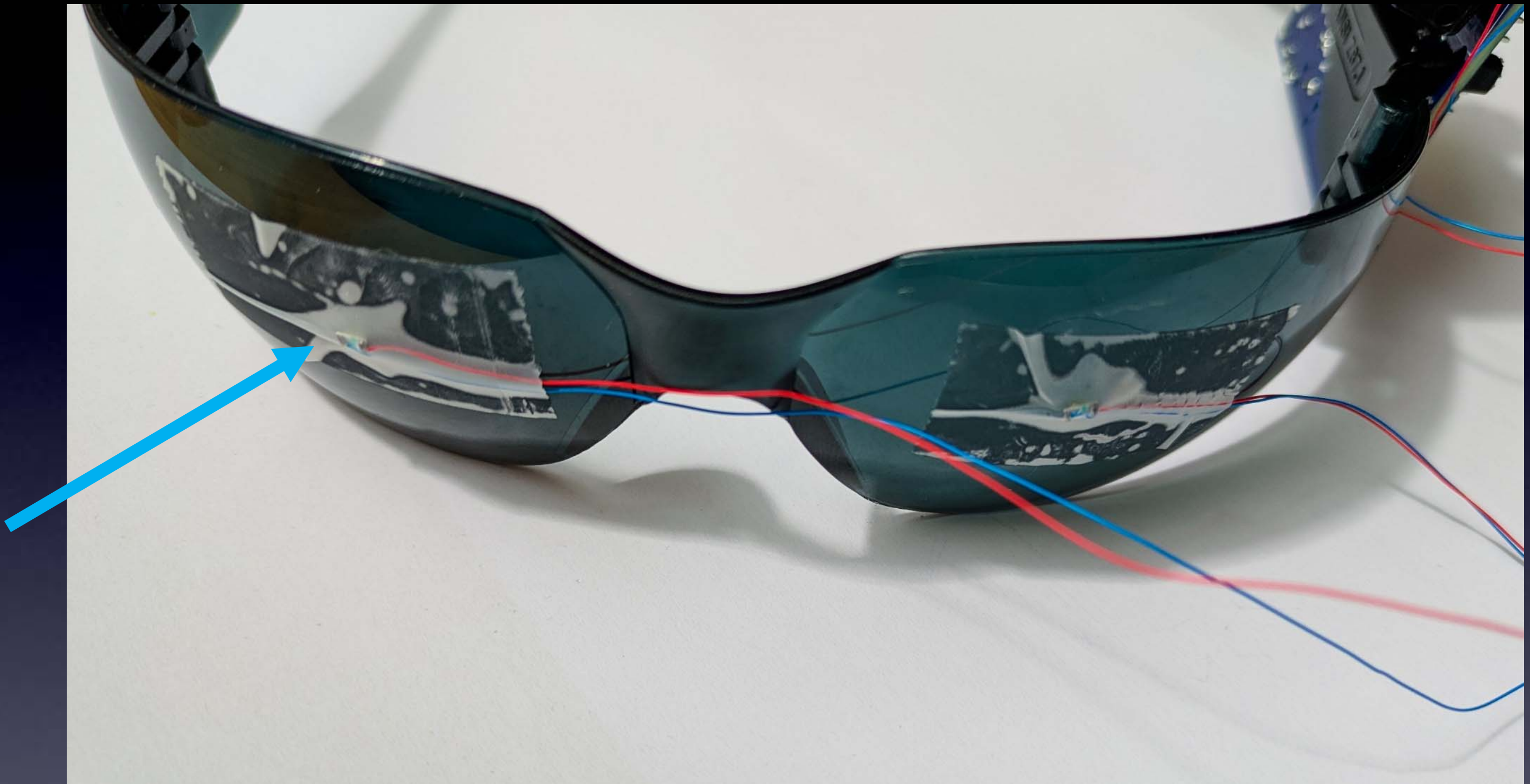
The LEDs light up on the flat white side

Tape Left LED to Glasses



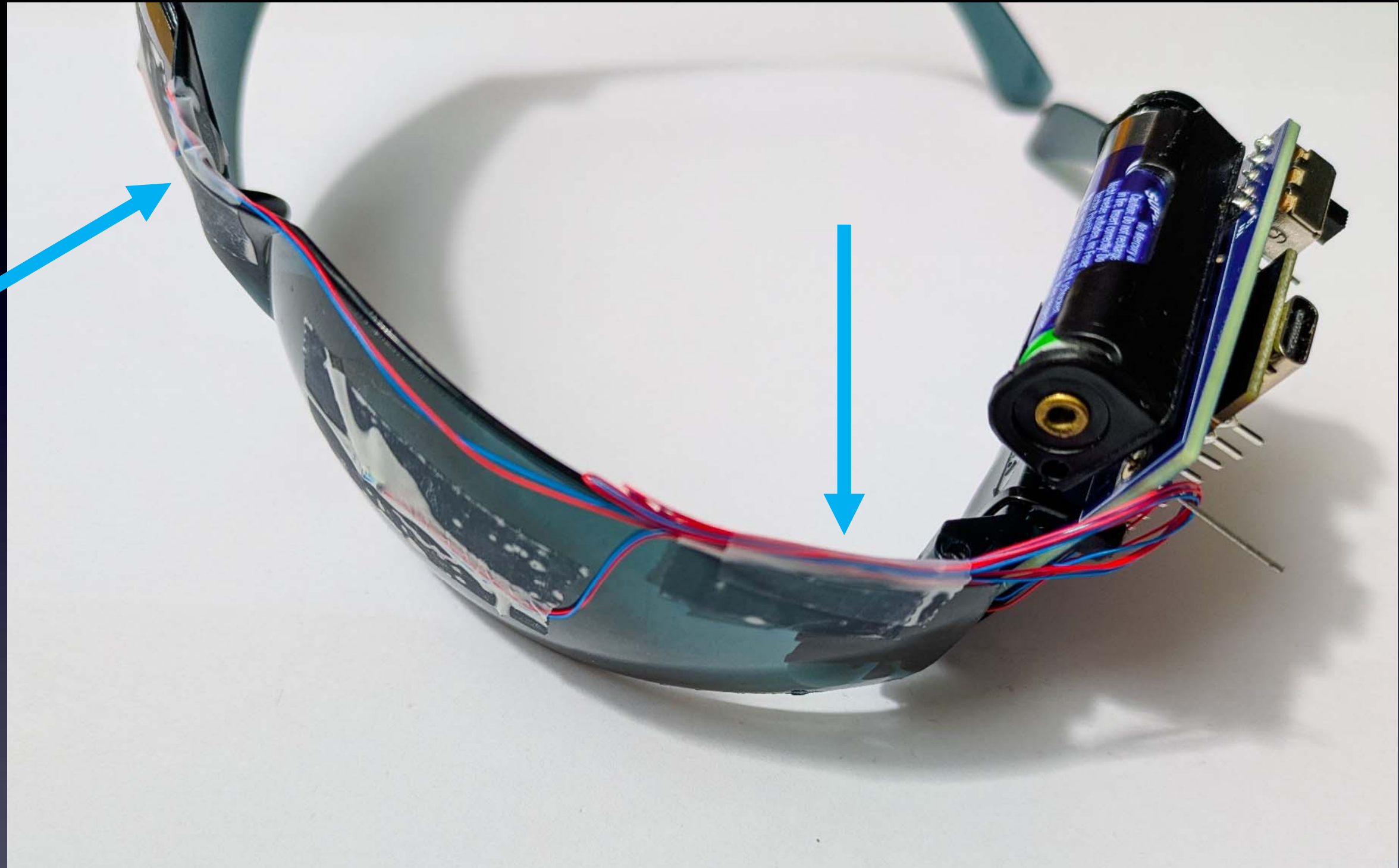
Tape the flat white side of D1 over the left mark
(so the light will shine on your eye)

Tape Right LED to Glasses



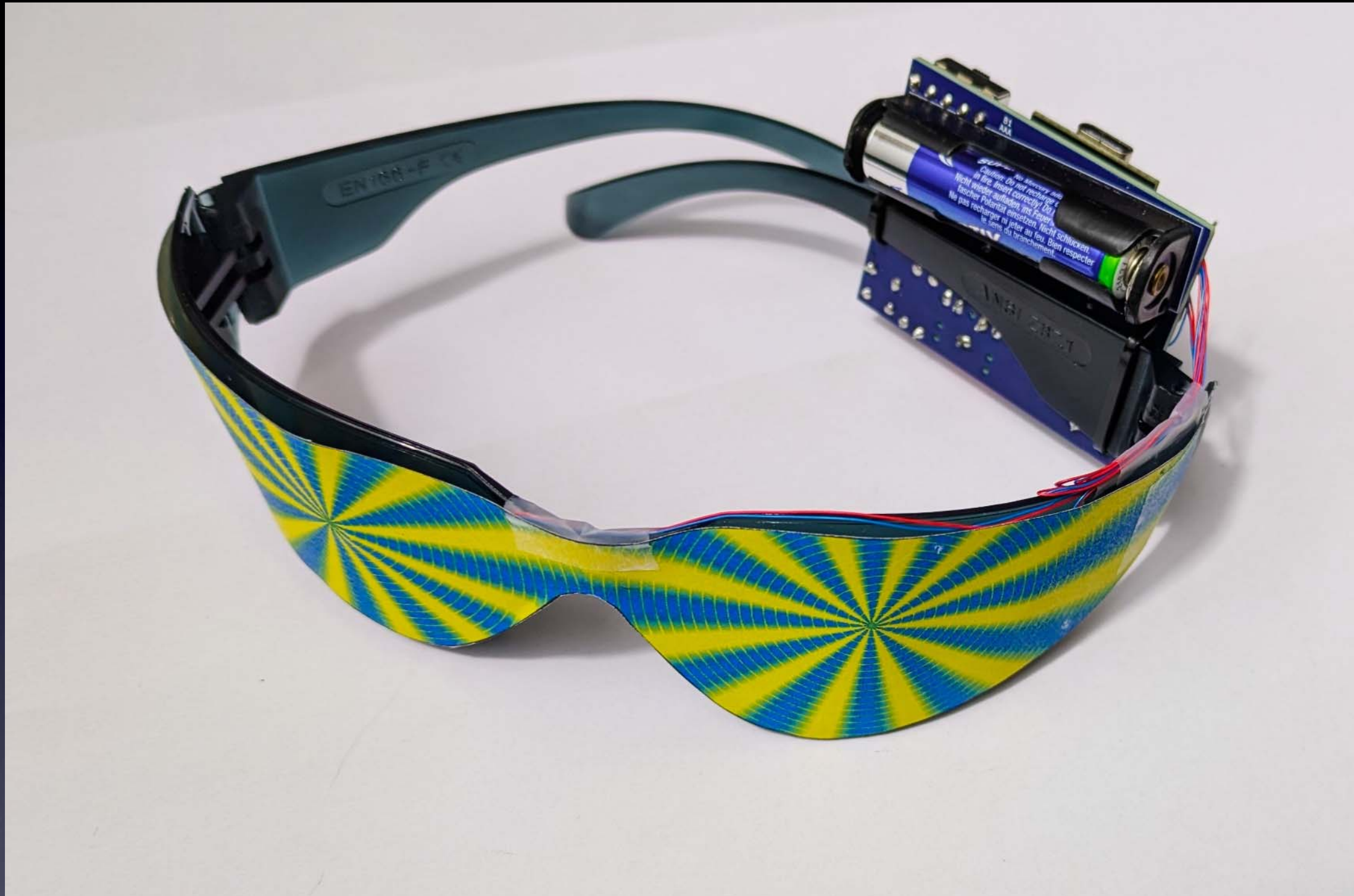
Tape the flat white side of D2 over the right mark
(so the light will shine on your eye)

Secure LED wires on Glasses



Use tape to clean up and secure the LED wires

Add Trippy Graphics !



Cut out the Trippy Graphics
and tape them over the glasses

Done!



Enjoy (with your eyes closed)



Meditate, Hallucinate, Trip Out !

Please Remember:

to

Wash your hands

after soldering

Let's Meditate

**Your Brain Machine comes pre-programmed
with a really nice 14-minute Meditation.**

**And, along the way you will hallucinate beautiful colors and patterns
from your imagination.**



Re-Programming

Your Brain Machine comes pre-programmed with a really nice 14-minute Meditation.

If you are happy with this meditation sequence then no need to re-program your Brain Machine.

But if you want to program other brainwave sequences the next pages show you how...



Re-programming the Brain Machine

We have one other sequence ready for you to use.

It is 1 hour of 40 Hz Gamma Waves

**The following slides show you
how to program this sequence into your Brain Machine...**



Re-programming the Brain Machine

We have one other sequence ready for you to use.

To program in a new sequence into your Brain Machine, you will need:

- the Arduino software
<<http://arduino.cc>>
- a USB-C cable
- the “sketch” for the other brainwave sequence
<<http://cornfieldelectronics.com/cfe/projects.php#brainmachine>>

The following slides show you how to do the above, in detail.



Arduino

**Arduino is a very powerful tool!
But it is very easy to use.**

It was designed for total beginners to use successfully.

I won't give a complete tutorial here – just some basics.

For more info, there are many good Arduino tutorials online.

A good place to start is:

<<https://www.arduino.cc/en/Tutorial/HomePage>>



Arduino

First:

Download and install the Arduino software

< <http://arduino.cc> >

Any version is OK



Re-programming the Brain Machine

Second:

Download the Brain Machine brainwave sequence sketch
<<http://cornfieldelectronics.com/cfe/projects.php#brainmachine>>

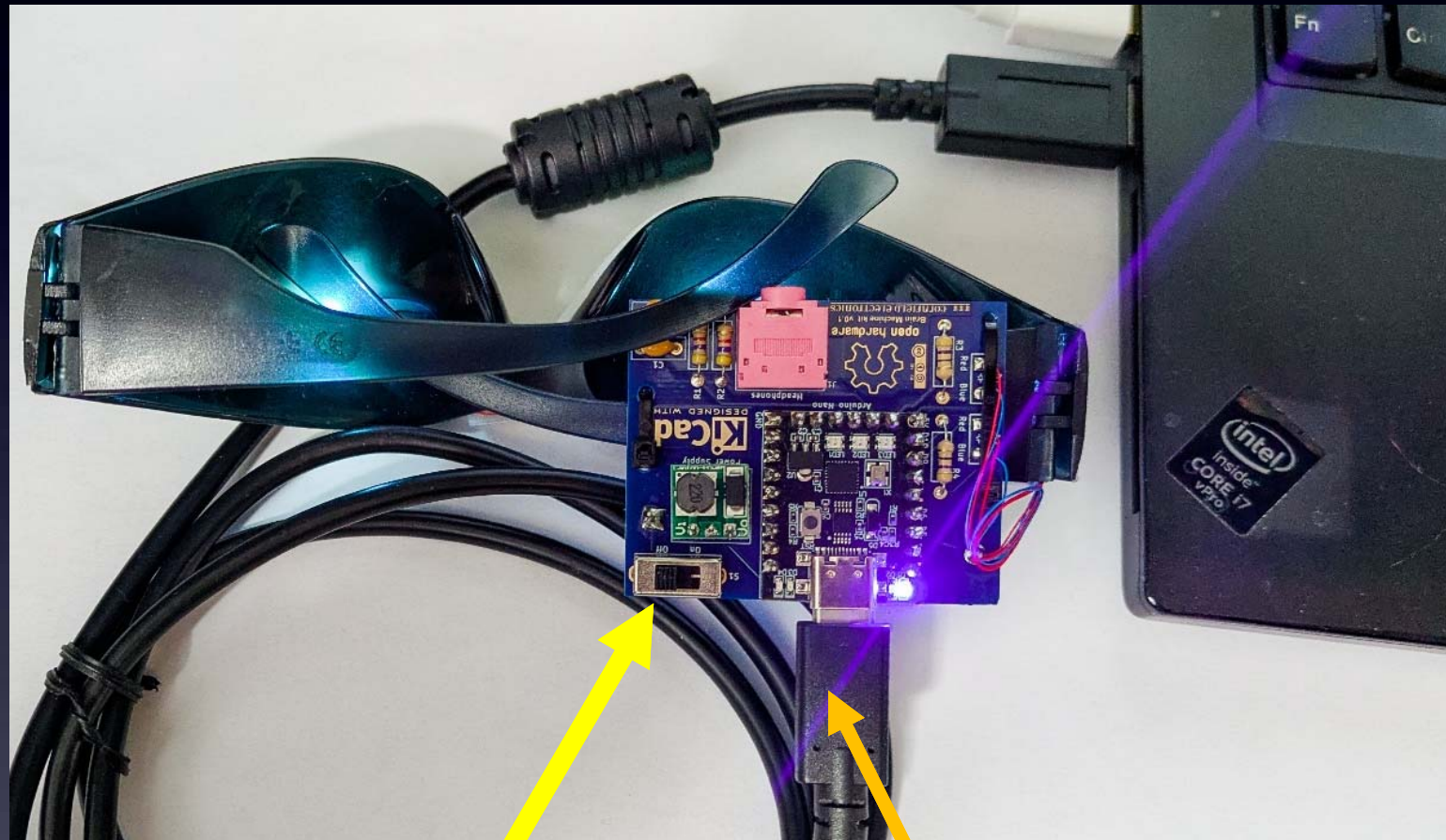
Store it on your computer anywhere you like.

(details on this soon)



Connecting your Brain Machine to your computer

USB-C cable

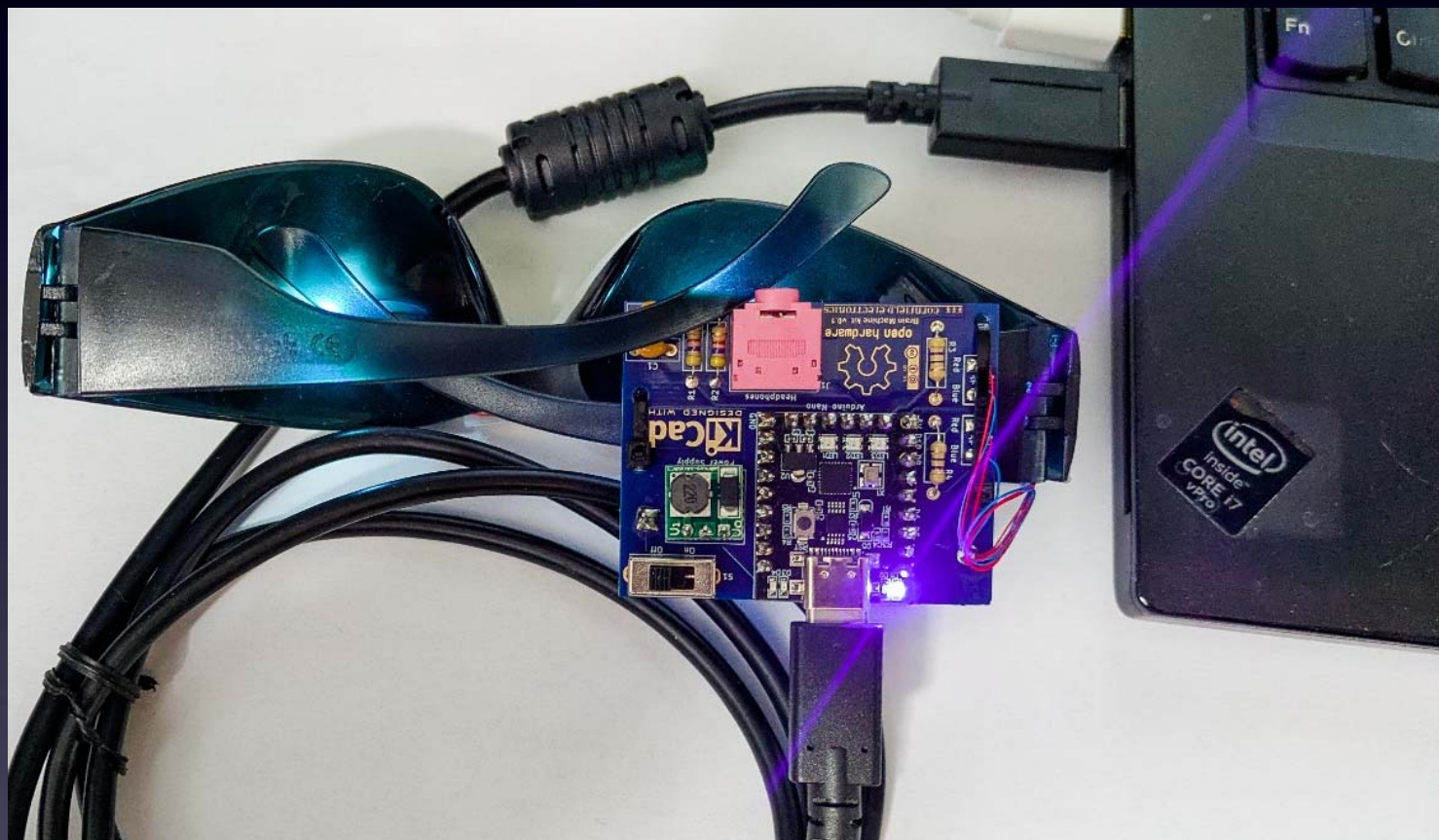


IMPORTANT:
Make sure the
Switch on your
Brain Machine
is *OFF*

to computer's USB

Connecting your Brain Machine to your computer

USB-C cable



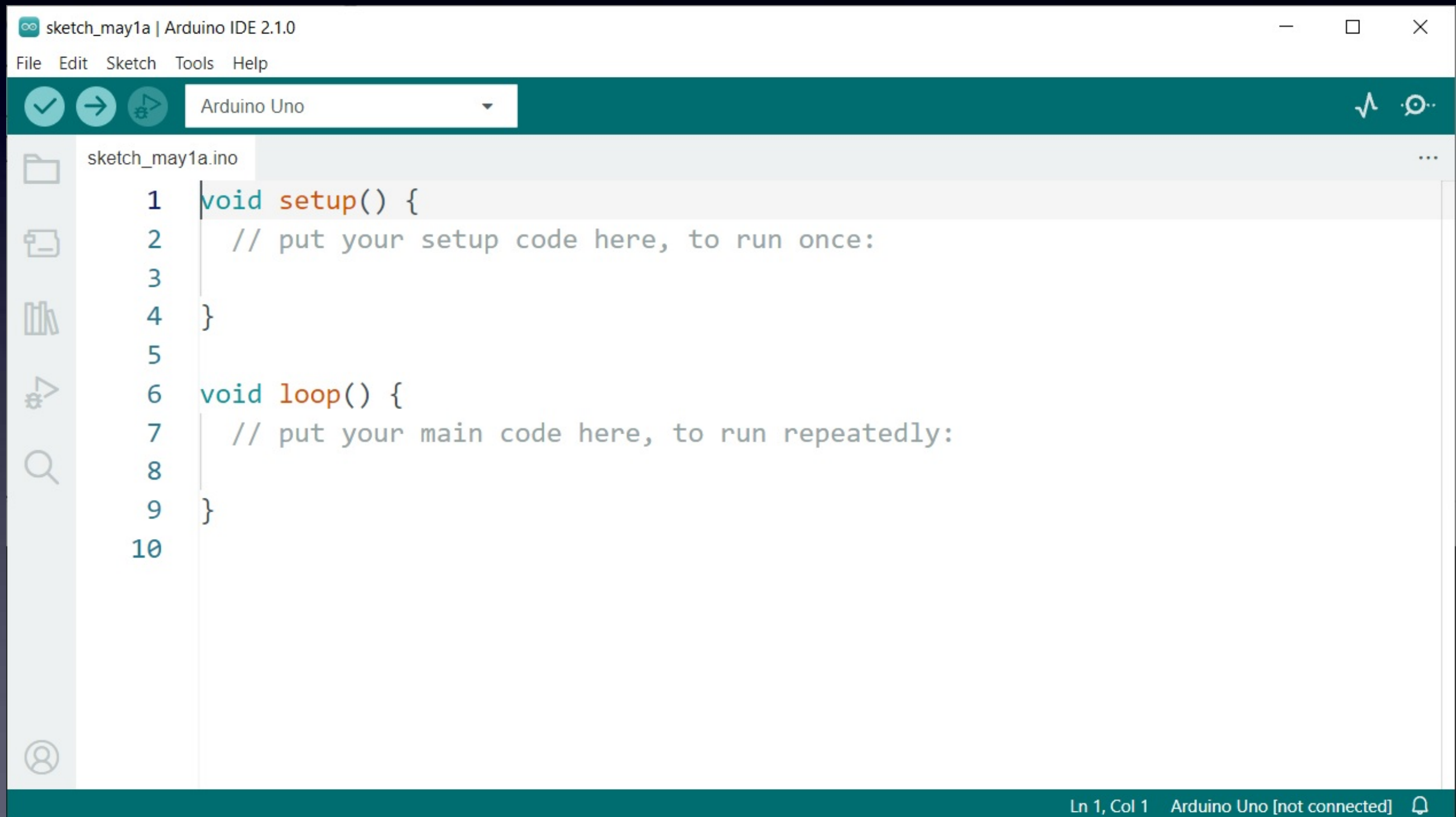
**You may need to download and install a driver
for your Operating System (Windows, MacOS, or Linux):**

[<https://learn.sparkfun.com/tutorials/how-to-install-ch340-drivers/all>](https://learn.sparkfun.com/tutorials/how-to-install-ch340-drivers/all)

Or search for:
“CH340 driver”

Arduino

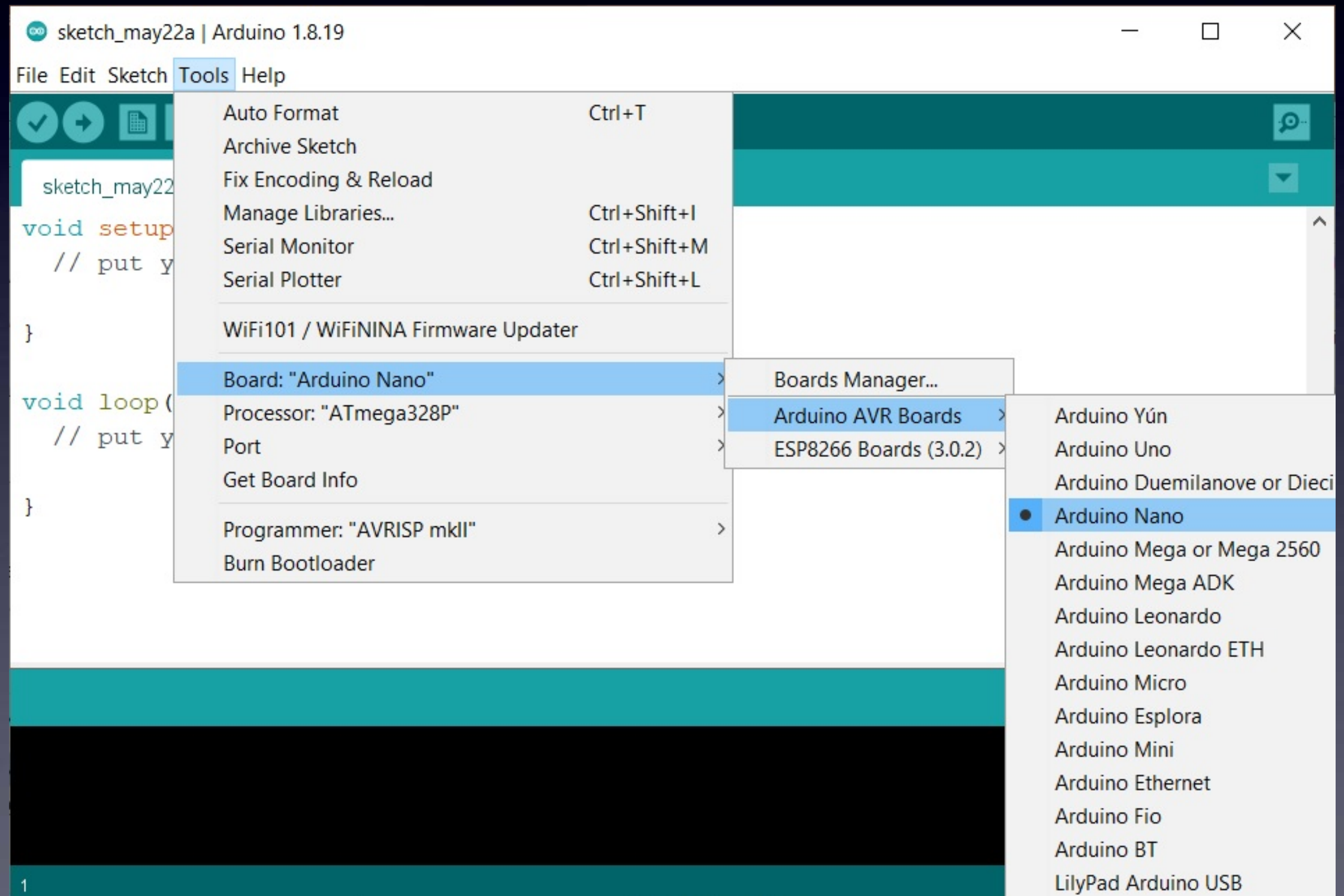
After you download and install the Arduino software start it, and you will see a screen that looks like this:



Arduino

The first time you start your Arduino software you need to set things up

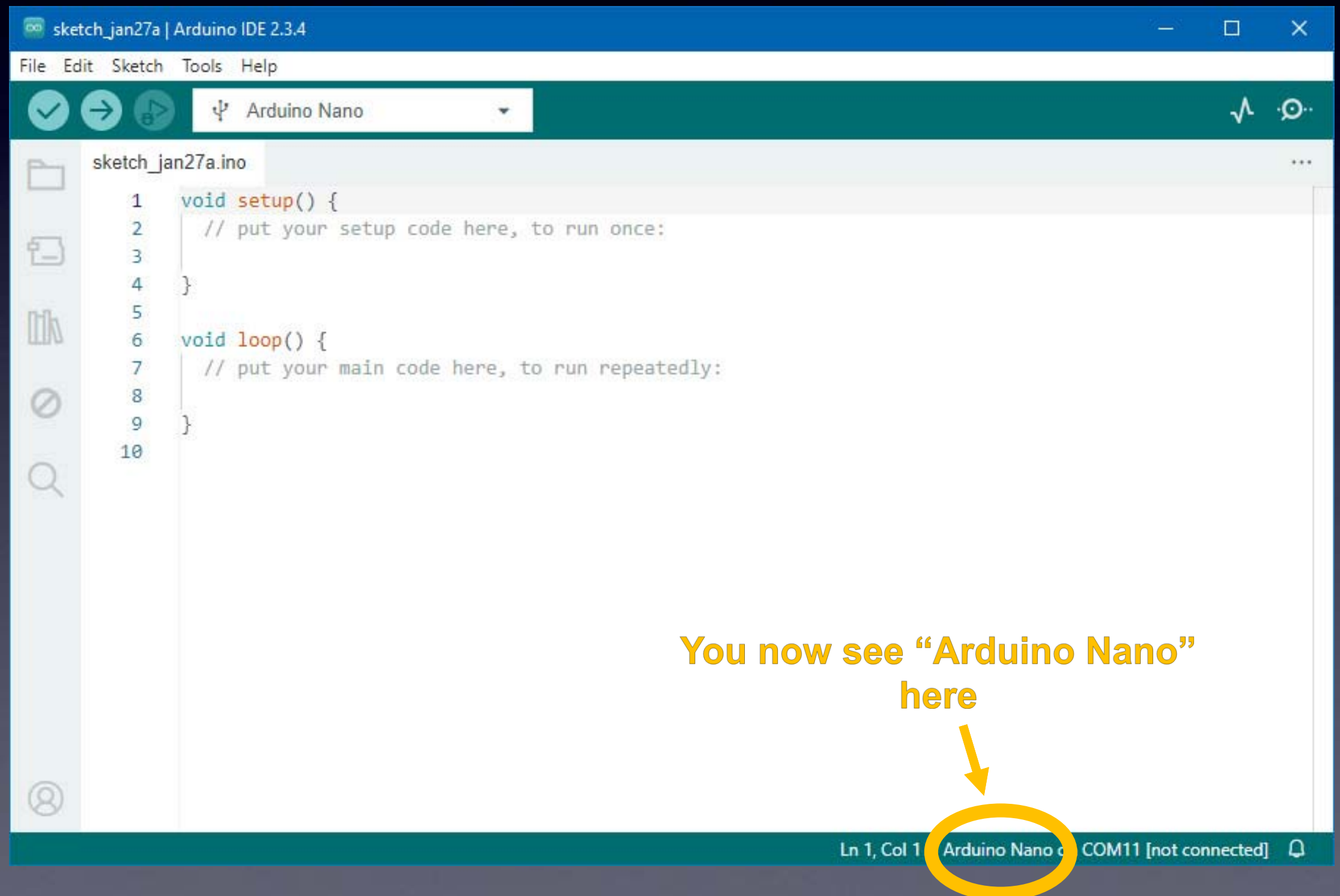
(1)
Choose
“Arduino Nano”
as the Board



Arduino

The first time you start your Arduino software
you need to set things up

(1)
Choose
“Arduino Nano”
as the Board



You now see “Arduino Nano”
here

Arduino

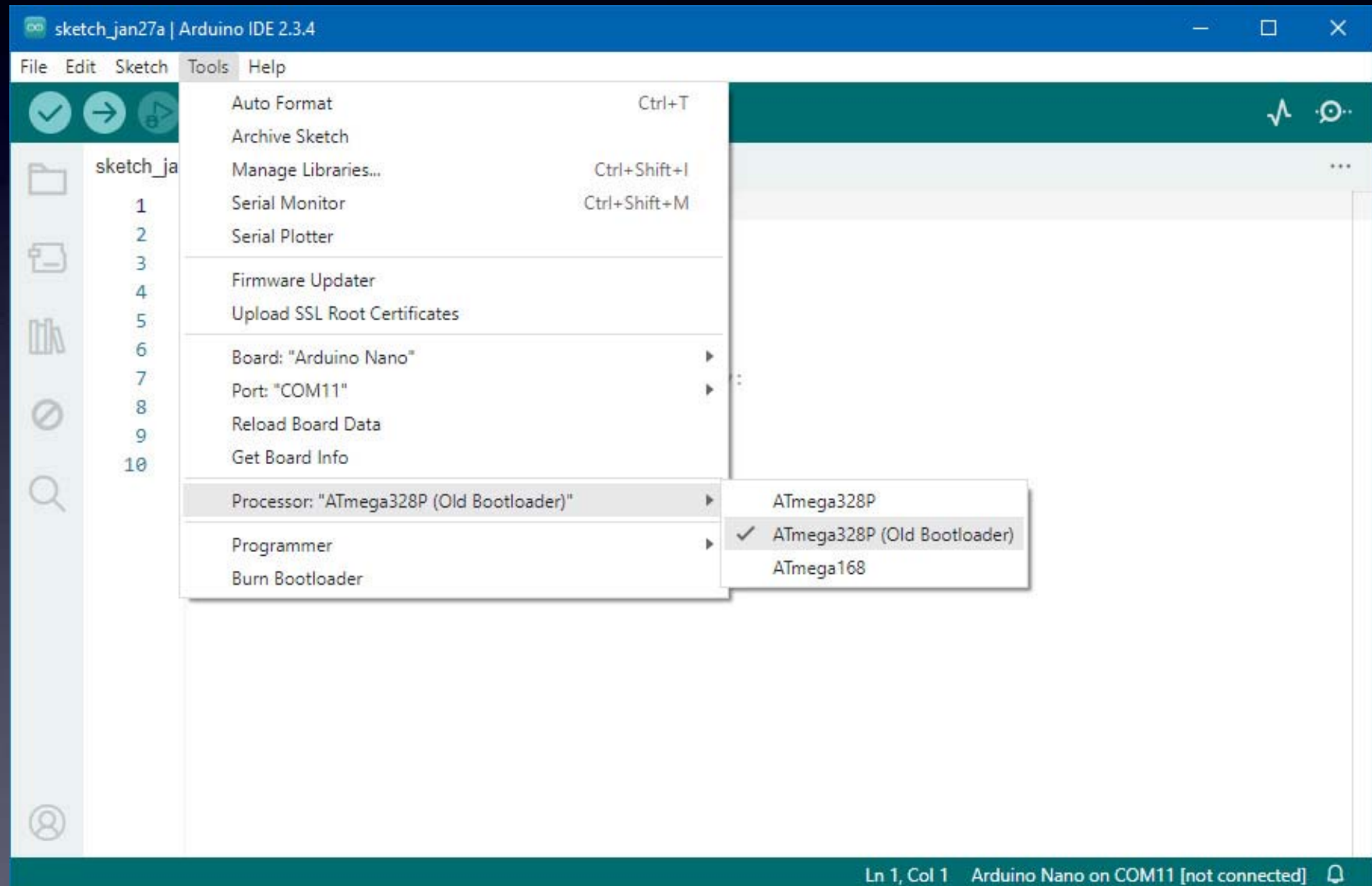
The first time you start your Arduino software
you need to set things up

(2)
Choose
your Processor

“ATmega328P (Old Bootloader)”



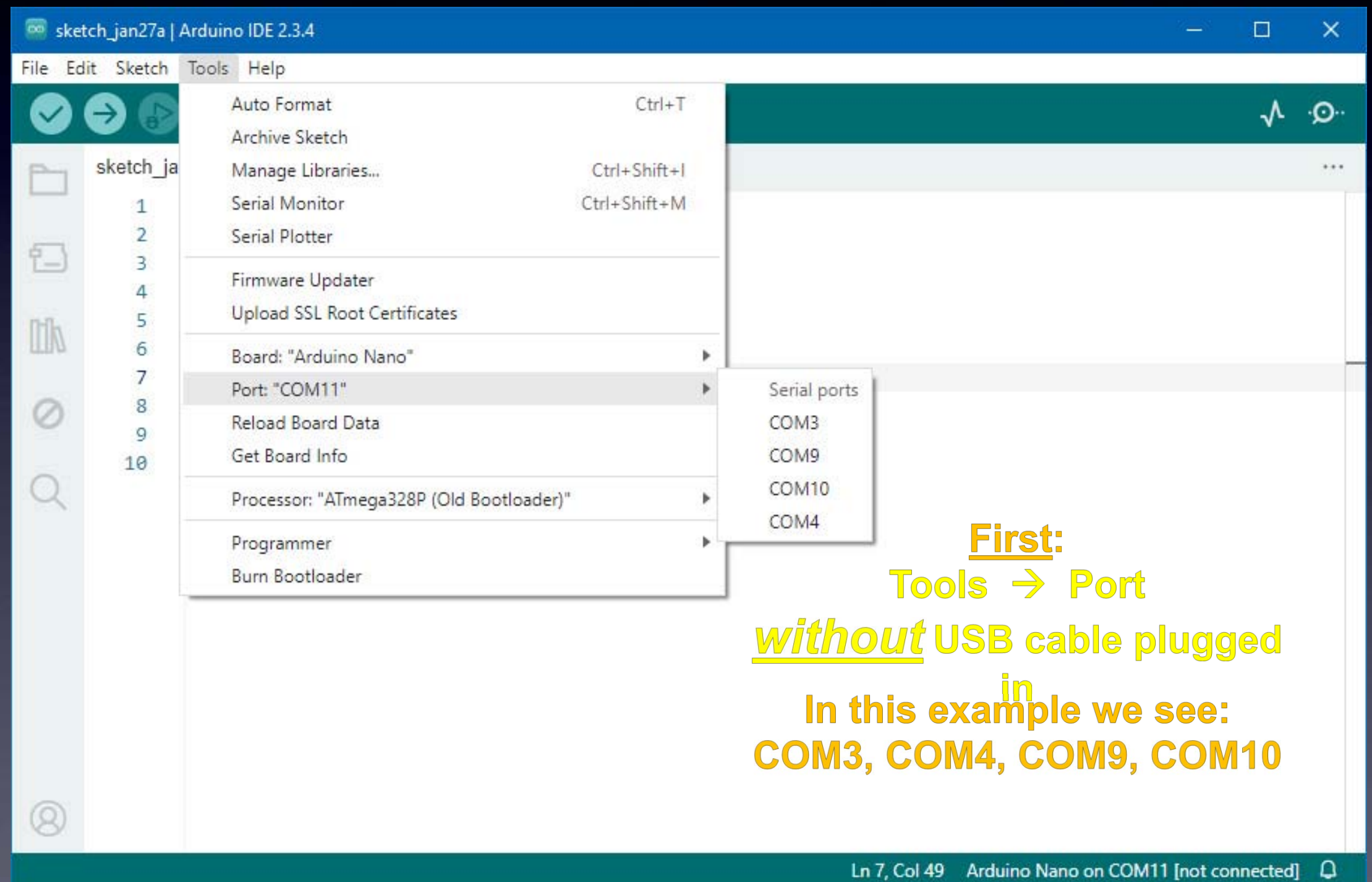
If this one doesn't work,
then
choose
“ATmega328P”



Arduino

The first time you start your Arduino software
you need to set things up

(3)
Choose
the Port
(this will be
different
depending on
your Operating
System)



First:
Tools → Port
without USB cable plugged
in
In this example we see:
COM3, COM4, COM9, COM10

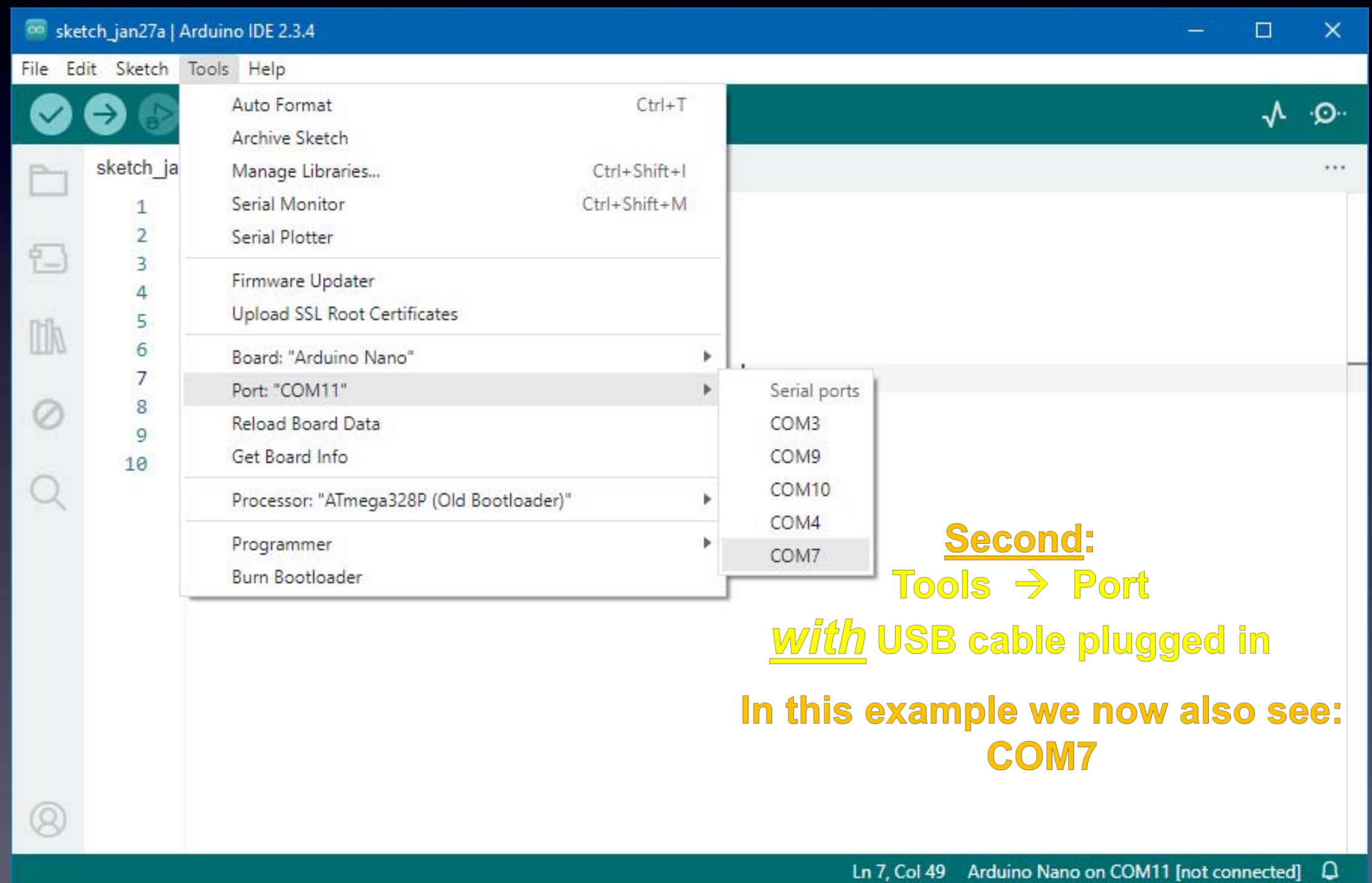
Arduino

The first time you start your Arduino software you need to set things up

(3)

Choose the Port
(this will be different depending on your Operating System)

(After installing the driver for your Arduino (USB-Serial adapter), with your Arduino plugged in, your operating system will see a serial port and it appears here.)



Second:
Tools → Port

with USB cable plugged in

In this example we now also see:
COM7

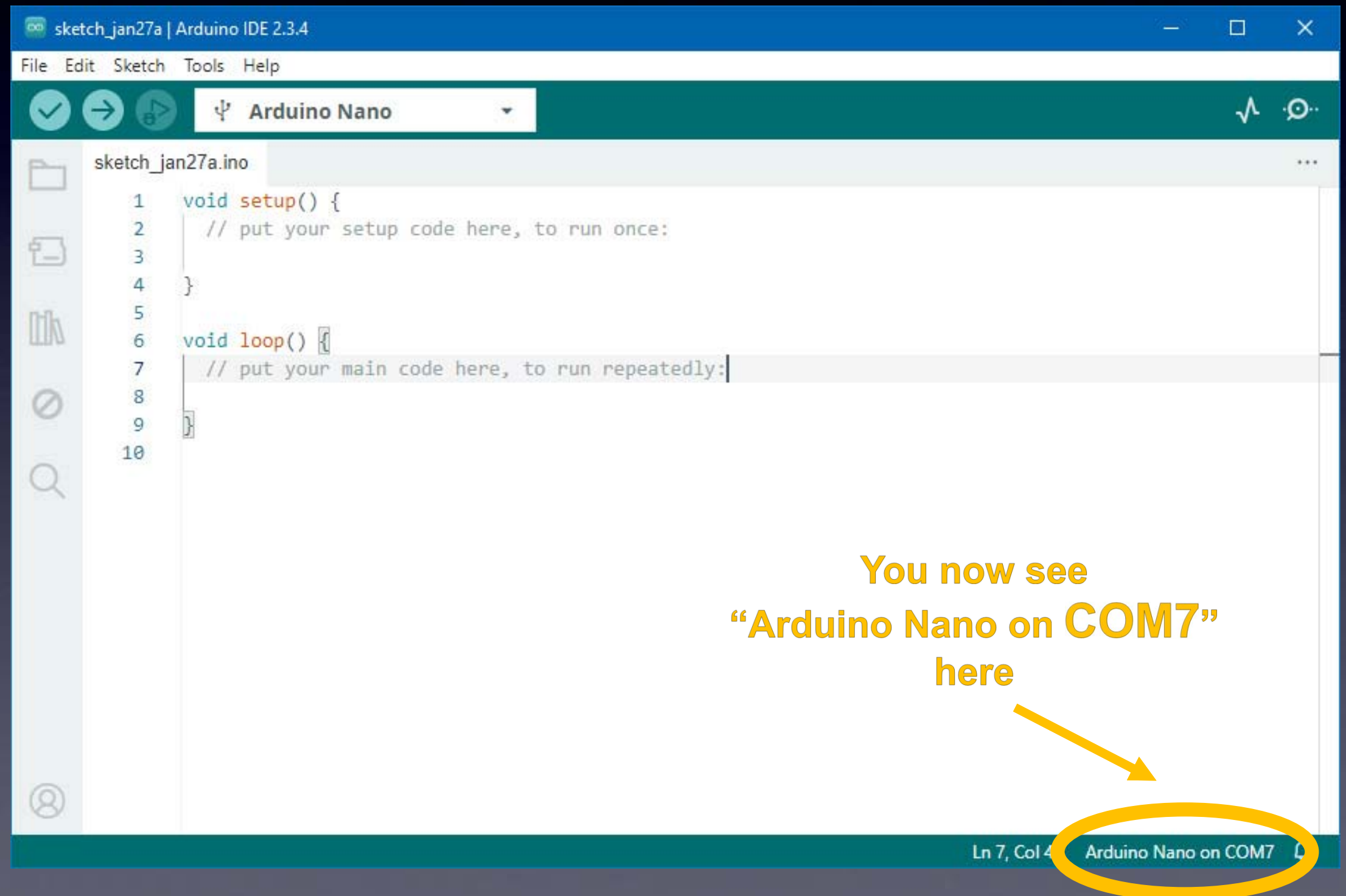
Arduino

The first time you start your Arduino software
you need to set things up

(3)

Choose
the Port
(this will be
different
depending on
your Operating
System)

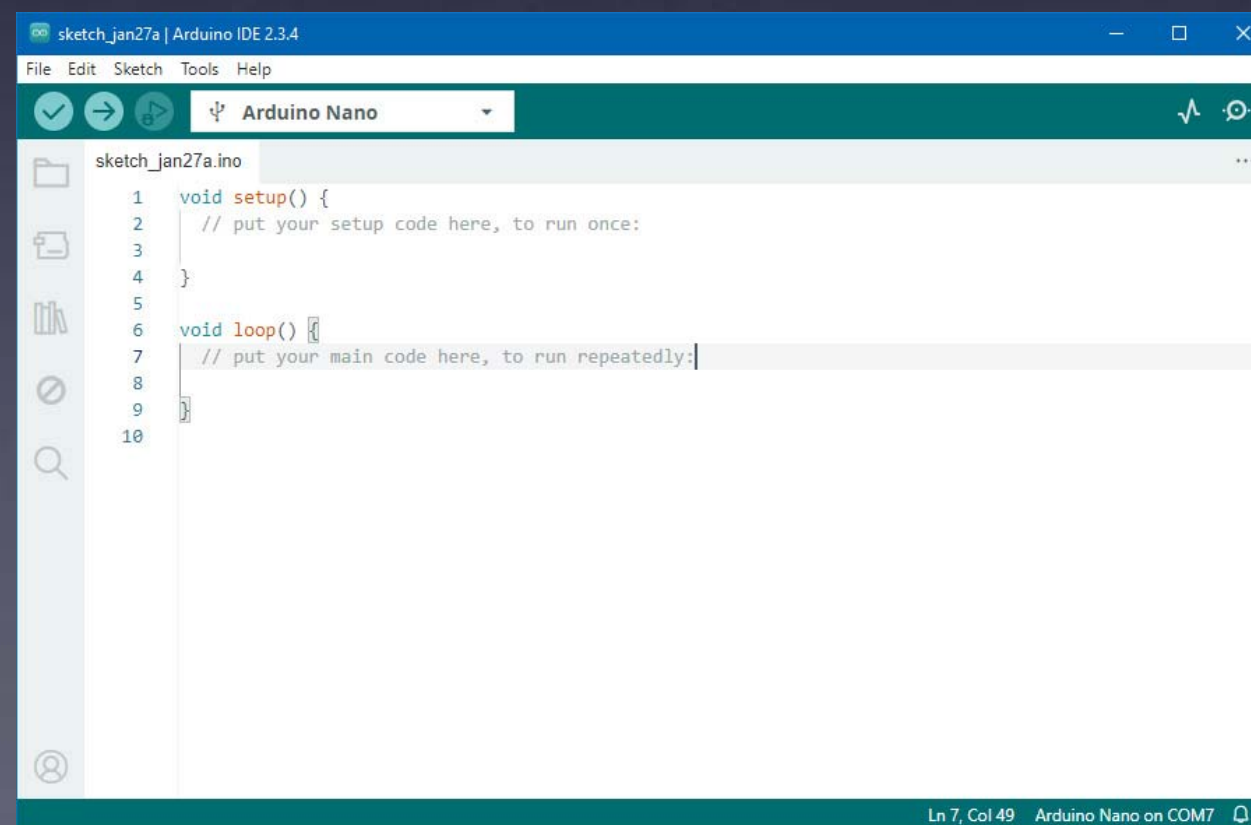
(After installing
the driver
for your Arduino
(USB-Serial adapter),
with your Arduino
plugged in,
your operating system
will see a serial port
and it appears here.)



Arduino

Your Arduino software is now ready

to program a new brainwave sequence sketch
into your Brain Machine !

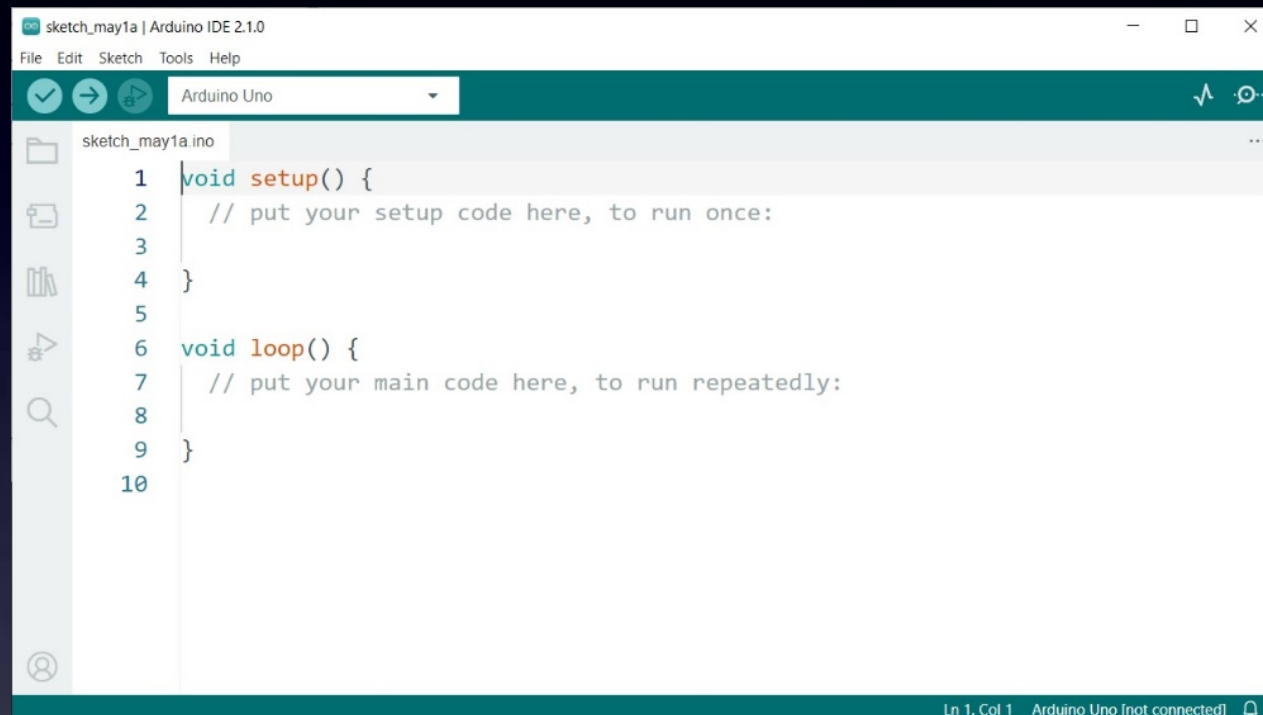


```
sketch_jan27a | Arduino IDE 2.3.4
File Edit Sketch Tools Help
ψ Arduino Nano
sketch_jan27a.ino
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }
10
```

Ln 7, Col 49 Arduino Nano on COM7

Arduino

Designed for non-geeky artists



```
1 void setup() {  
2   // put your setup code here, to run once:  
3  
4 }  
5  
6 void loop() {  
7   // put your main code here, to run repeatedly:  
8  
9 }  
10
```

Definition of

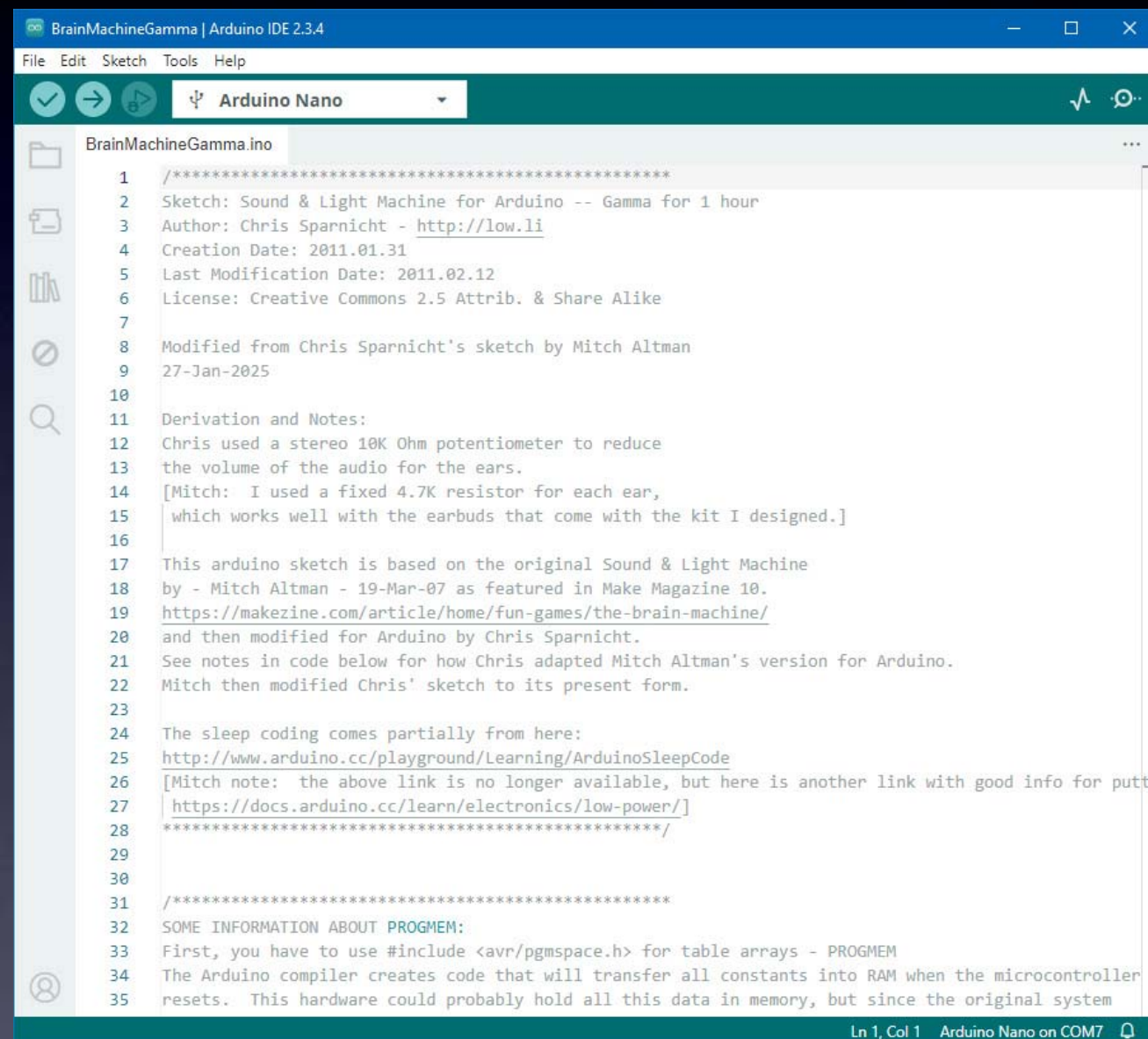
“Sketch” :

an Arduino program

Arduino

Designed for non-geeky artists

Download
the new
Gamma
“sketch”



```
BrainMachineGamma.ino
1  /*****
2  Sketch: Sound & Light Machine for Arduino -- Gamma for 1 hour
3  Author: Chris Sparnicht - http://low.li
4  Creation Date: 2011.01.31
5  Last Modification Date: 2011.02.12
6  License: Creative Commons 2.5 Attrib. & Share Alike
7
8  Modified from Chris Sparnicht's sketch by Mitch Altman
9  27-Jan-2025
10
11 Derivation and Notes:
12 Chris used a stereo 10K Ohm potentiometer to reduce
13 the volume of the audio for the ears.
14 [Mitch: I used a fixed 4.7K resistor for each ear,
15 which works well with the earbuds that come with the kit I designed.]
16
17 This arduino sketch is based on the original Sound & Light Machine
18 by - Mitch Altman - 19-Mar-07 as featured in Make Magazine 10.
19 https://makezine.com/article/home/fun-games/the-brain-machine/
20 and then modified for Arduino by Chris Sparnicht.
21 See notes in code below for how Chris adapted Mitch Altman's version for Arduino.
22 Mitch then modified Chris' sketch to its present form.
23
24 The sleep coding comes partially from here:
25 http://www.arduino.cc/playground/Learning/ArduinoSleepCode
26 [Mitch note: the above link is no longer available, but here is another link with good info for putting
27 https://docs.arduino.cc/learn/electronics/low-power/]
28 *****/
29
30
31 /*****
32 SOME INFORMATION ABOUT PROGMEM:
33 First, you have to use #include <avr/pgmspace.h> for table arrays - PROGMEM
34 The Arduino compiler creates code that will transfer all constants into RAM when the microcontroller
35 resets. This hardware could probably hold all this data in memory, but since the original system
```

“Sketch” :
an Arduino program

The following slides show where to find this sketch...

Arduino

Download a new brainwave sequence “sketch”



<https://CornfieldElectronics.com>

Arduino

Download a new brainwave sequence “sketch”



“Projects” tab

Arduino

Download a new brainwave sequence “sketch”



“Projects” tab

Arduino

Download a new brainwave sequence “sketch”

Click here to
download the
Gamma wave
sequence
sketch

Project: Brain Machine kit
-- Make your own Brain Machine!



The Brain Machine is a Sound and Light Machine kit for total beginners to learn to solder. When you are finished, wear them (with your eyes closed), turn it on, and your brain will automatically follow along to the really nice pre-programmed 14-minute-long meditation brainwave sequence, presented through pulsing lights and sound. Oh, and you will also hallucinate really beautiful colors and patterns along the way!

This project is based on my original article in [MAKE Magazine](#). The first Brain Machine kit was a collaboration between Mitch and [Ladyada / Adafruit](#). This new version of the Brain Machine kit makes use of the [Arduino Brain Machine project, created by Chris Sparnicht "LaughterOnWater"](#). All documentation for this new version of the Brain Machine kit is available on my Github: [Brain Machine kit Github page](#).

DISCLAIMER: Light and Sound Machines, such as this one, can be fun for many of us, but may be seriously dangerous for those prone to seizures or who are photosensitive.

This kit takes about 60 minutes to complete.

For **assembly instructions**, please see: [Brain Machine kit assembly instructions](#)

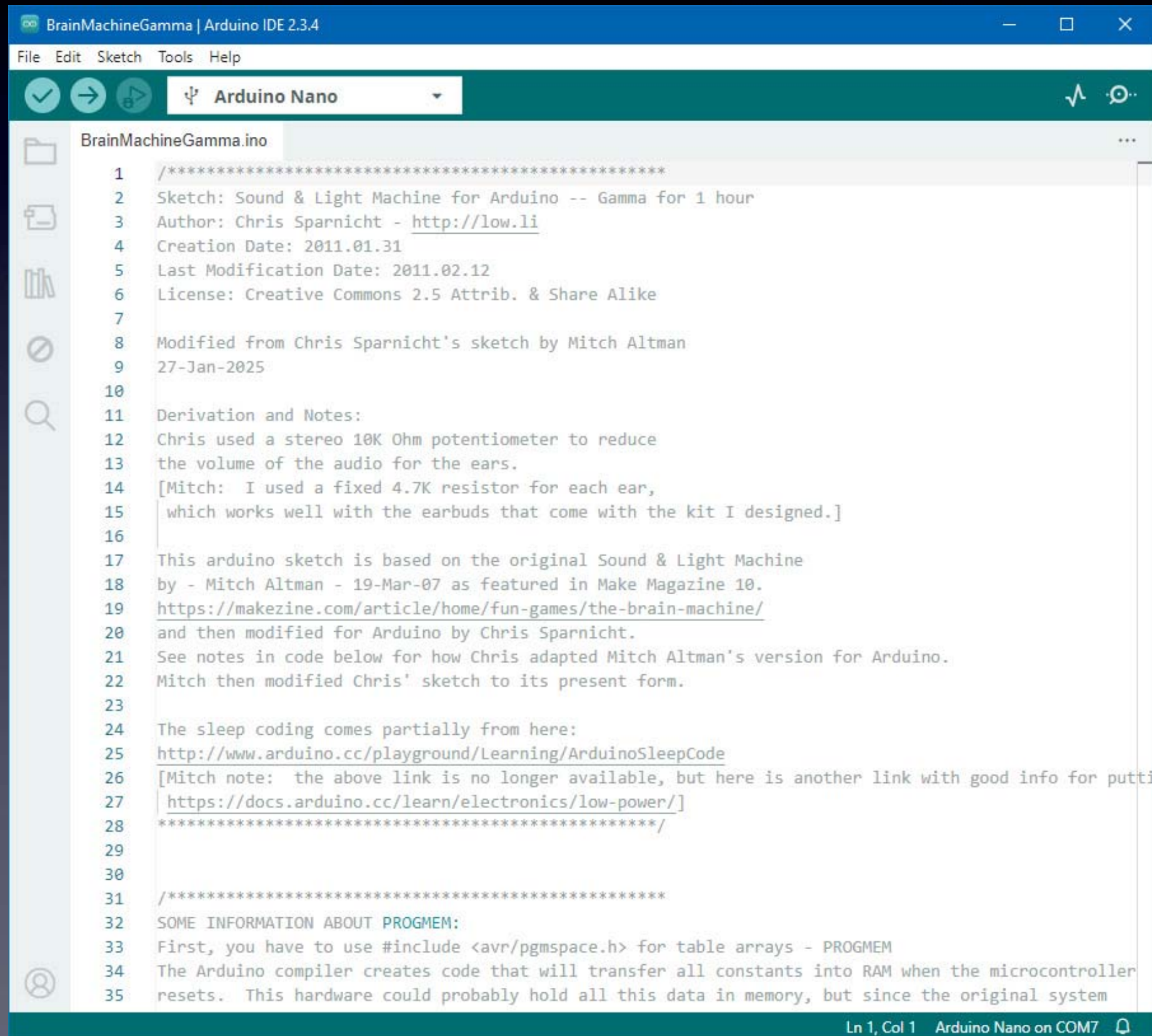
Arduino Sketches for brainwave sequences:
[Brain Machine Meditation sequence sketch](#) -- to play a nice 14-minute Meditation
[Brain Machine Gamma sequence sketch](#) -- to play Gama waves (40.0 Hz) for 1 hour

[Early research over the last few years at MIT](#) and other research labs shows that "plaque" (which is one cause of Alzheimer's pathology) is reduced in mice. Studies are ongoing for helping humans with Alzheimer's pathology. 40 Hz Gamma stimulation may also be helpful for ["chemo brain fog"](#). There may also be some benefit to people with CFS/ME, or people with "brain fog" from long Covid.

Scroll down

Arduino

You can now open the brainwave sequence sketch:
File → Open...



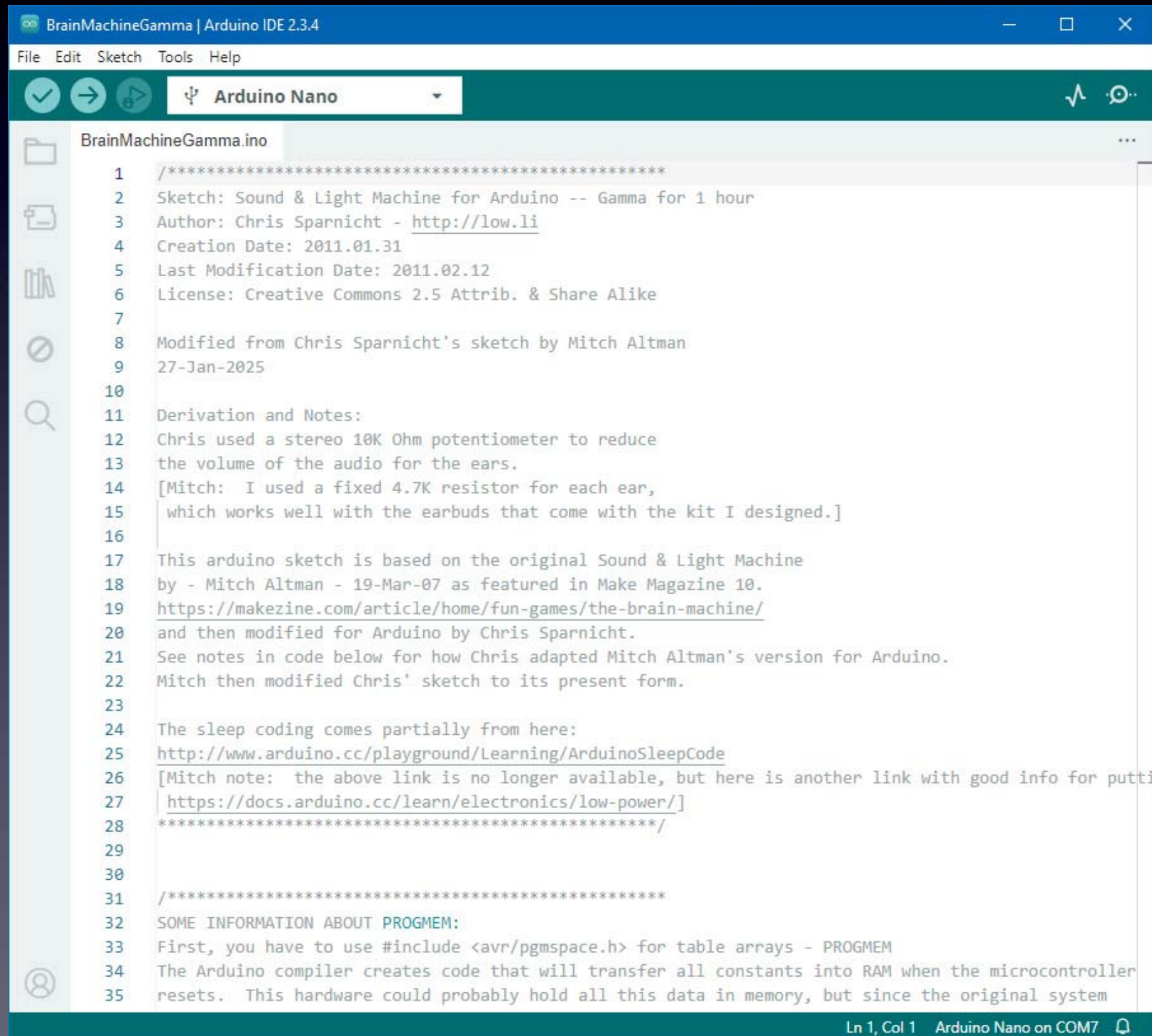
The screenshot shows the Arduino IDE 2.3.4 interface. The title bar reads "BrainMachineGamma | Arduino IDE 2.3.4". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar shows a checkmark, a right arrow, a play button, a USB icon, and a dropdown menu currently set to "Arduino Nano". The left sidebar contains icons for a file explorer, a sketchbook, a library, a serial monitor, and a search icon. The main editor window displays the "BrainMachineGamma.ino" sketch with the following content:

```
1  /*****
2  Sketch: Sound & Light Machine for Arduino -- Gamma for 1 hour
3  Author: Chris Sparnicht - http://low.li
4  Creation Date: 2011.01.31
5  Last Modification Date: 2011.02.12
6  License: Creative Commons 2.5 Attrib. & Share Alike
7
8  Modified from Chris Sparnicht's sketch by Mitch Altman
9  27-Jan-2025
10
11 Derivation and Notes:
12 Chris used a stereo 10K Ohm potentiometer to reduce
13 the volume of the audio for the ears.
14 [Mitch: I used a fixed 4.7K resistor for each ear,
15  which works well with the earbuds that come with the kit I designed.]
16
17 This arduino sketch is based on the original Sound & Light Machine
18 by - Mitch Altman - 19-Mar-07 as featured in Make Magazine 10.
19 https://makezine.com/article/home/fun-games/the-brain-machine/
20 and then modified for Arduino by Chris Sparnicht.
21 See notes in code below for how Chris adapted Mitch Altman's version for Arduino.
22 Mitch then modified Chris' sketch to its present form.
23
24 The sleep coding comes partially from here:
25 http://www.arduino.cc/playground/Learning/ArduinoSleepCode
26 [Mitch note: the above link is no longer available, but here is another link with good info for putting
27 https://docs.arduino.cc/learn/electronics/low-power/]
28 *****/
29
30
31 /*****
32 SOME INFORMATION ABOUT PROGMEM:
33 First, you have to use #include <avr/pgmspace.h> for table arrays - PROGMEM
34 The Arduino compiler creates code that will transfer all constants into RAM when the microcontroller
35 resets. This hardware could probably hold all this data in memory, but since the original system
```

The status bar at the bottom indicates "Ln 1, Col 1" and "Arduino Nano on COM7".

Arduino

You can now program your Brain Machine with a new synth sketch !

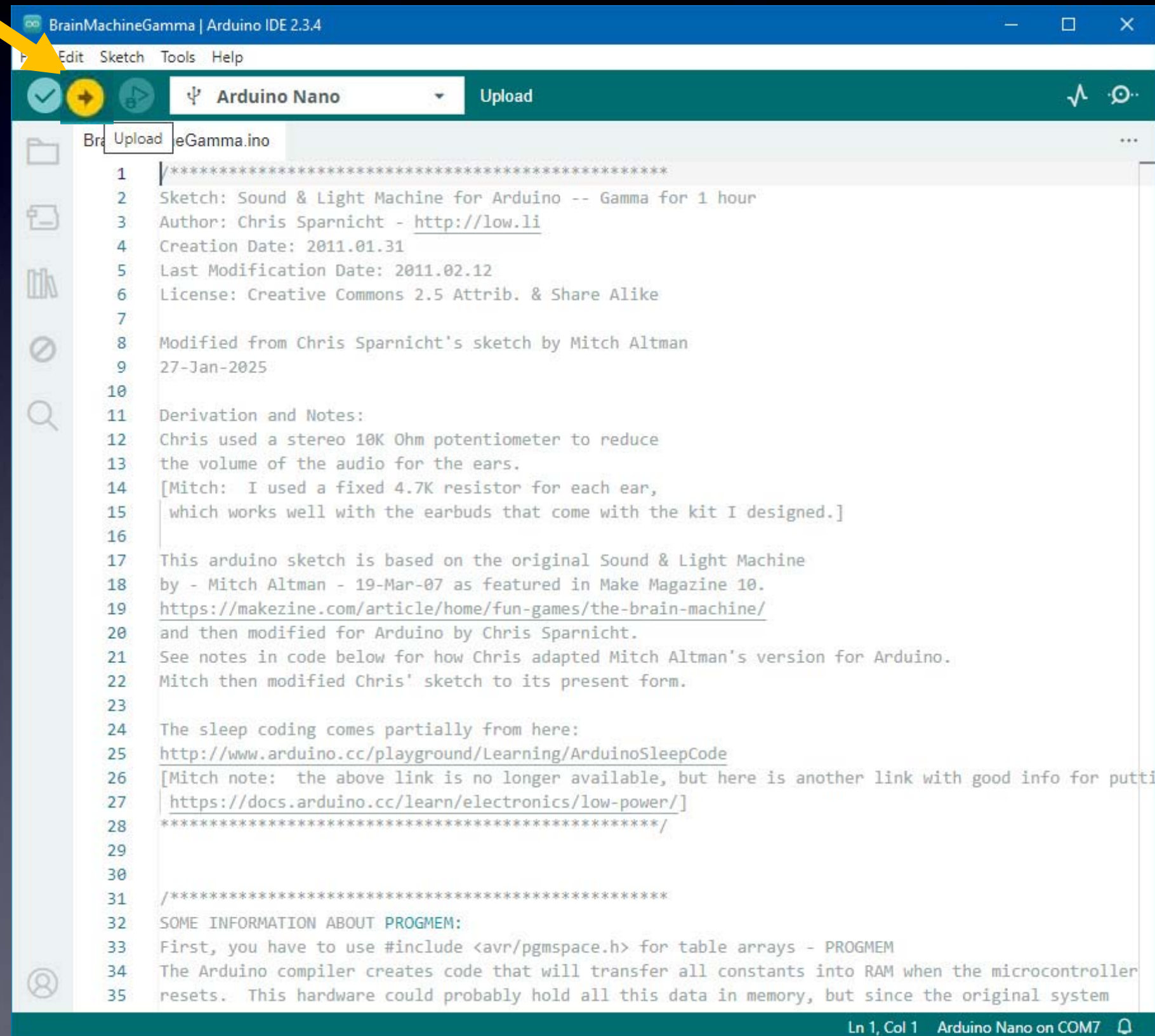


```
BrainMachineGamma | Arduino IDE 2.3.4
File Edit Sketch Tools Help
✓ → ⏮ Arduino Nano
BrainMachineGamma.ino
1 /*****
2 Sketch: Sound & Light Machine for Arduino -- Gamma for 1 hour
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Ln 1, Col 1 Arduino Nano on COM7

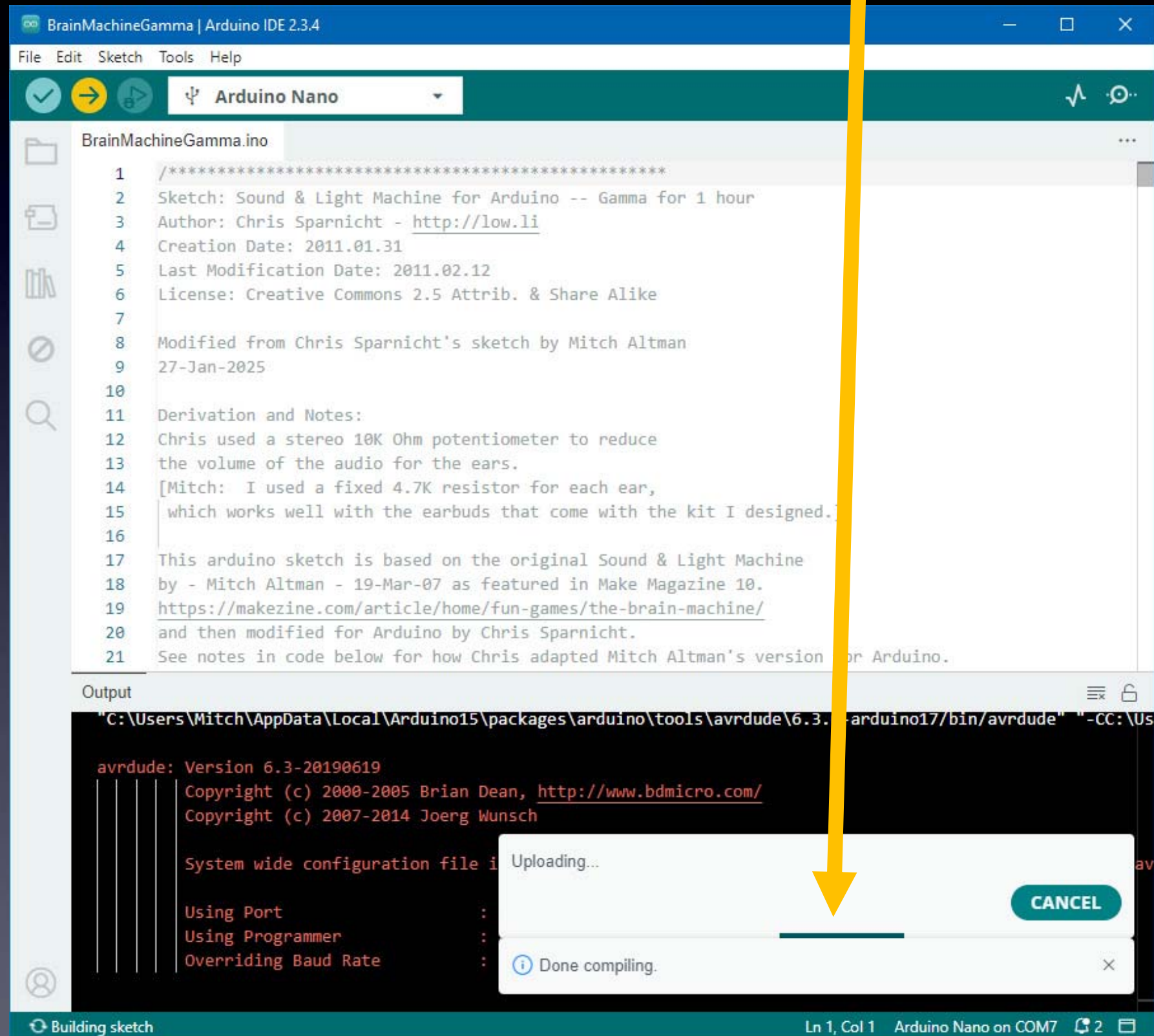
Arduino

With the USB-C cable connected to your Brain Machine press the “Upload” button



Arduino

While uploading, you will see a progress bar...



...and when it's completed successfully, it says: "Upload done"

Brain Machine

**Disconnect your Brain Machine board
from the USB-C cable,**

turn on your Brain Machine,

And...

Let's Trip Out in New Ways !



Please Remember:

to

Wash your hands

after soldering

Brain Machine kit

Hack Your Brain With Sound & Light



open source
hardware



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cornFIELD electronics