

Brain Machine kit

Assembly Instructions & Programming Instructions



open source
hardware



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CORNFIELD electronics

Brain Machine kit



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.

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.)

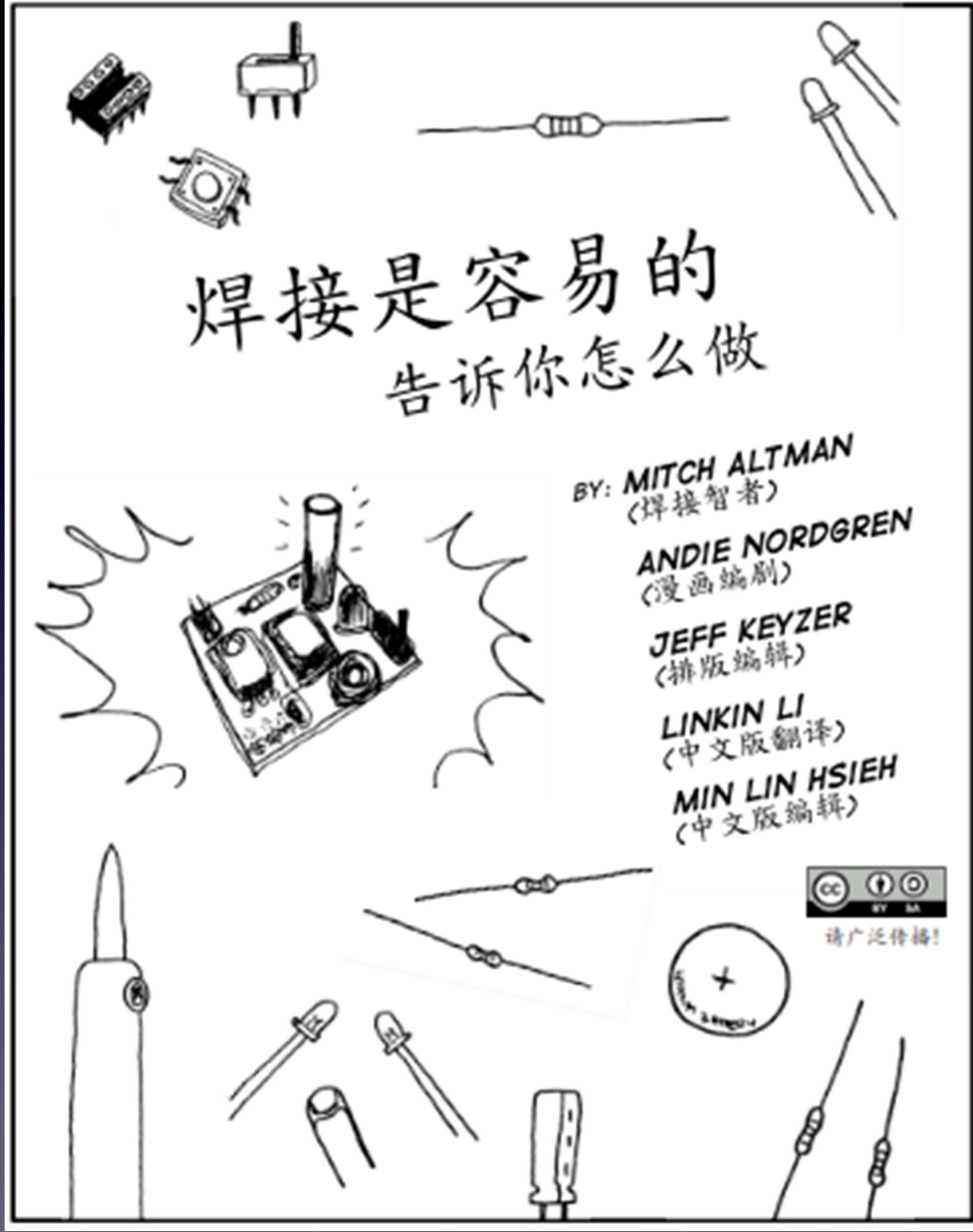
download for free at:
<http://mightyohm.com/soldercomic>

Learn To Solder



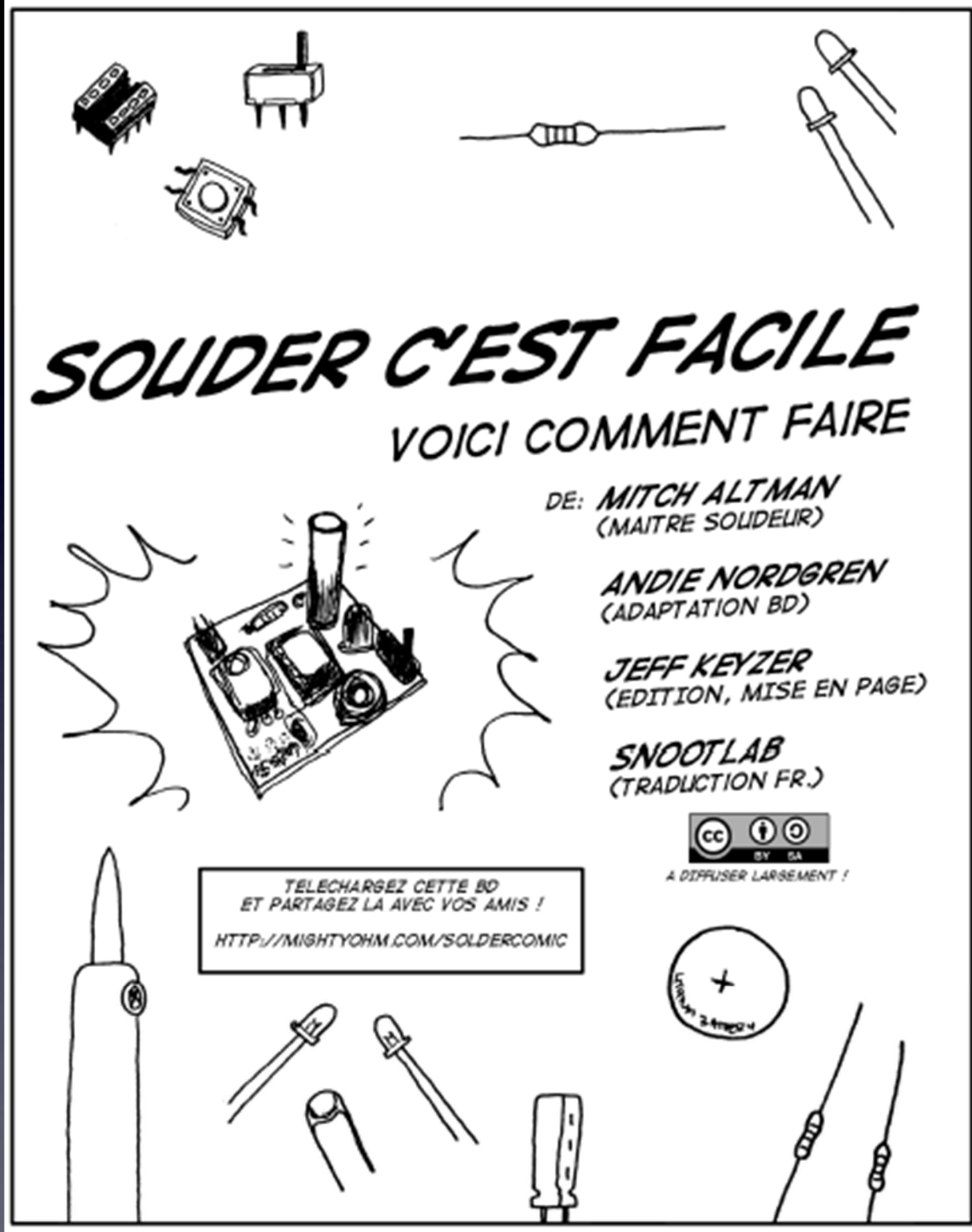
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Learn To Solder



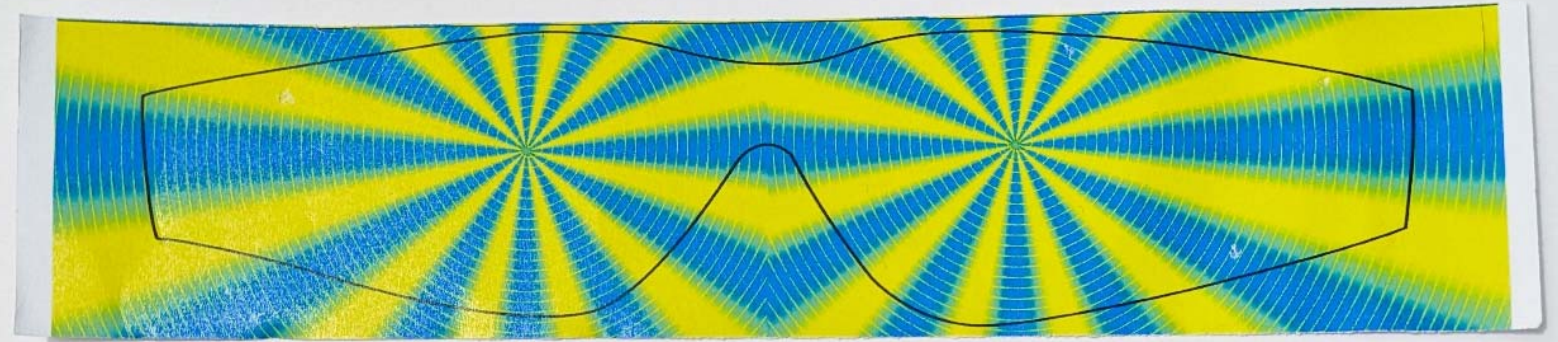
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Learn To Solder

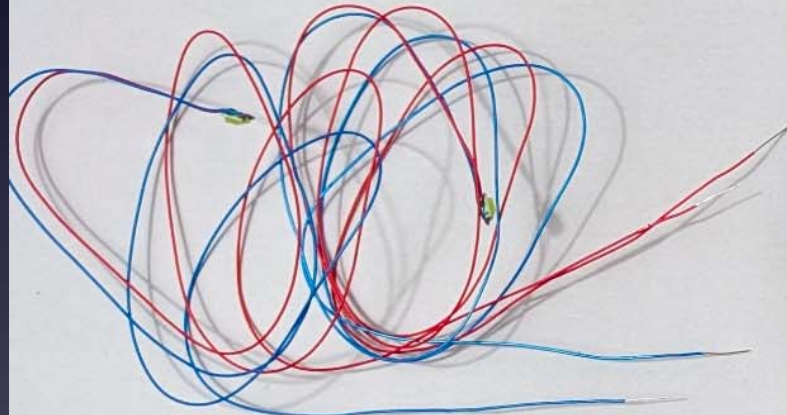


download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Trippy Graphix



LED1, LED2



Arduino Nano



Power Supply

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



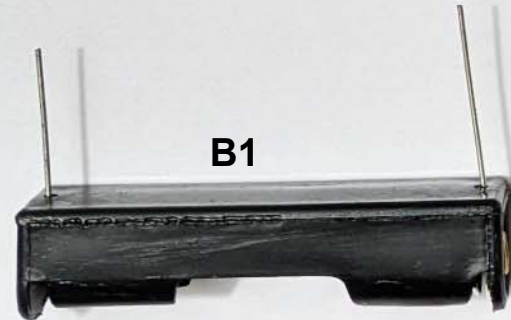
R3, R4 (47) Yellow, Violet, Black, Gold



J1



C1, C2



B1



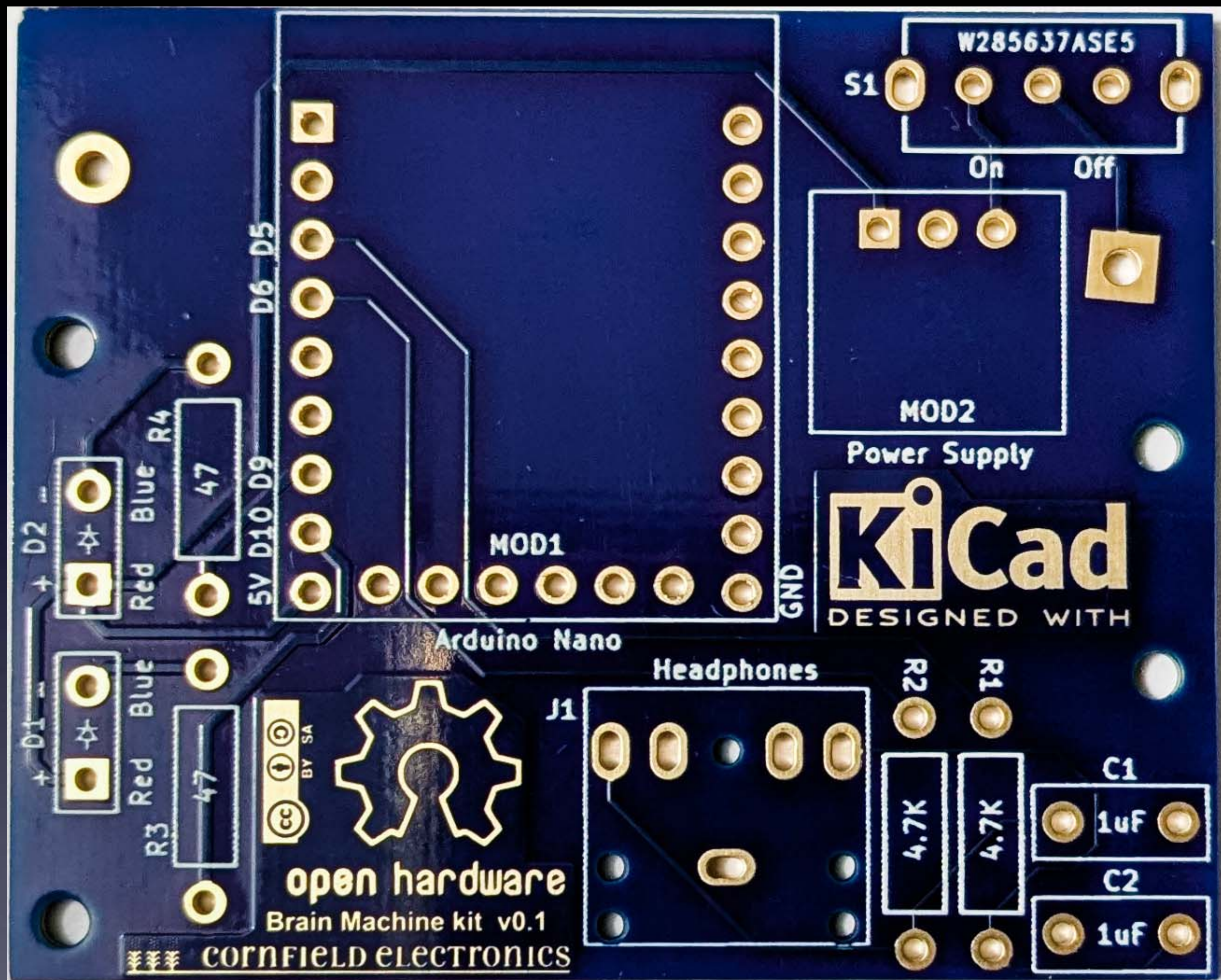
S1



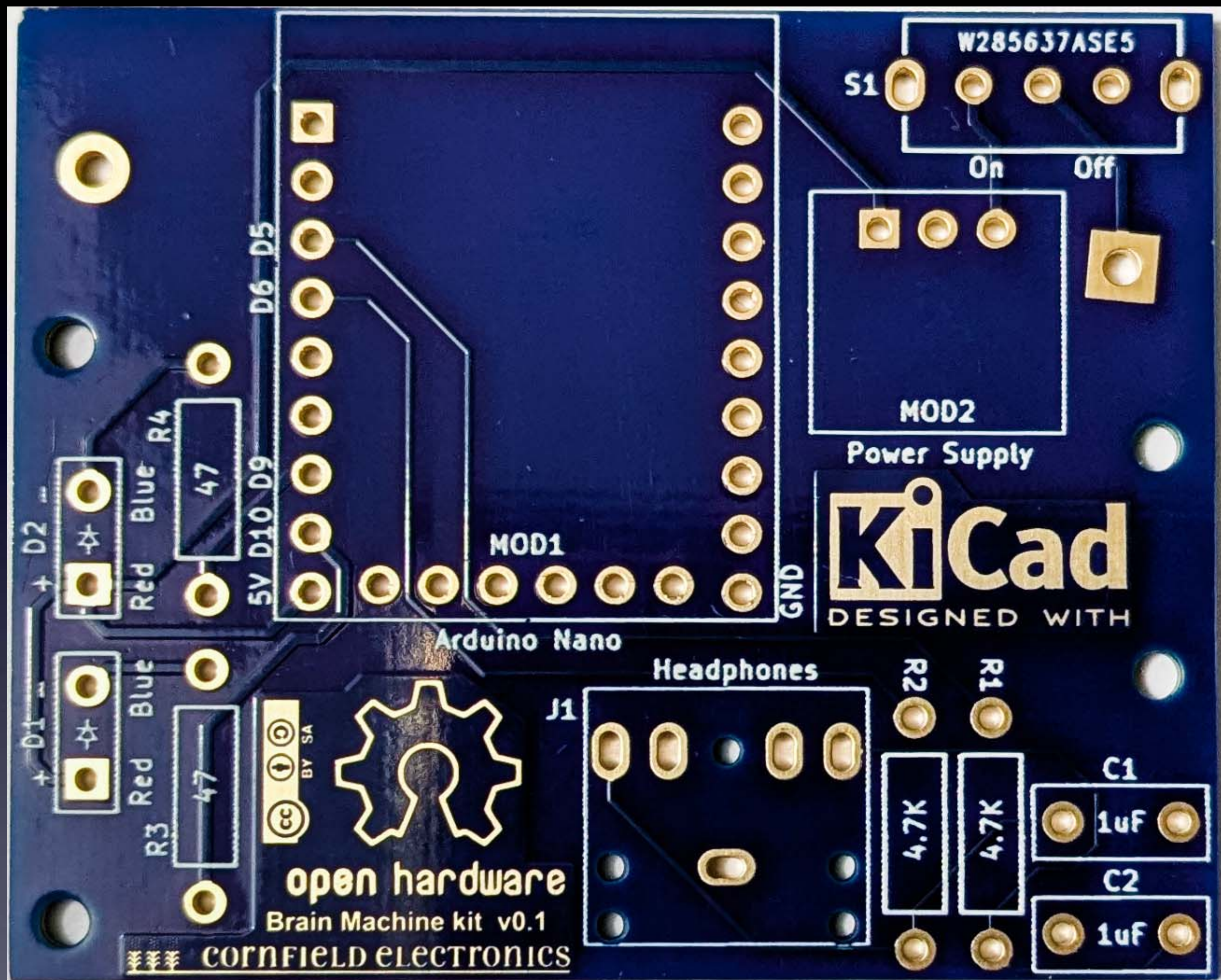
Header pins

Zip ties

All of the parts



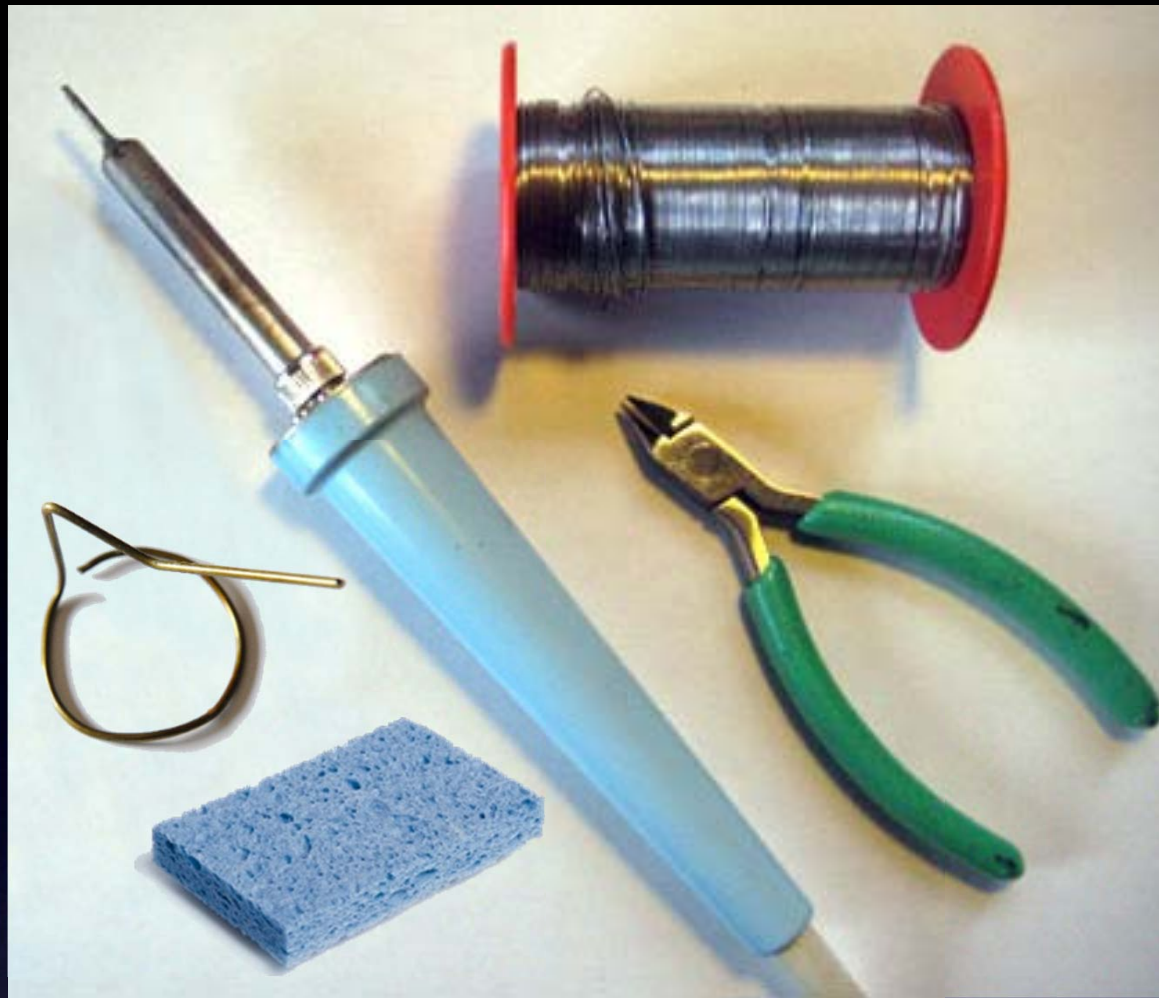
The board we'll solder the parts to



Front/Top of board



Back/Bottom of board



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



Note:
If you use **Lead-Free** solder
it is very helpful
to also have
flux paste in a syringe
And **Isopropyl Alcohol**

- tape
- felt-tip pen
- scissors

Our first part



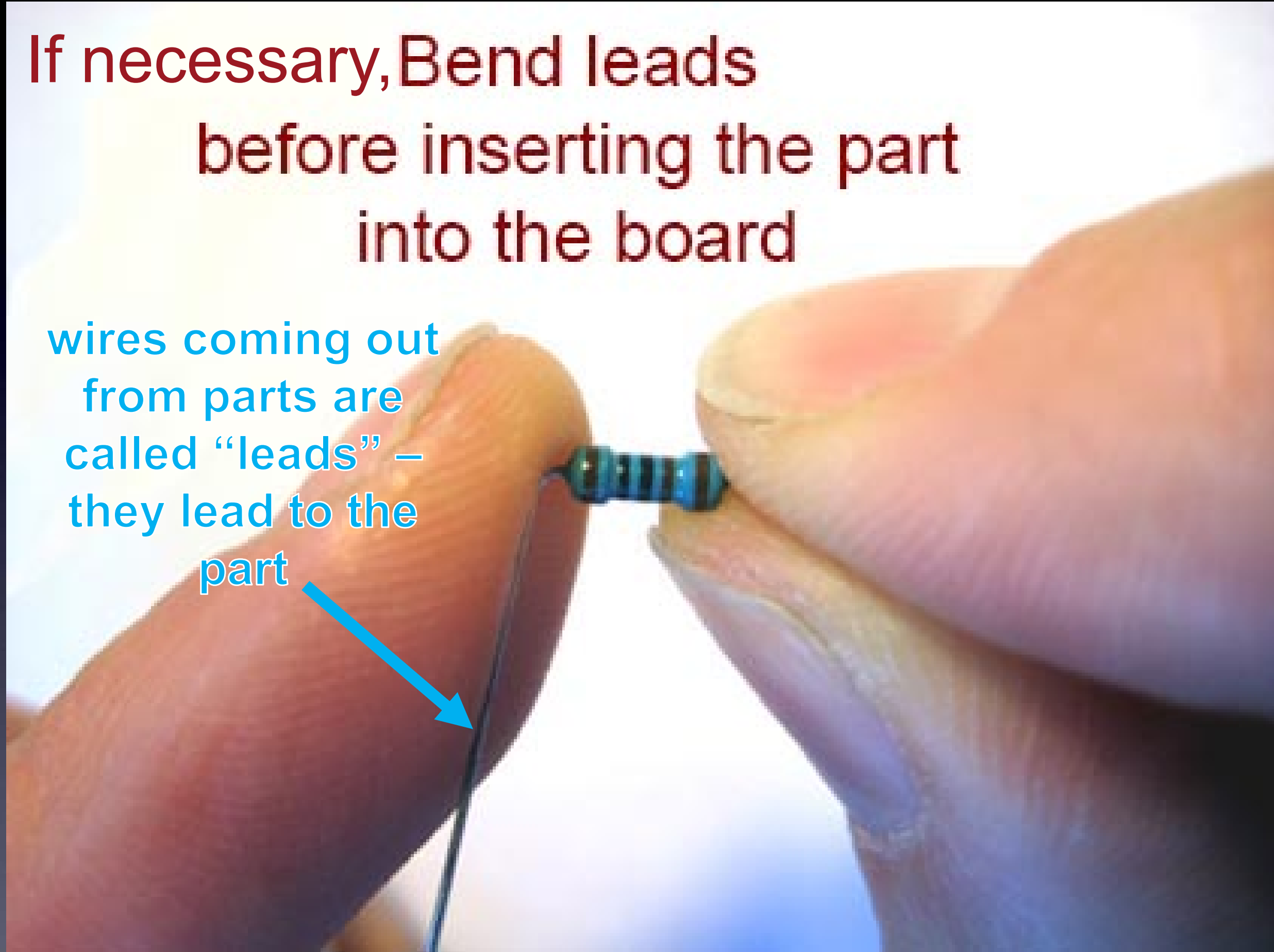
R1: Yellow, Violet, Red

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

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

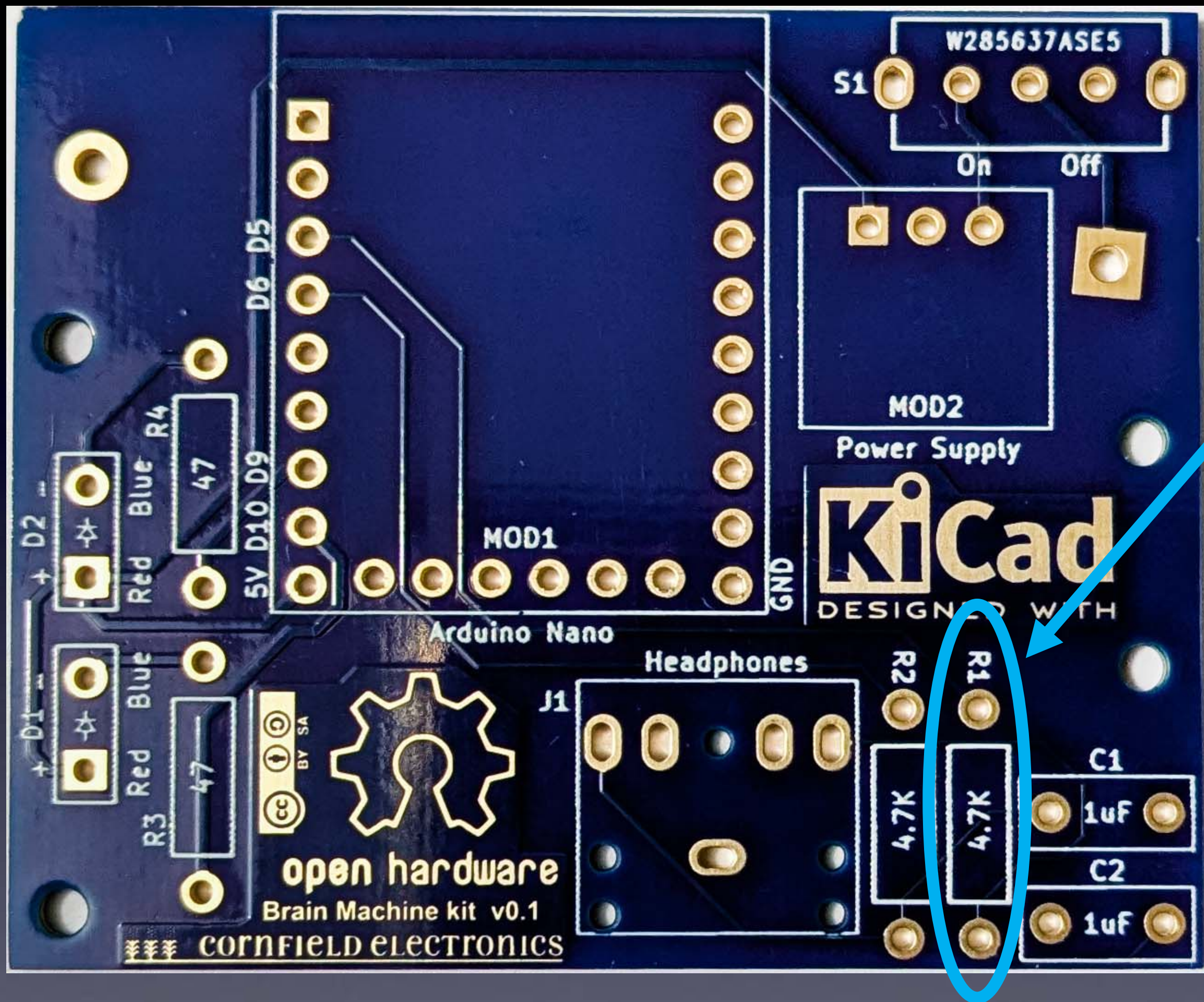
If necessary, Bend leads
before inserting the part
into the board

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



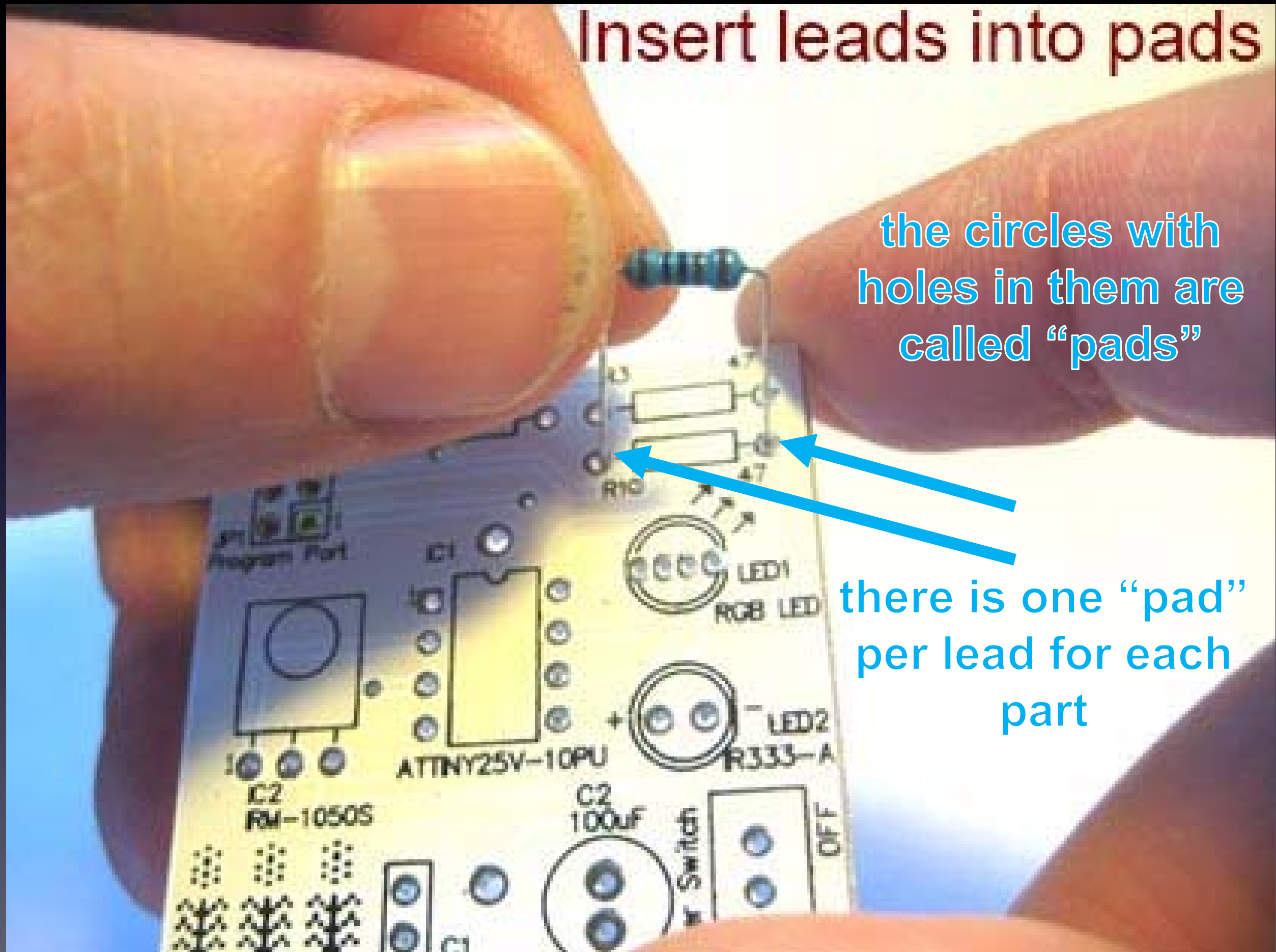
R1

R1 – this is where it goes

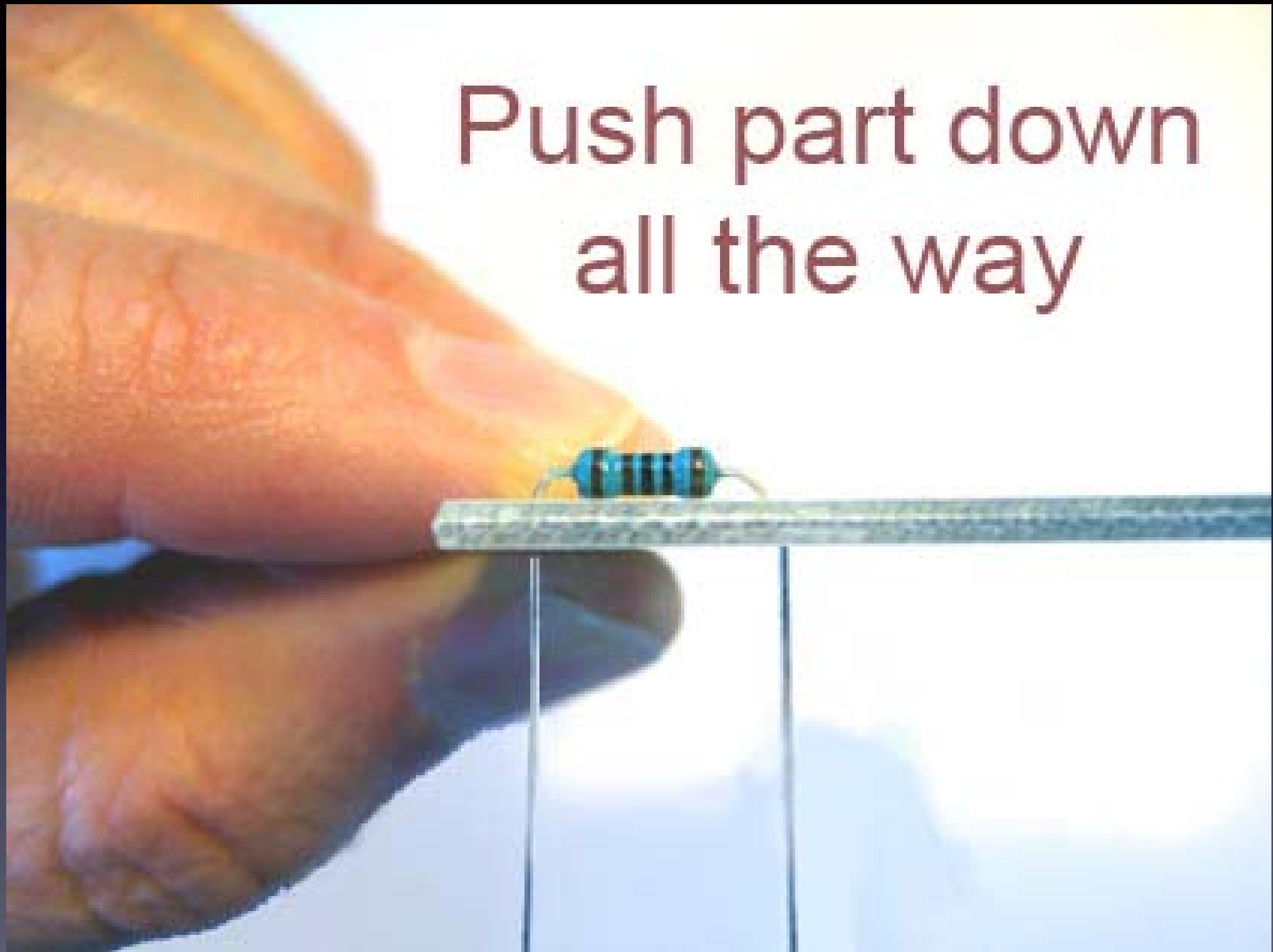
Insert leads into pads

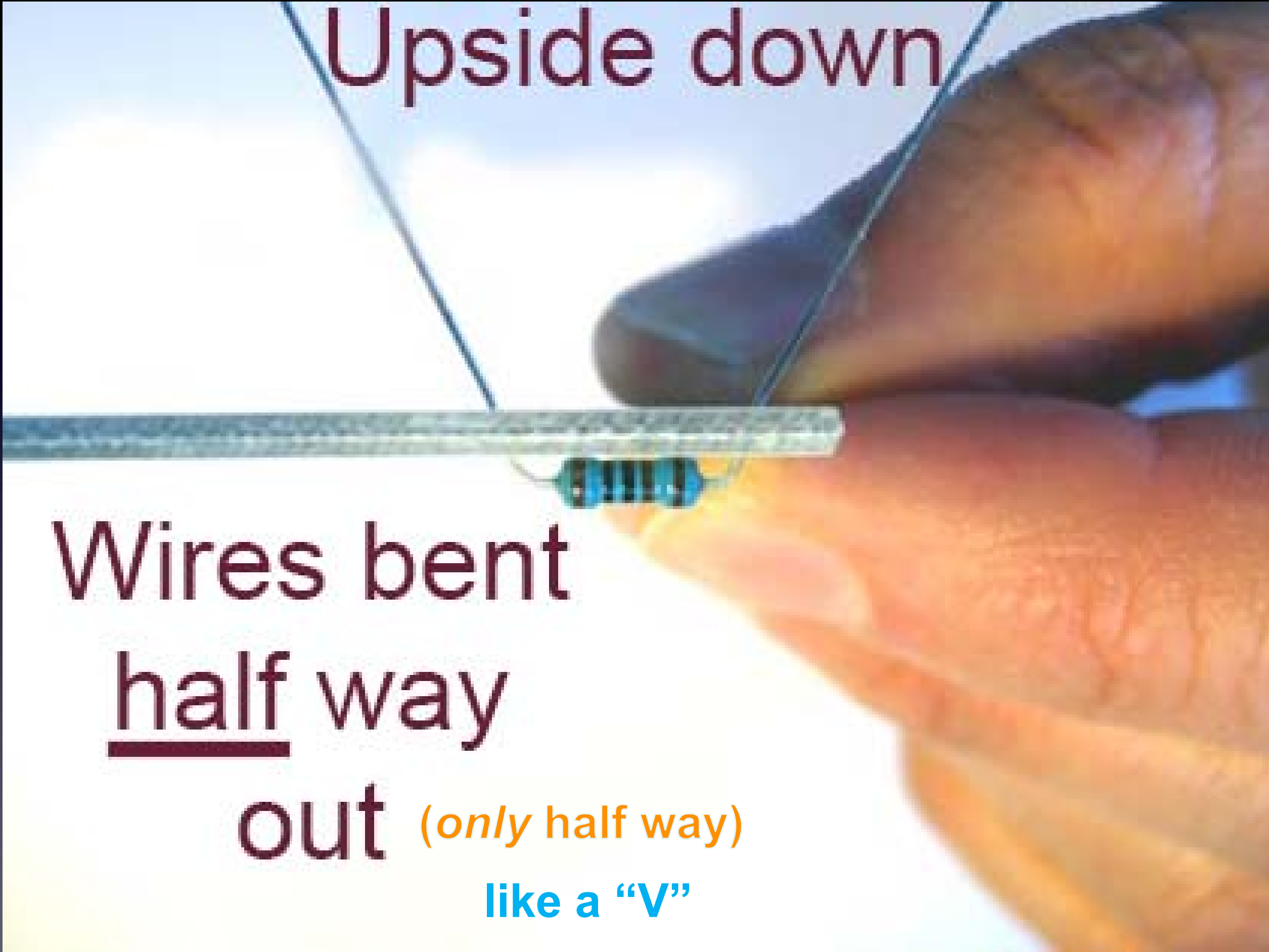
the circles with
holes in them are
called "pads"

there is one "pad"
per lead for each
part



Push part down
all the way

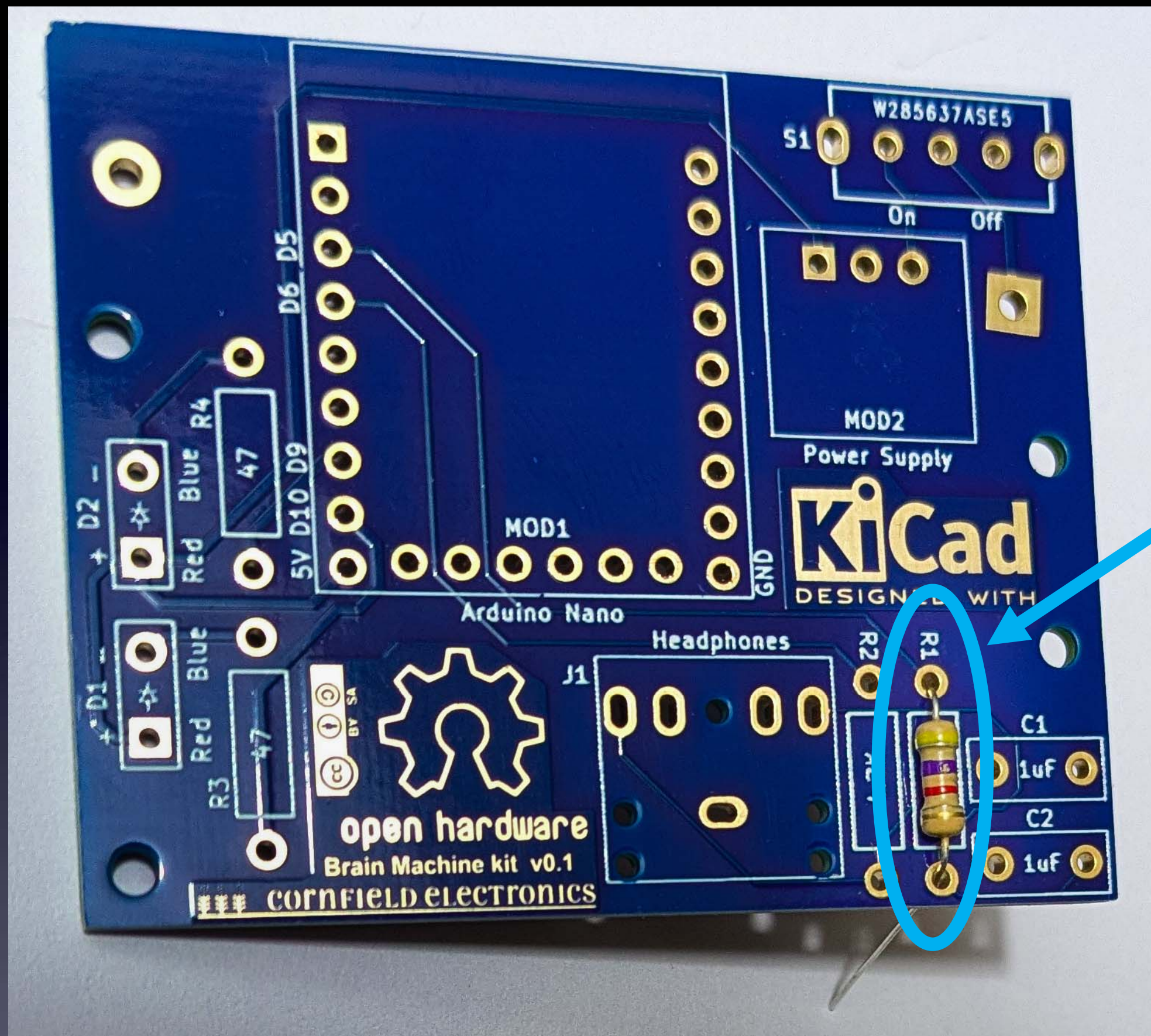


A close-up photograph of a person's hand holding a thin metal wire. A small, cylindrical electronic component, likely a resistor, is attached to the wire. The wire is bent into a V-shape at the point where the component is attached. The background is a plain, light-colored surface.

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!

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)

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:

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



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)

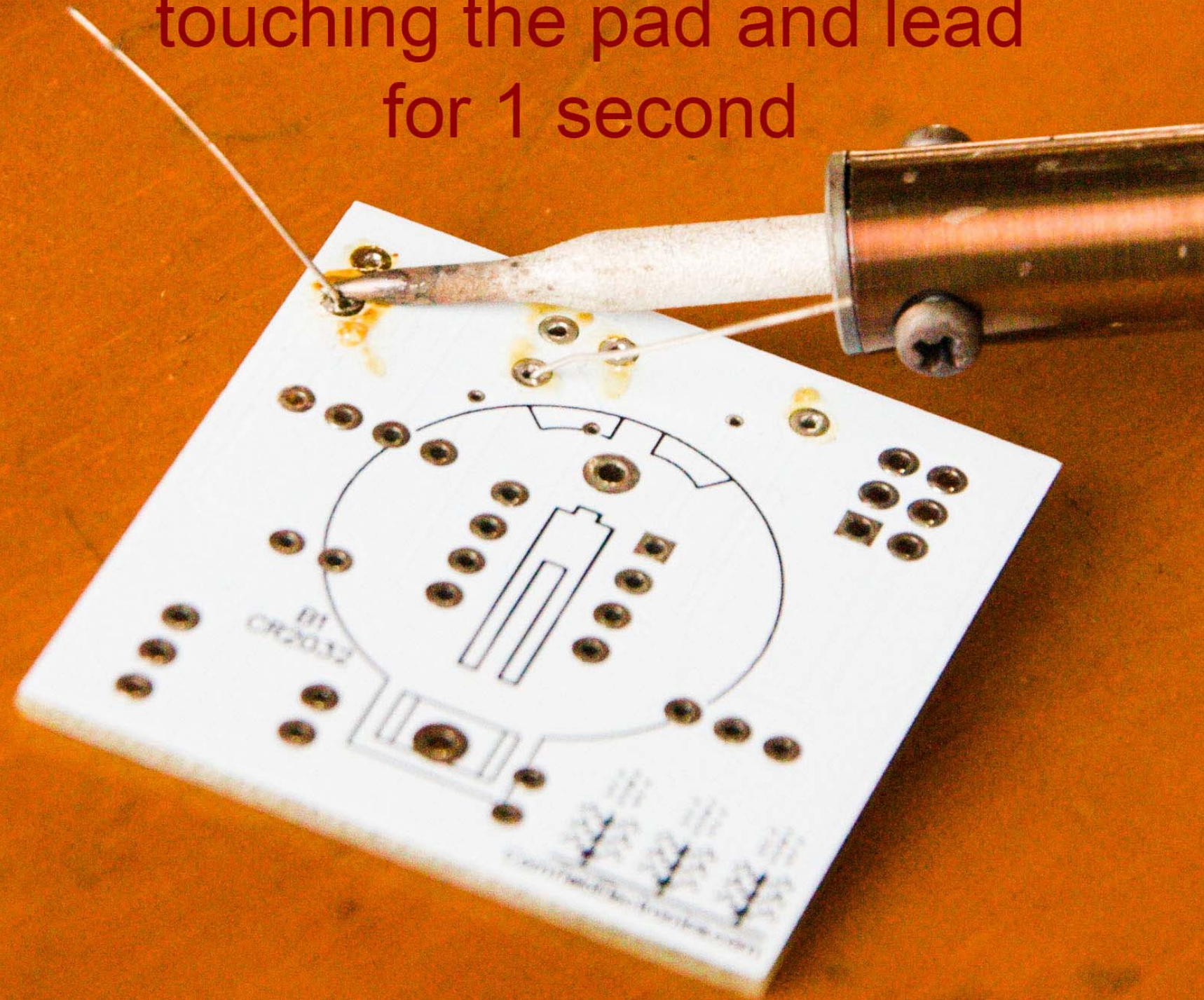
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

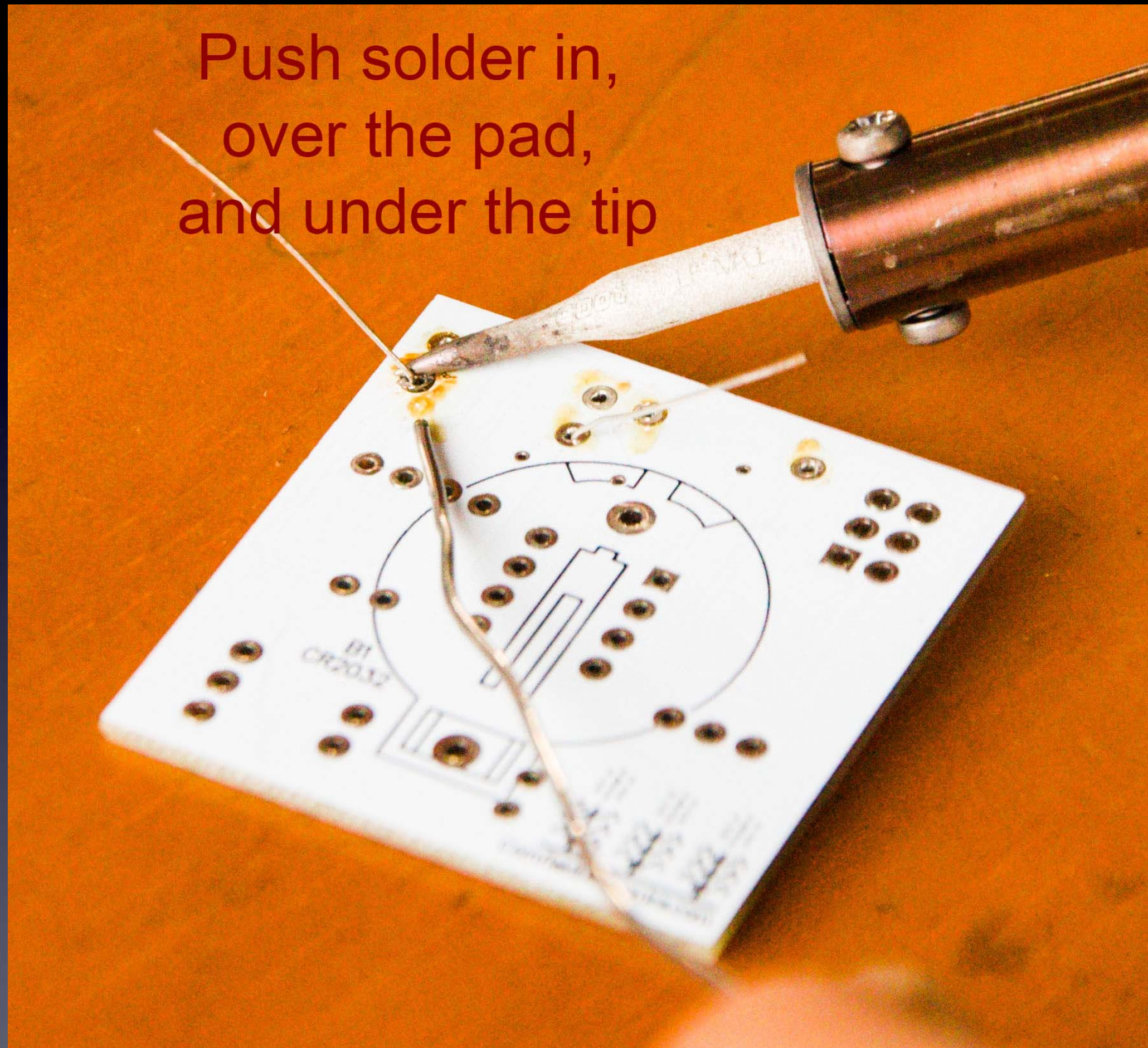
Keep the tip shiny silver!

knock solder off the tip

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

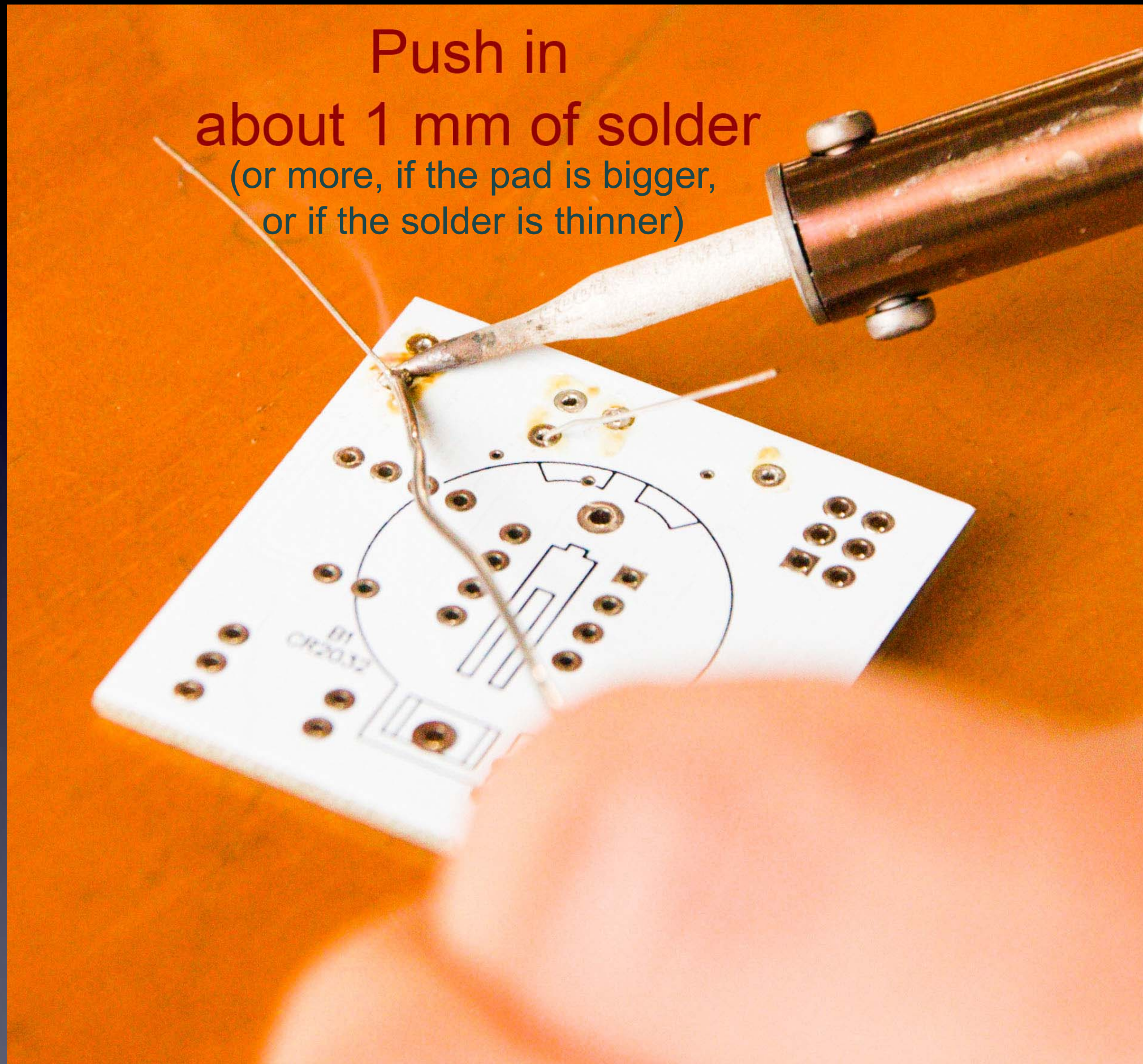


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second



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)!



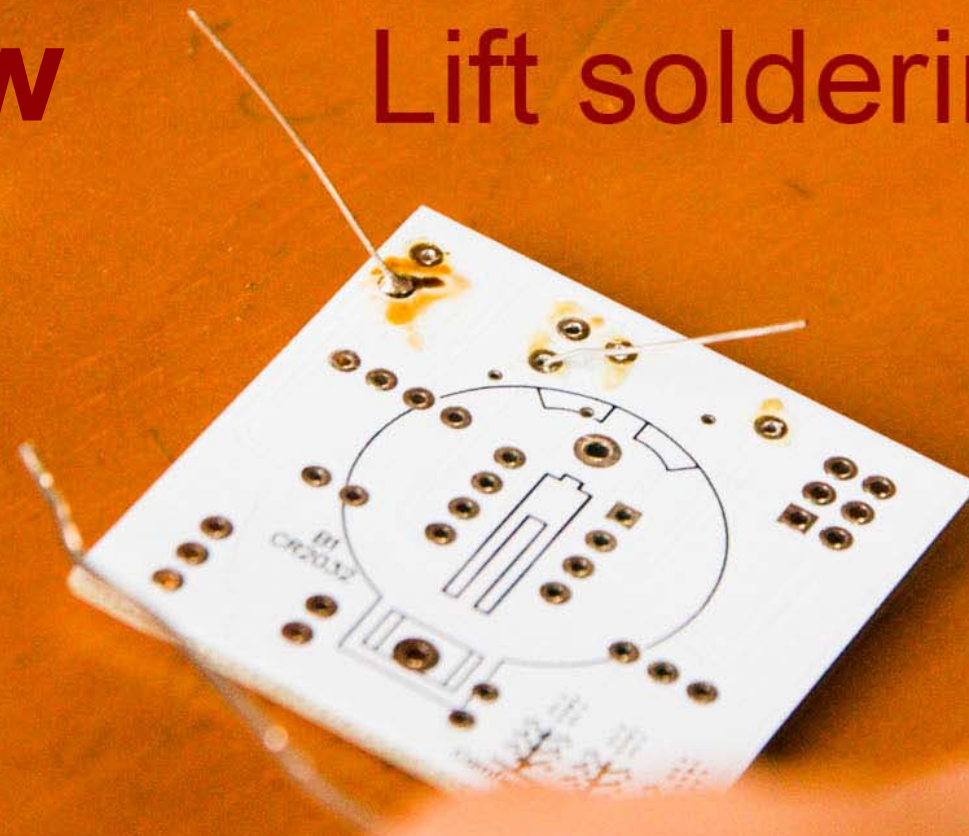
Pull solder away,
But keep holding soldering iron down
for 1 more second !!

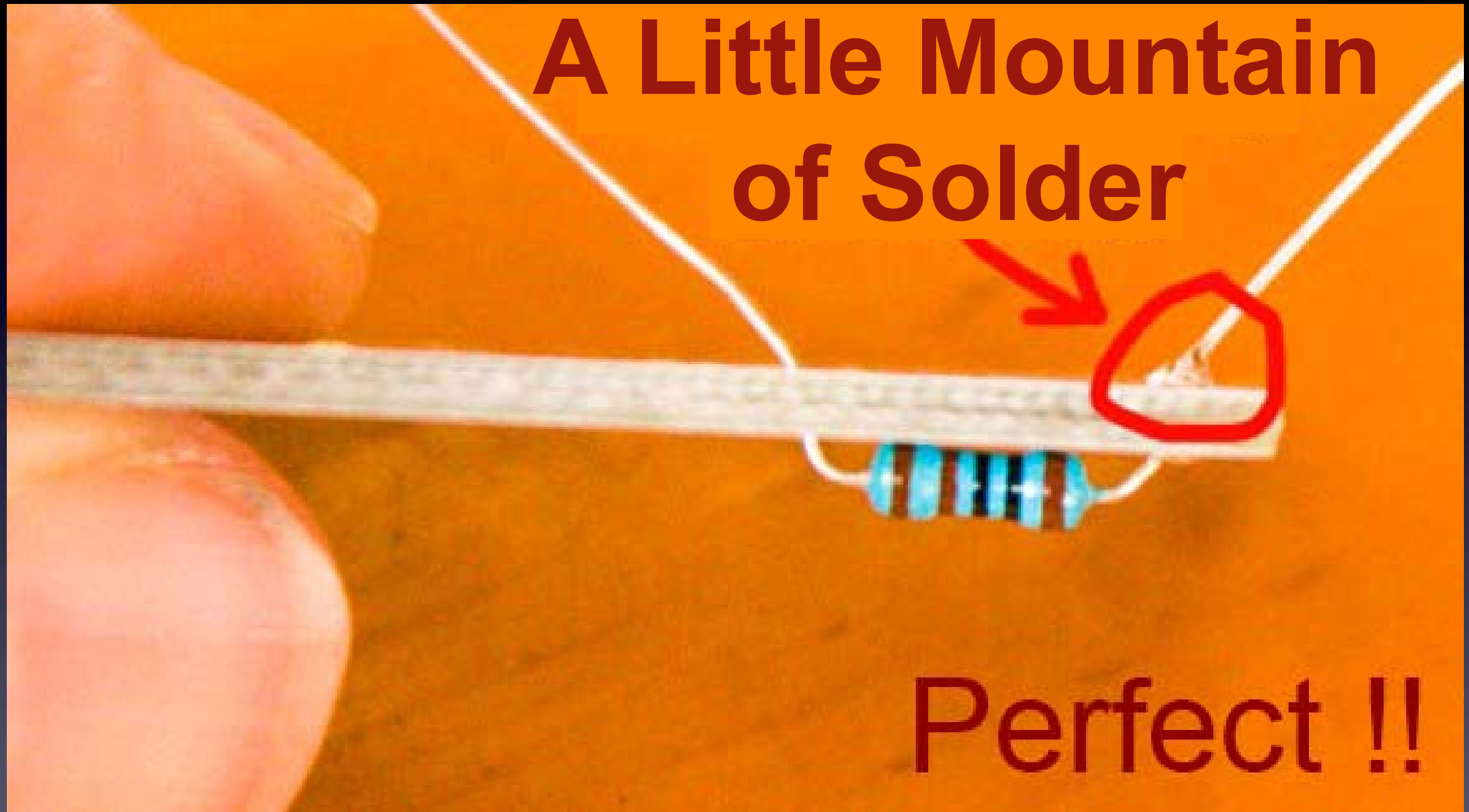
Secret #2:

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)



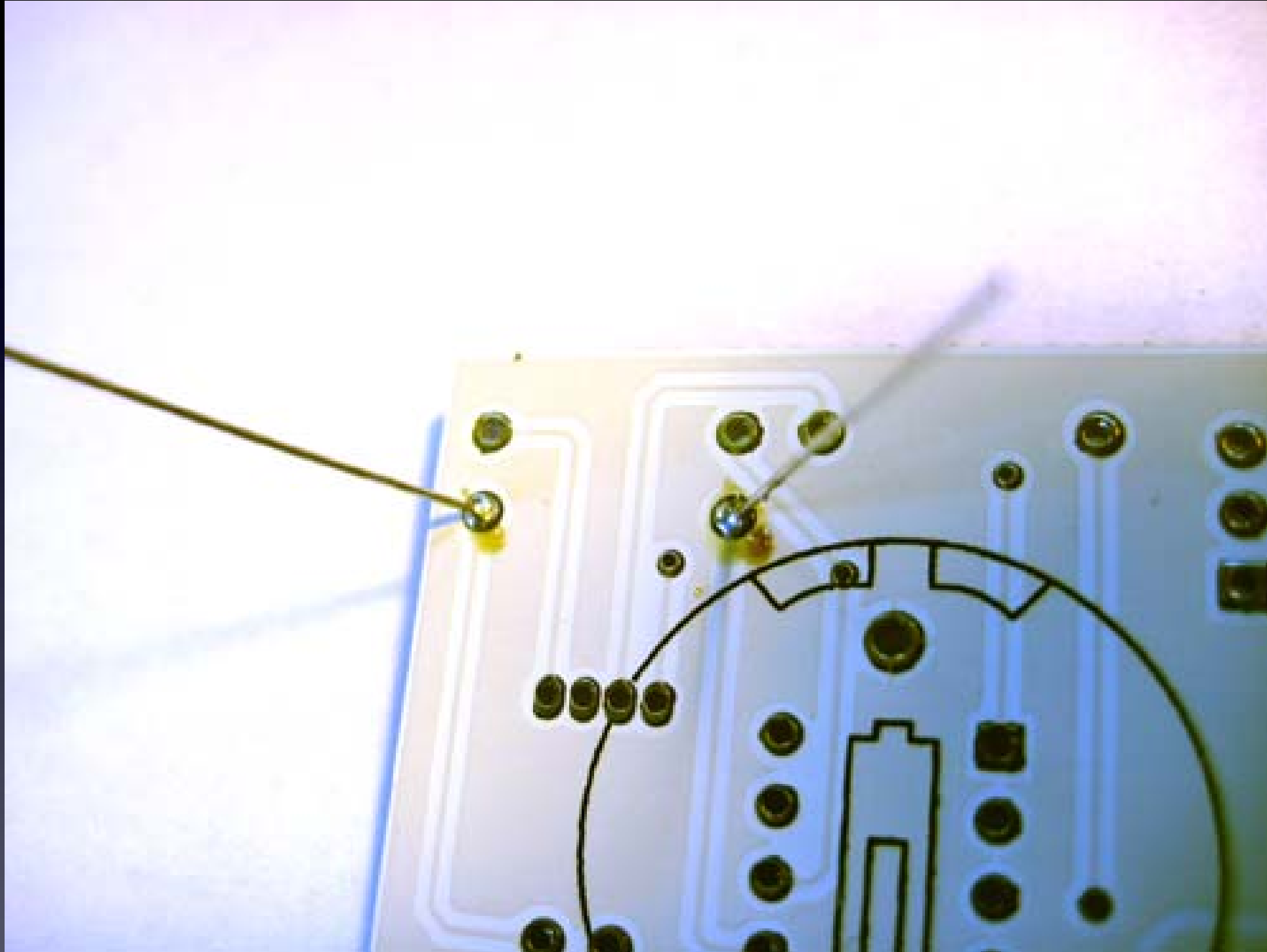
WAIT !

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



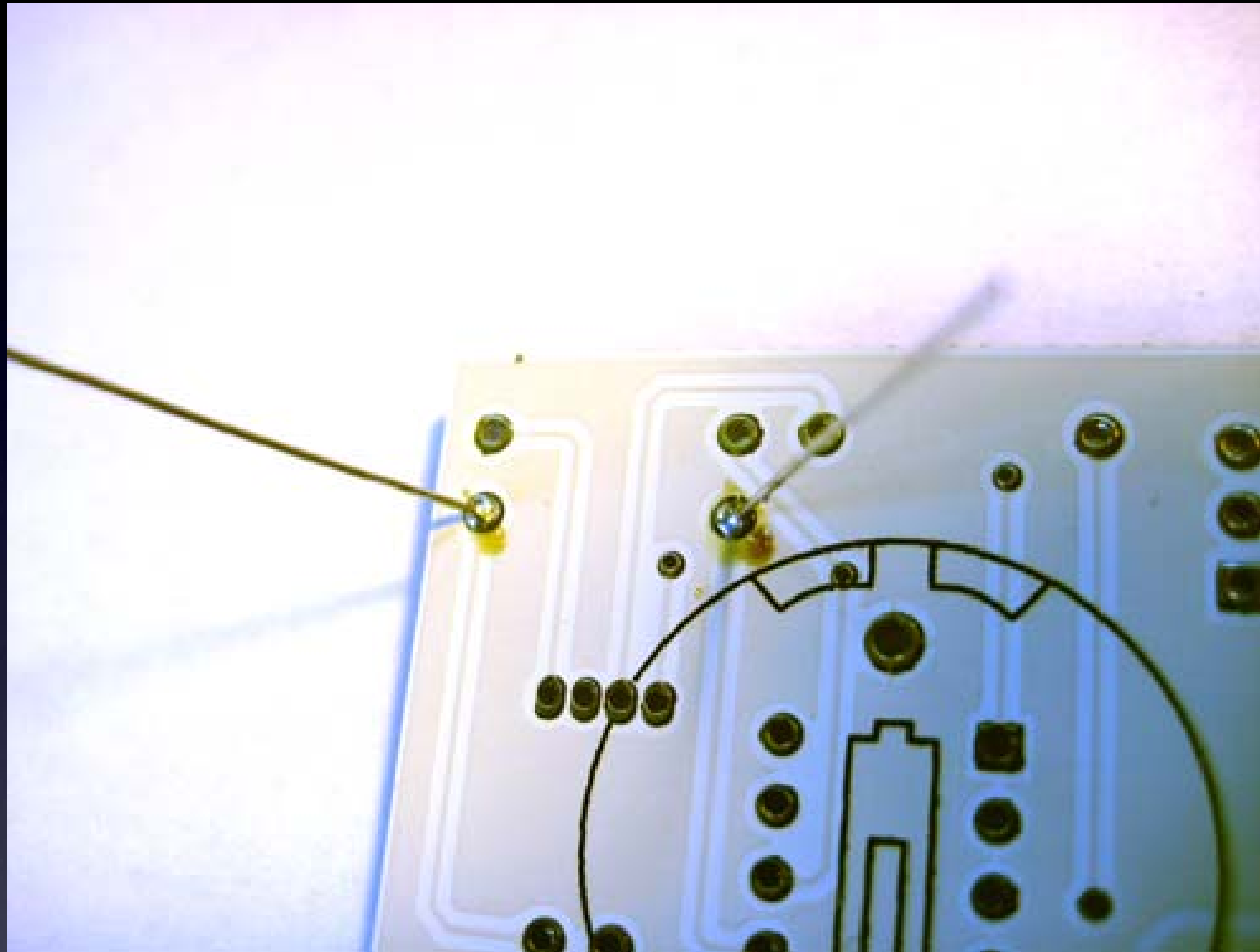
Lift Tip

If you are using solder WITH lead (Pb), you can now
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

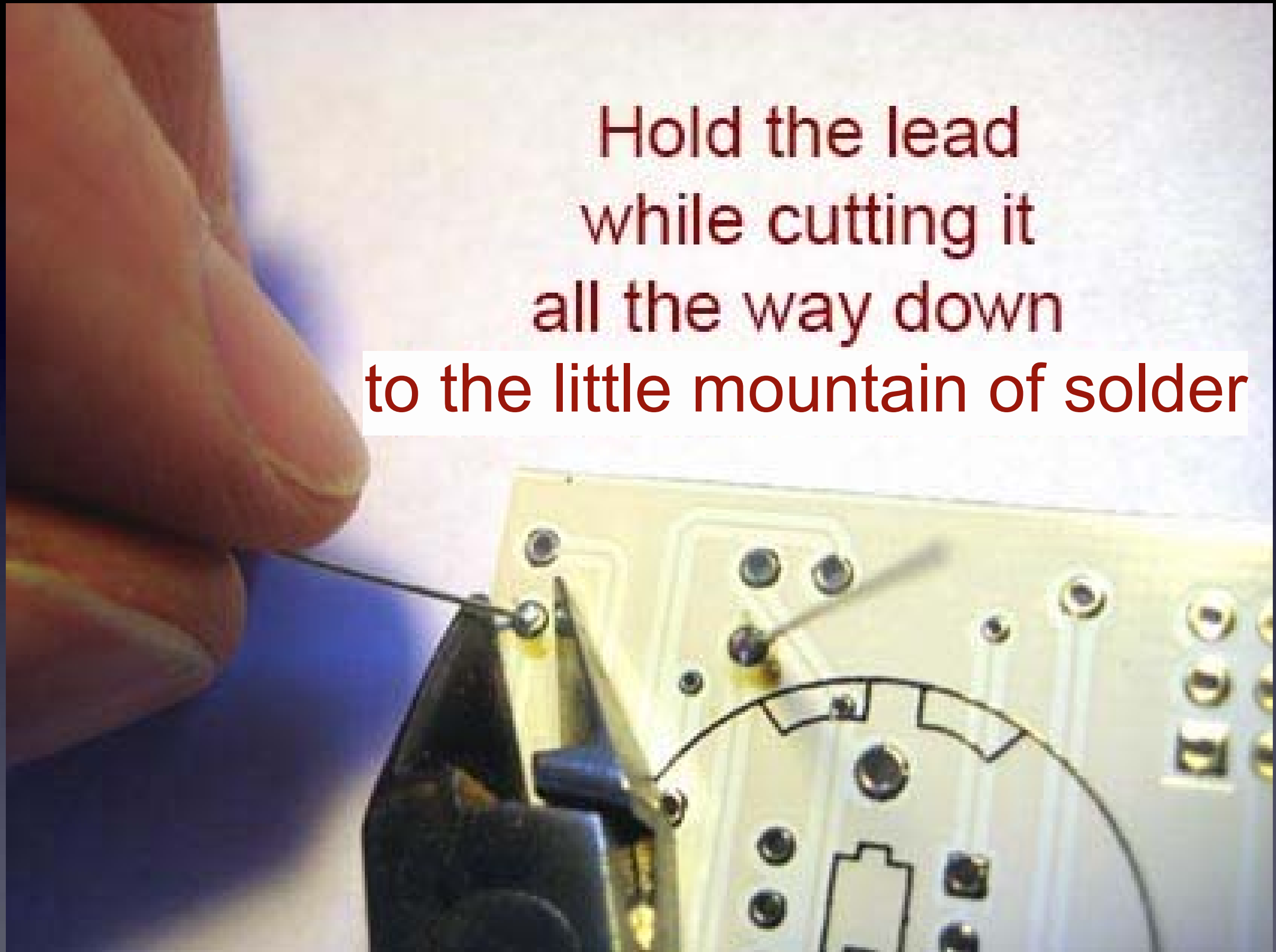
Two good solder connections



- 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 !

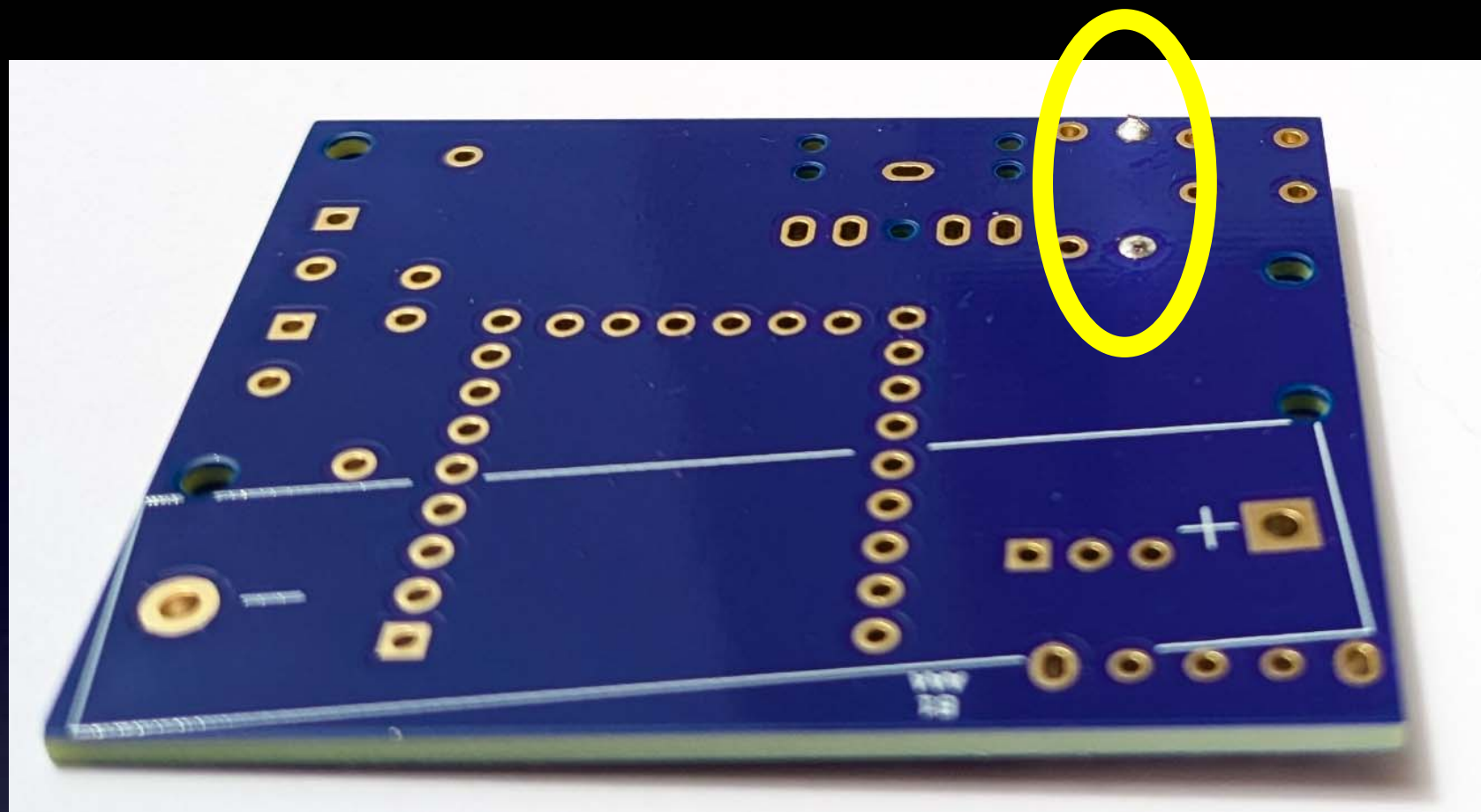
(or it will fly into your eye!)

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



All done !

No wires sticking out



2 good solder connections

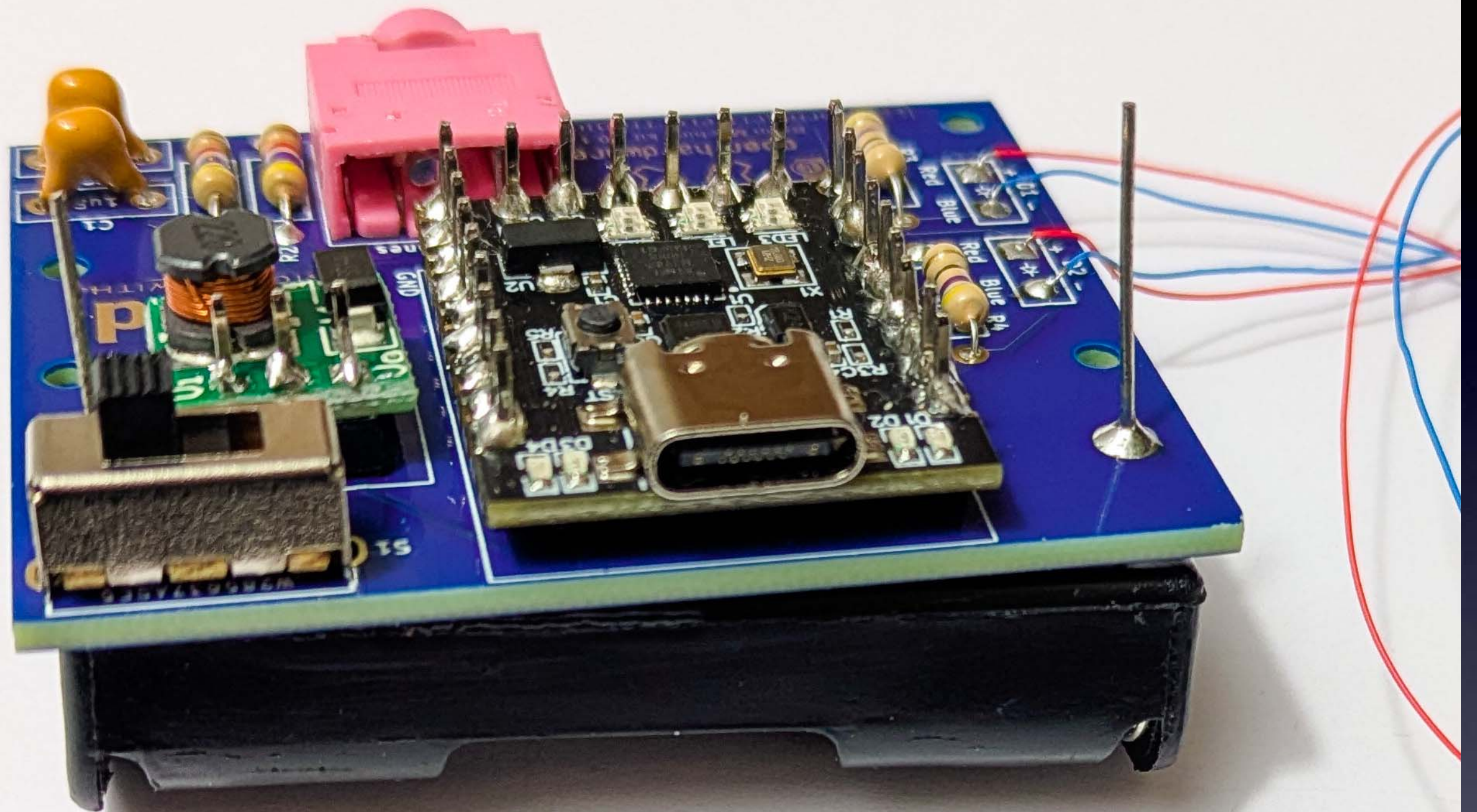
R1 soldered to the board

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

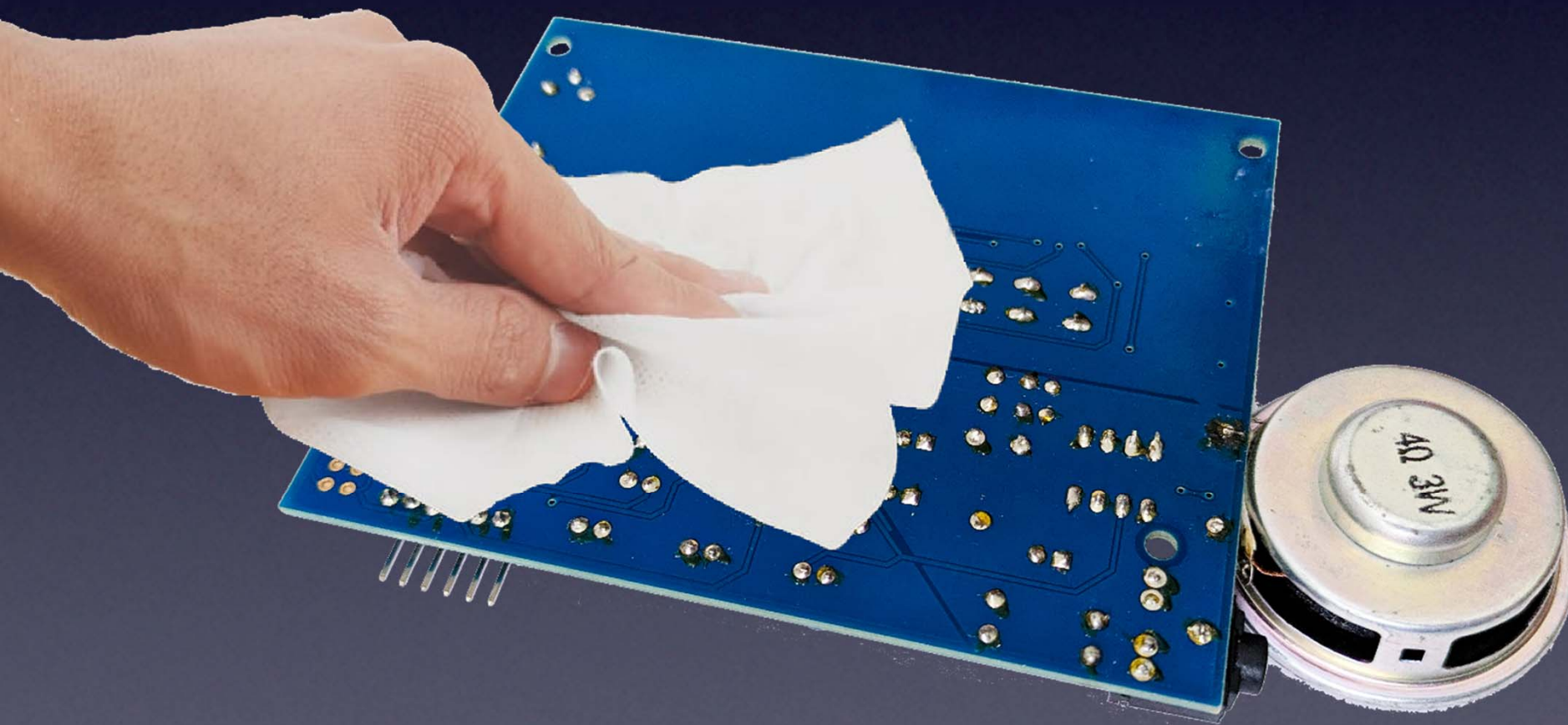


And it will look like this when you're done soldering.

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*

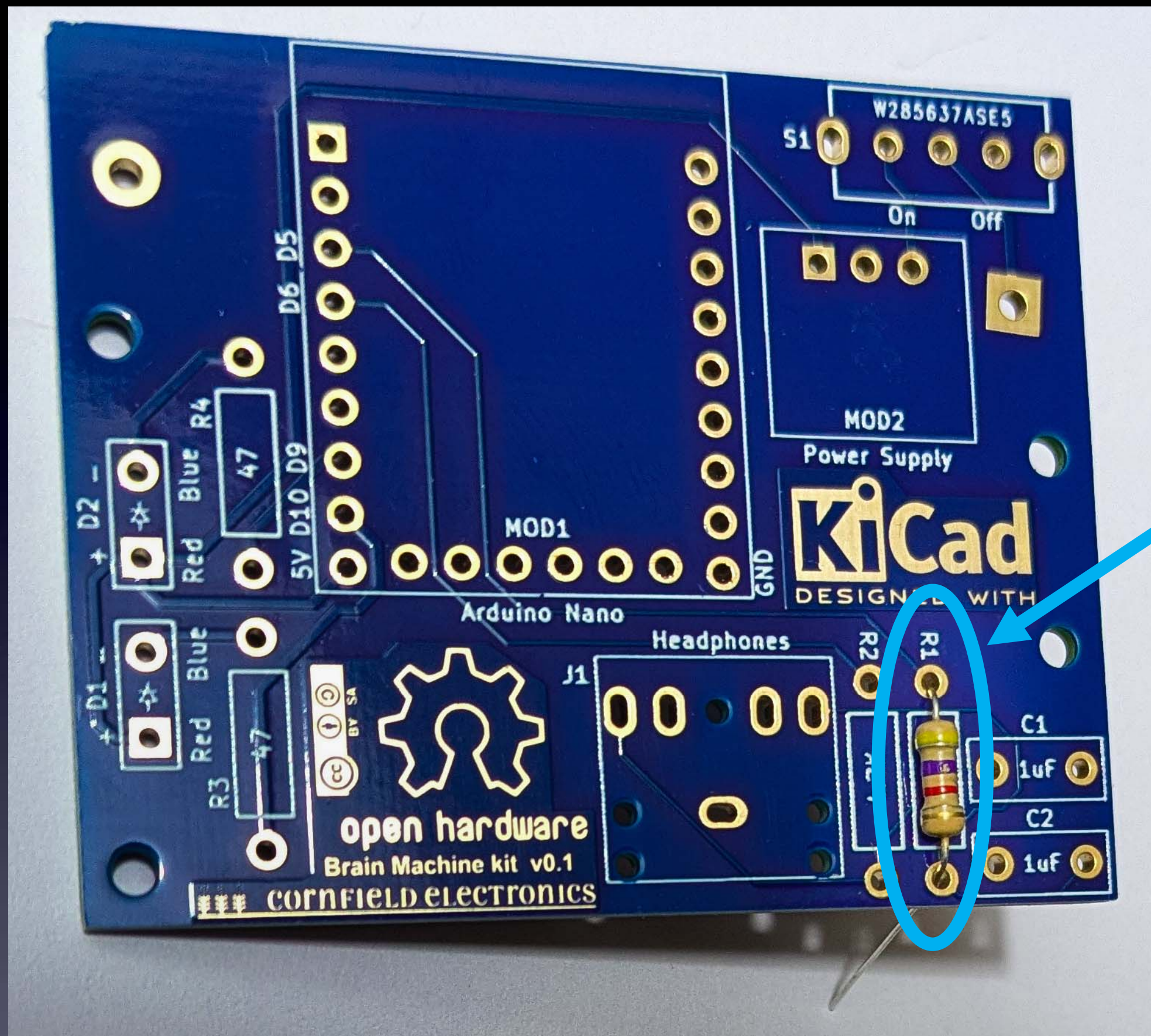
Then put in the battery,

Turn it on,

And it works!

(Or you start debugging.)

Let's start!



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

R1, R2:

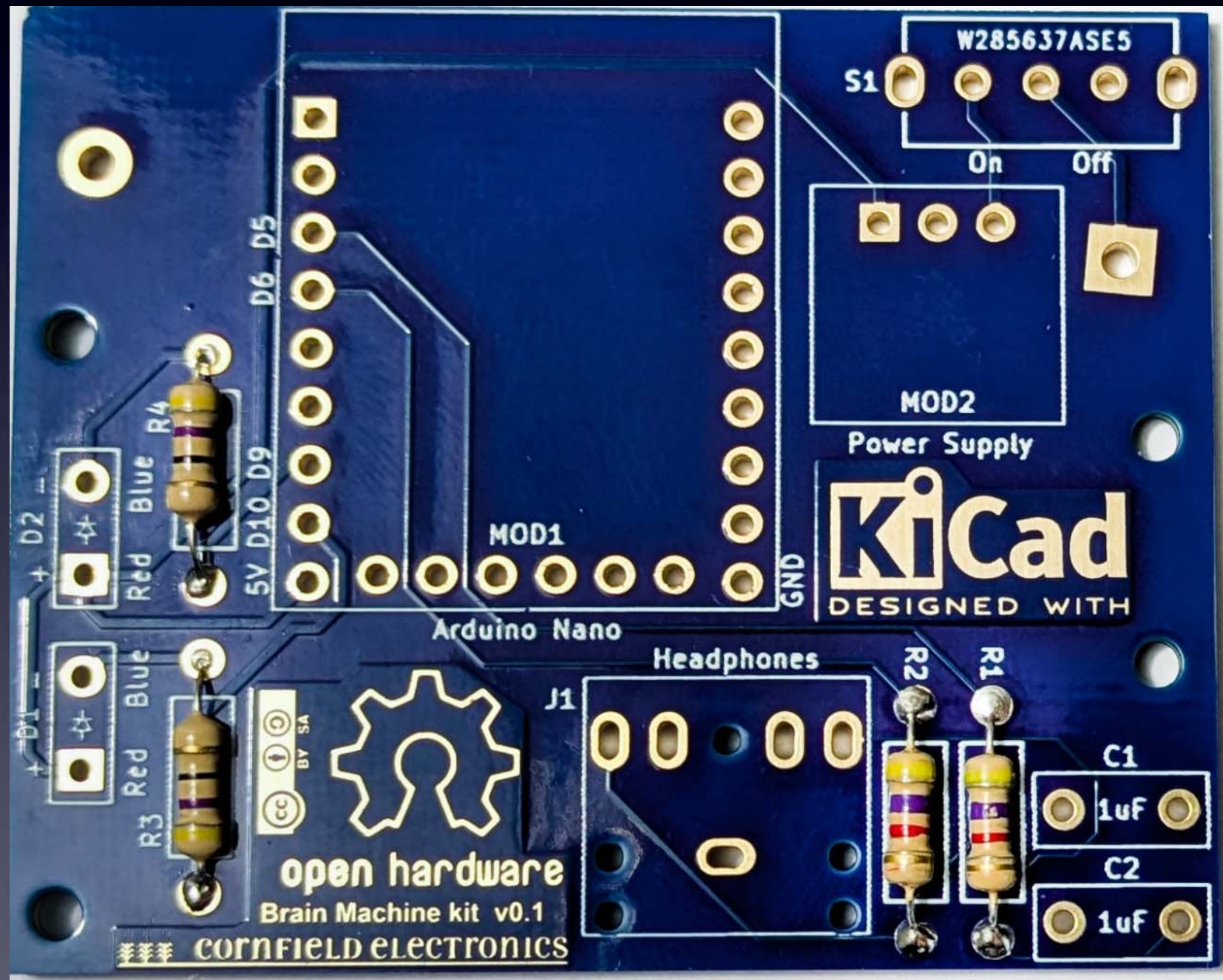


4.7K: Yellow, Violet, Red

R3, R4:



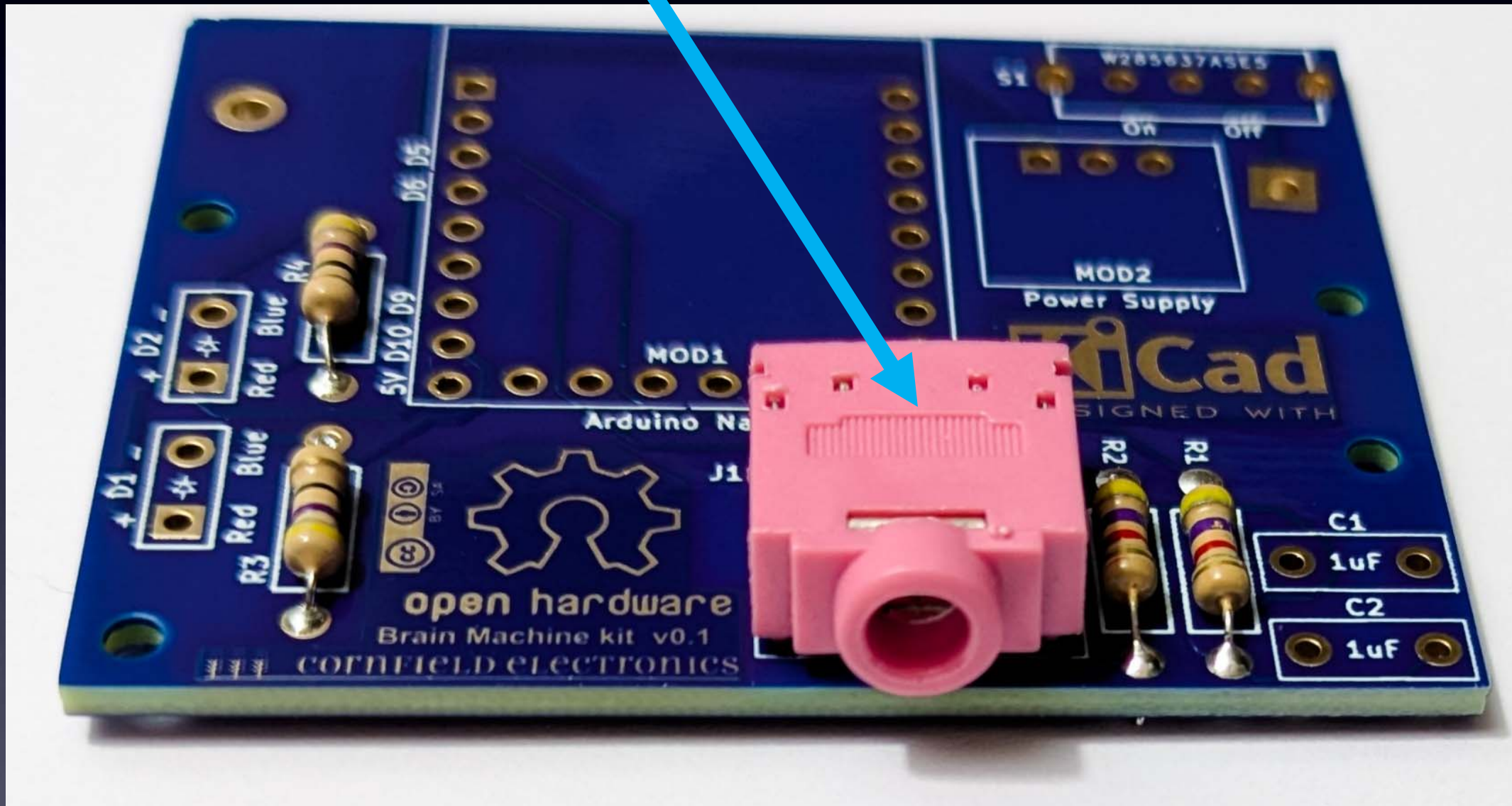
47: Yellow, Violet, Black



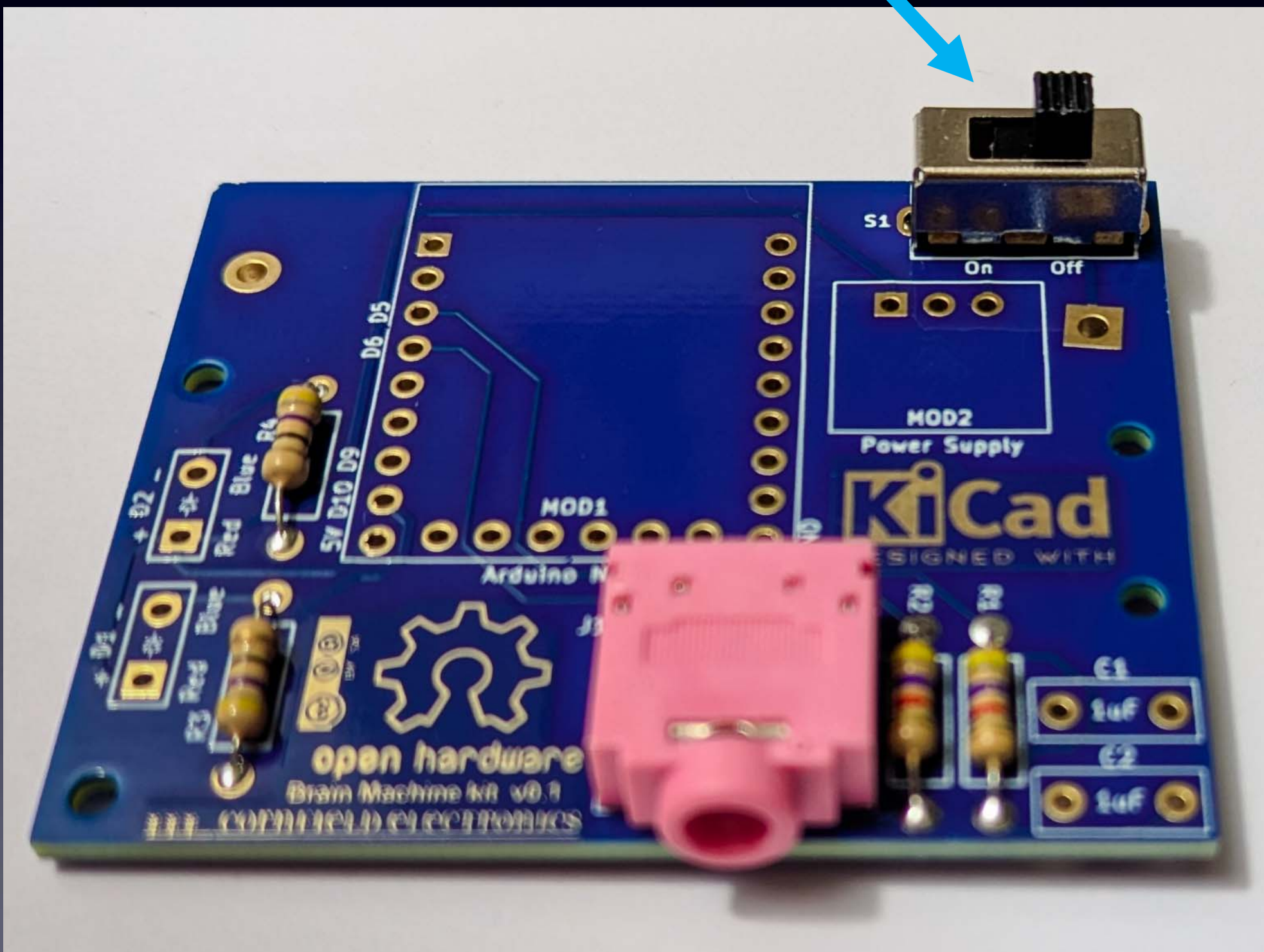
Direction does not matter

All 4 resistors

J1: Headphone Jack



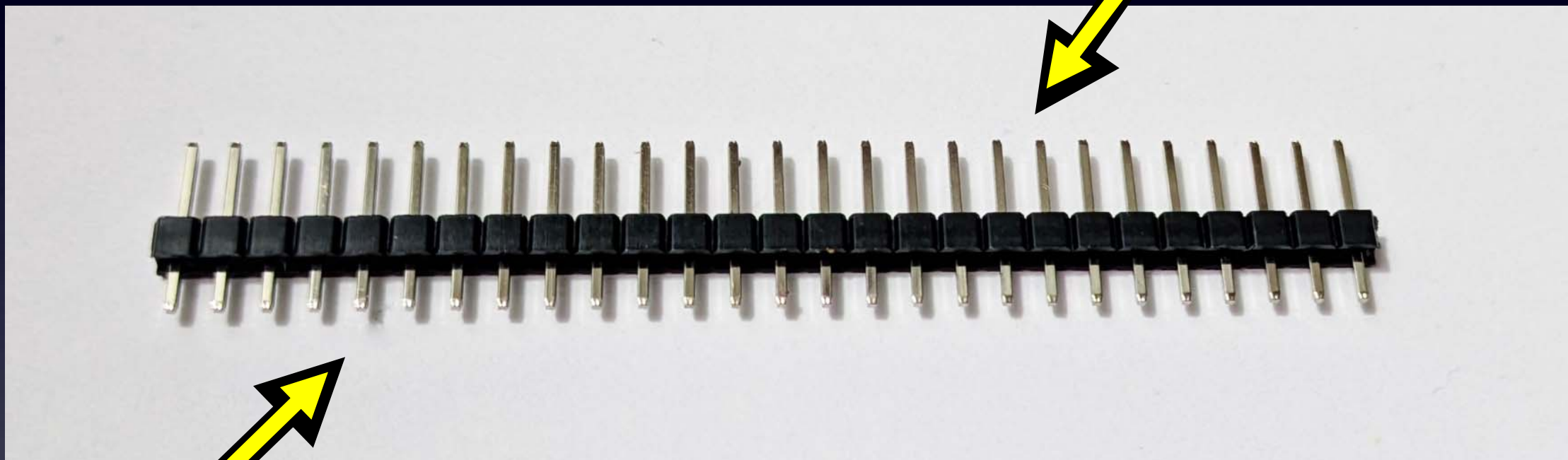
S1: On/Off switch



Direction does not matter

Pin Headers

long pins



27 pins

short pins

Pin Headers

long pins

short pins

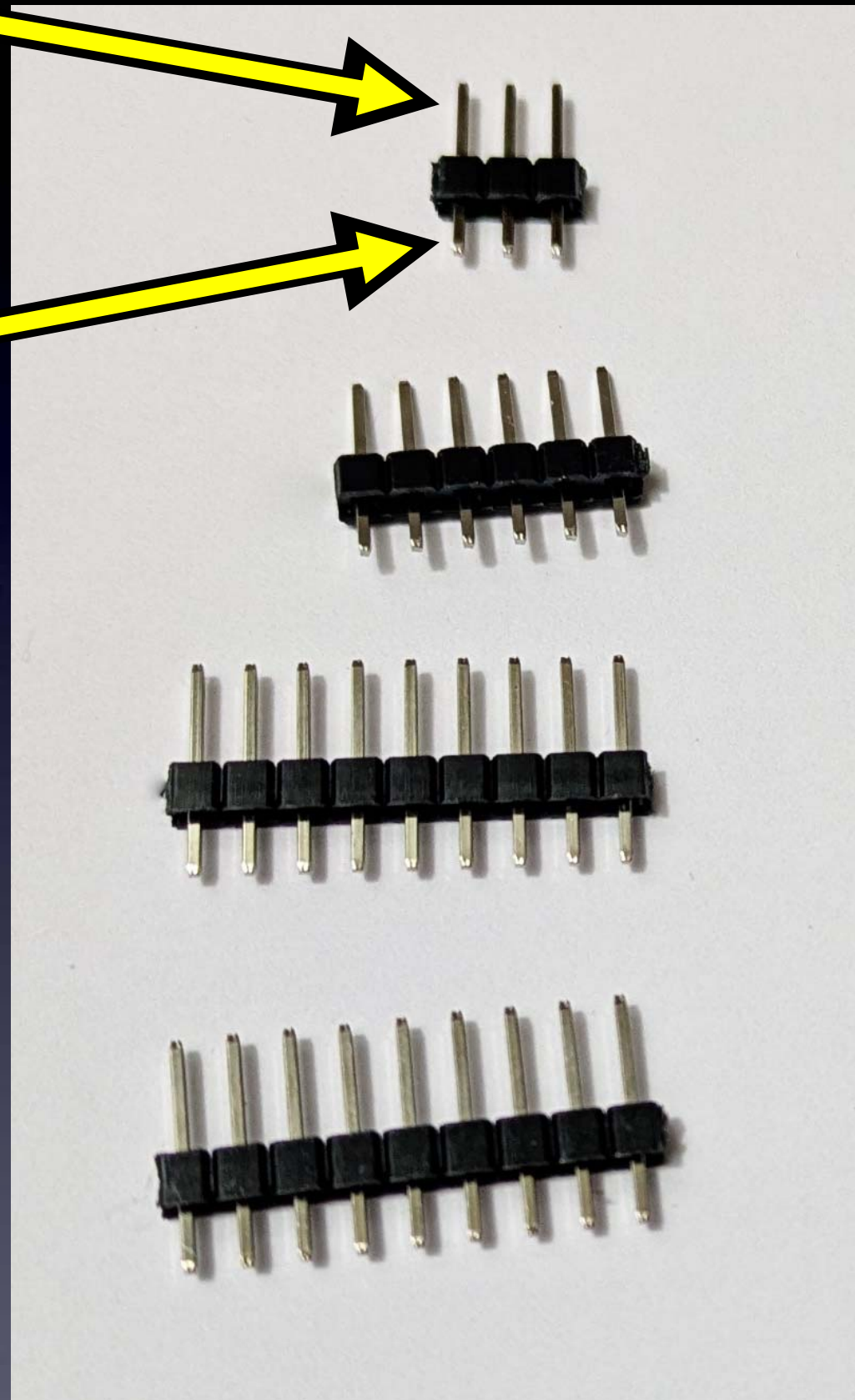
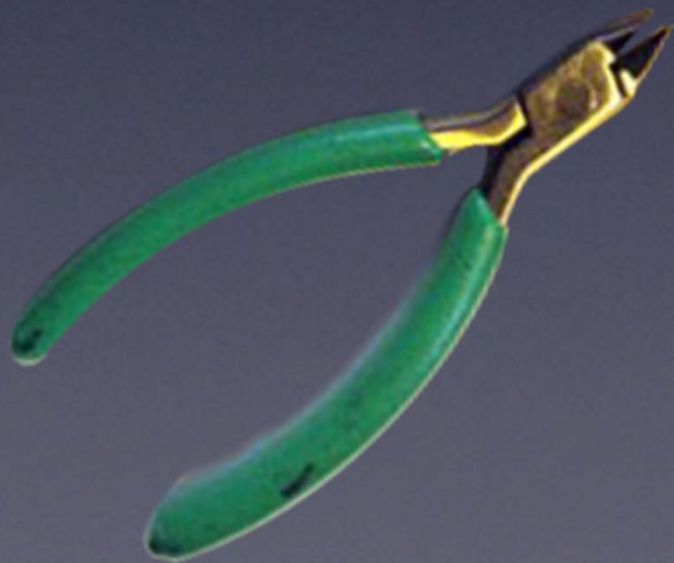
3 pins

6 pins

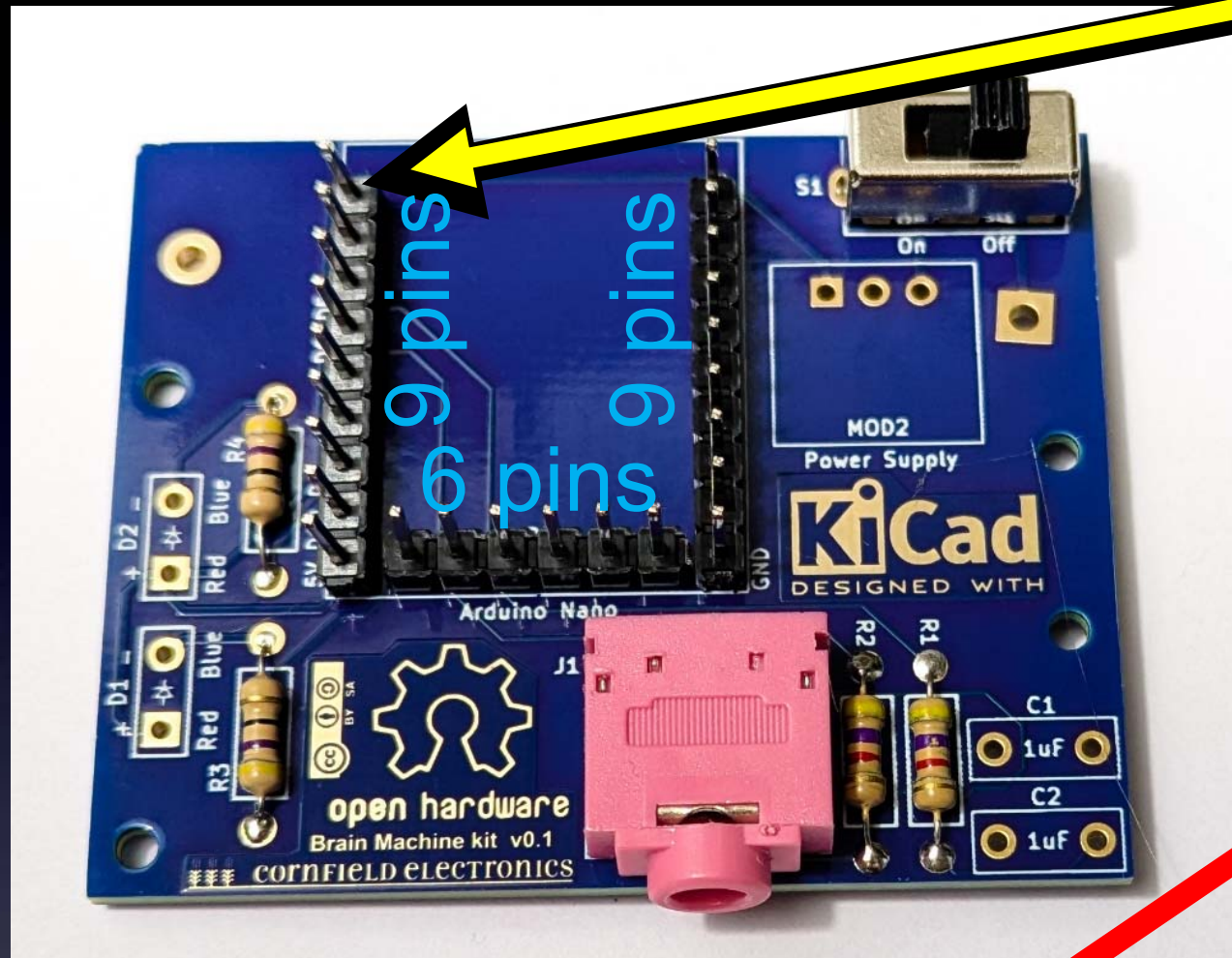
9 pins

9 pins

Use wire cutters



Pin Headers for Arduino Nano



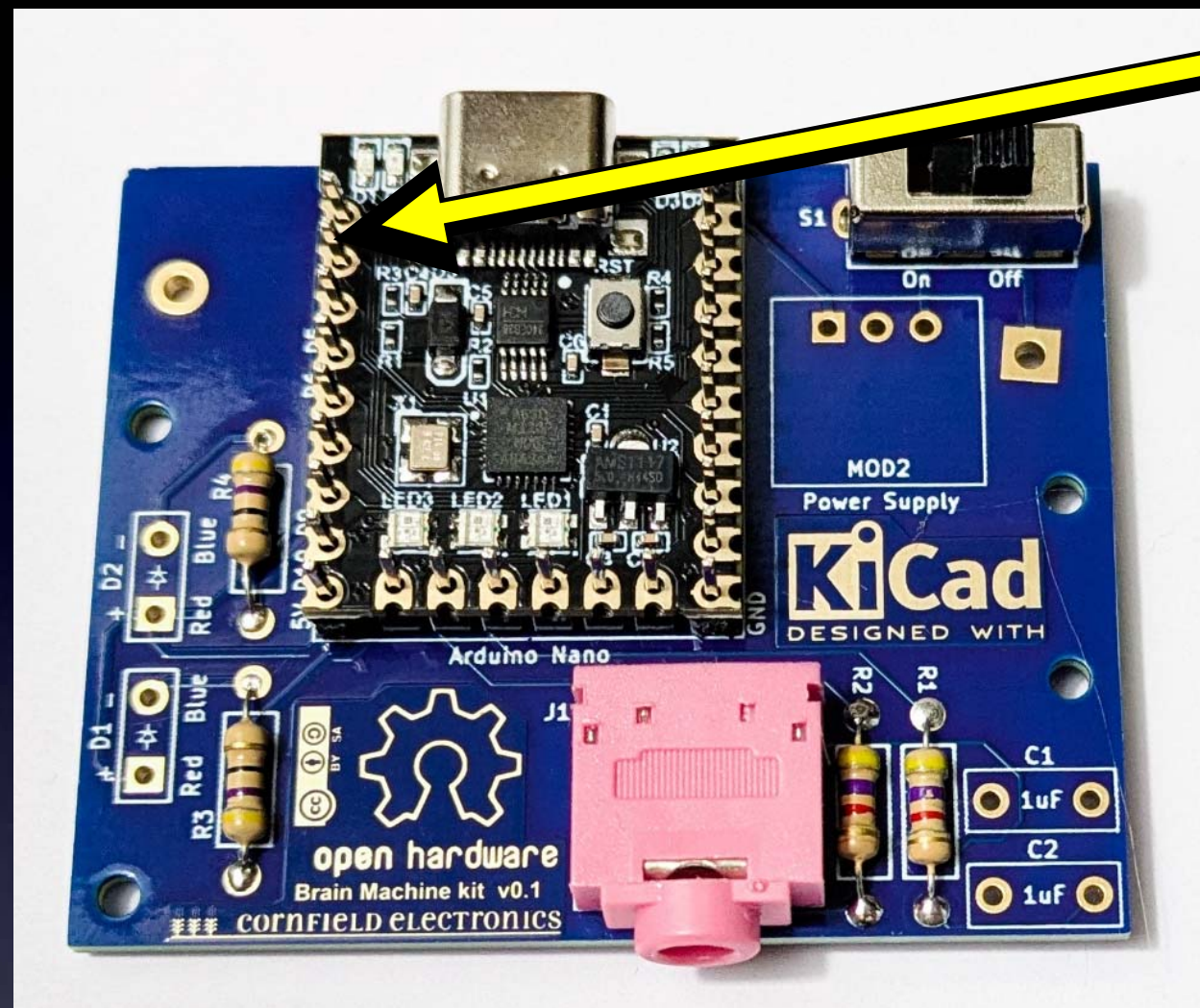
long pins sticking up

IMPORTANT!

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

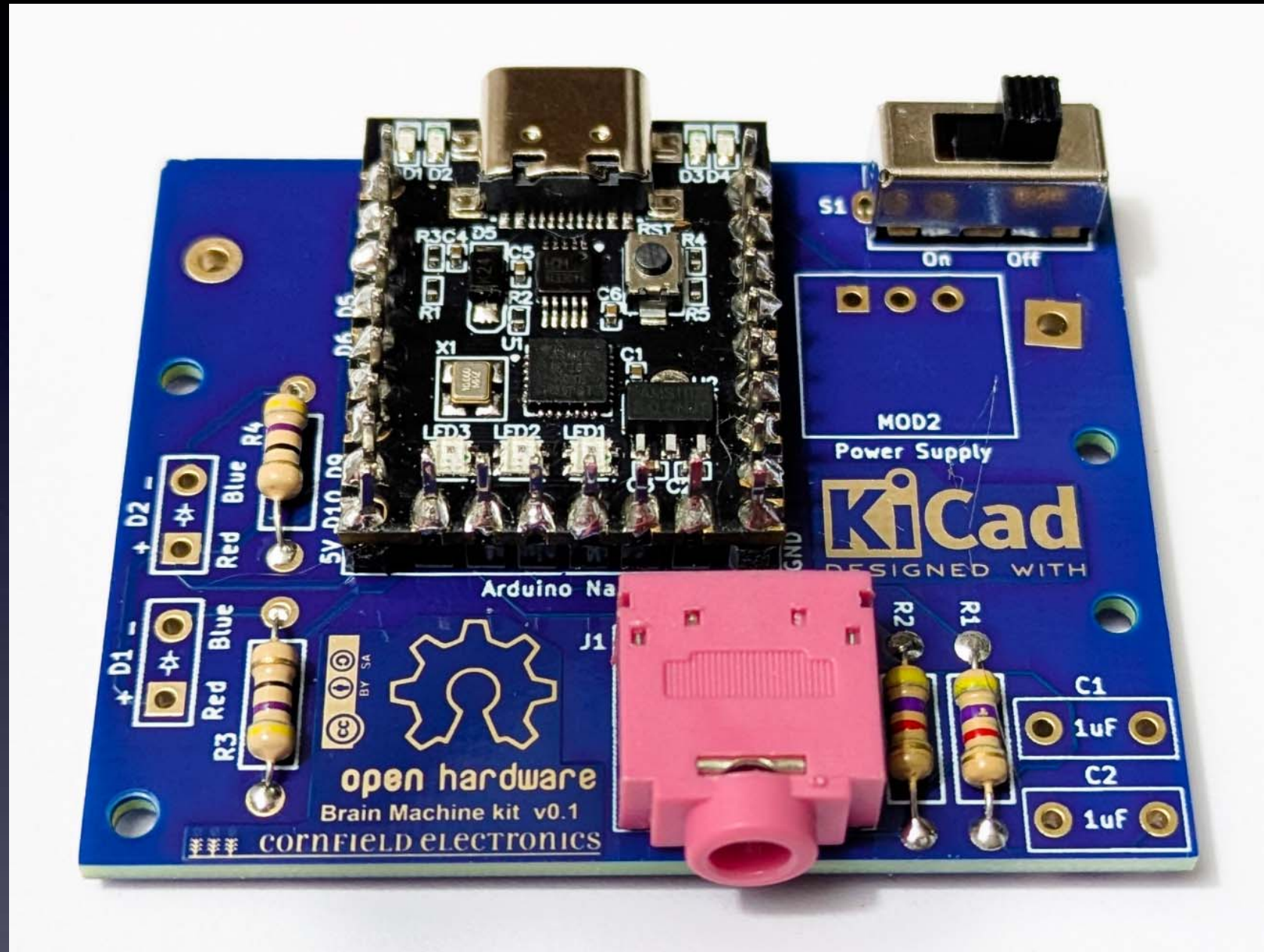
Arduino Nano placed on its pins



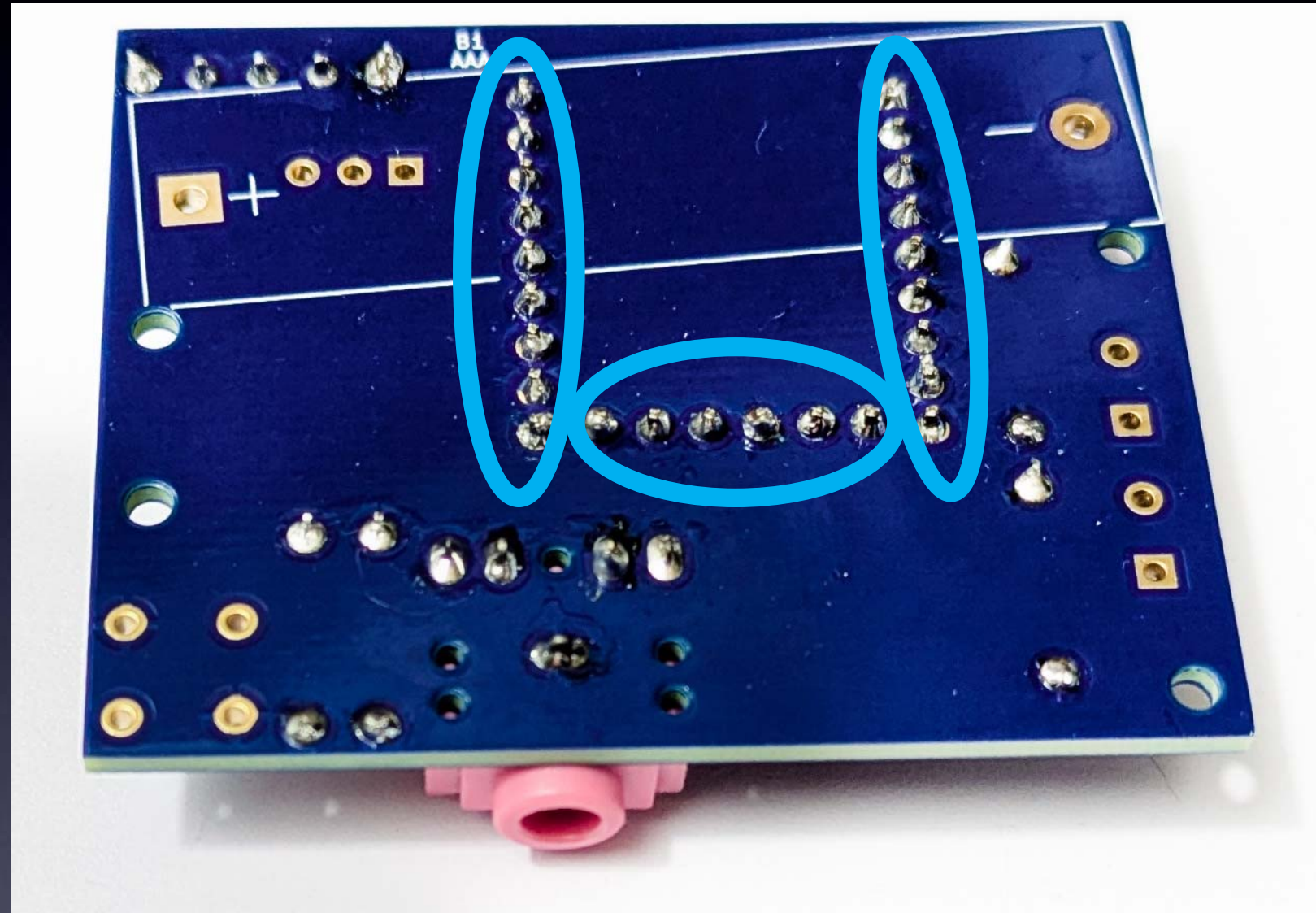
long pins sticking up

→ Short pins go into the board ! ←

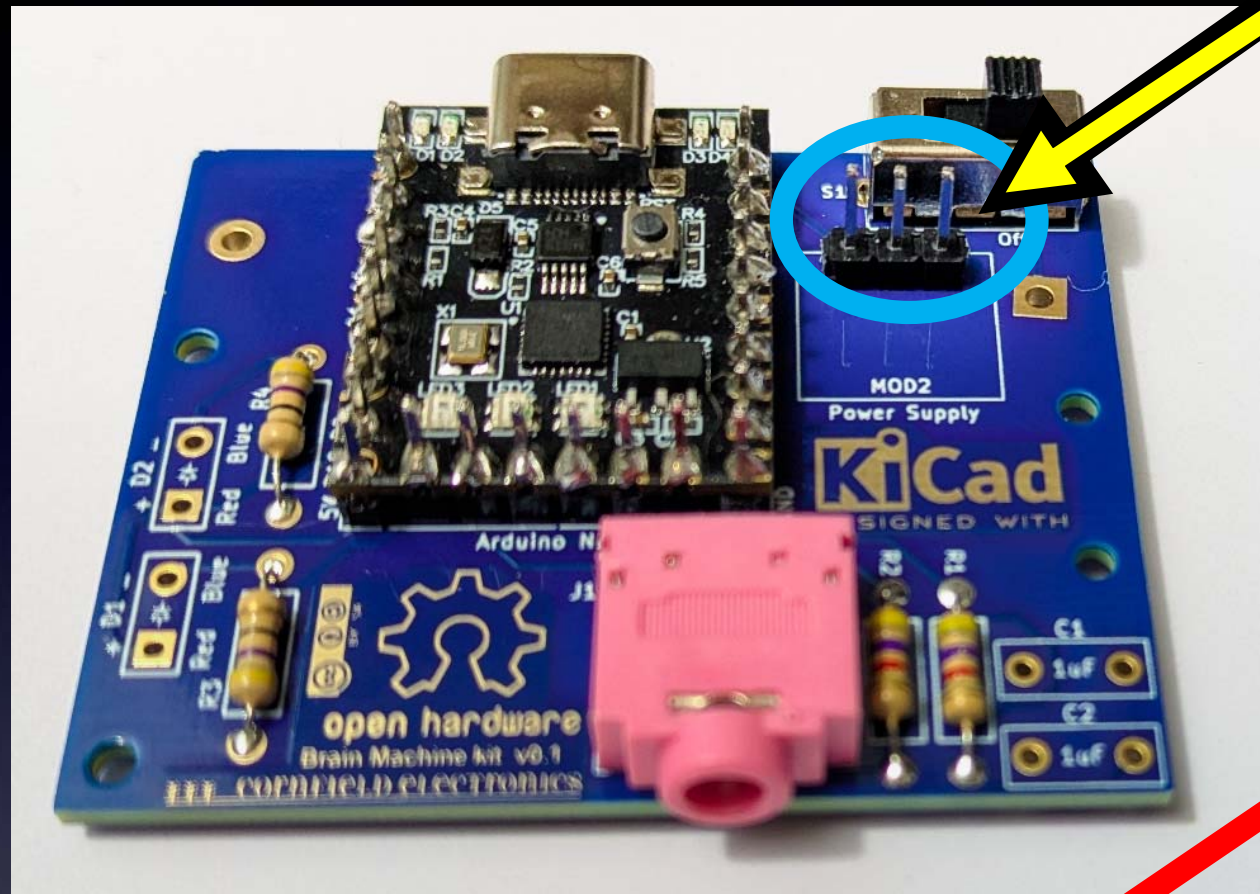
Arduino Nano soldered to its pins



Arduino Nano soldered to board



Pin Headers for Power Supply



long pins sticking up

3 pins

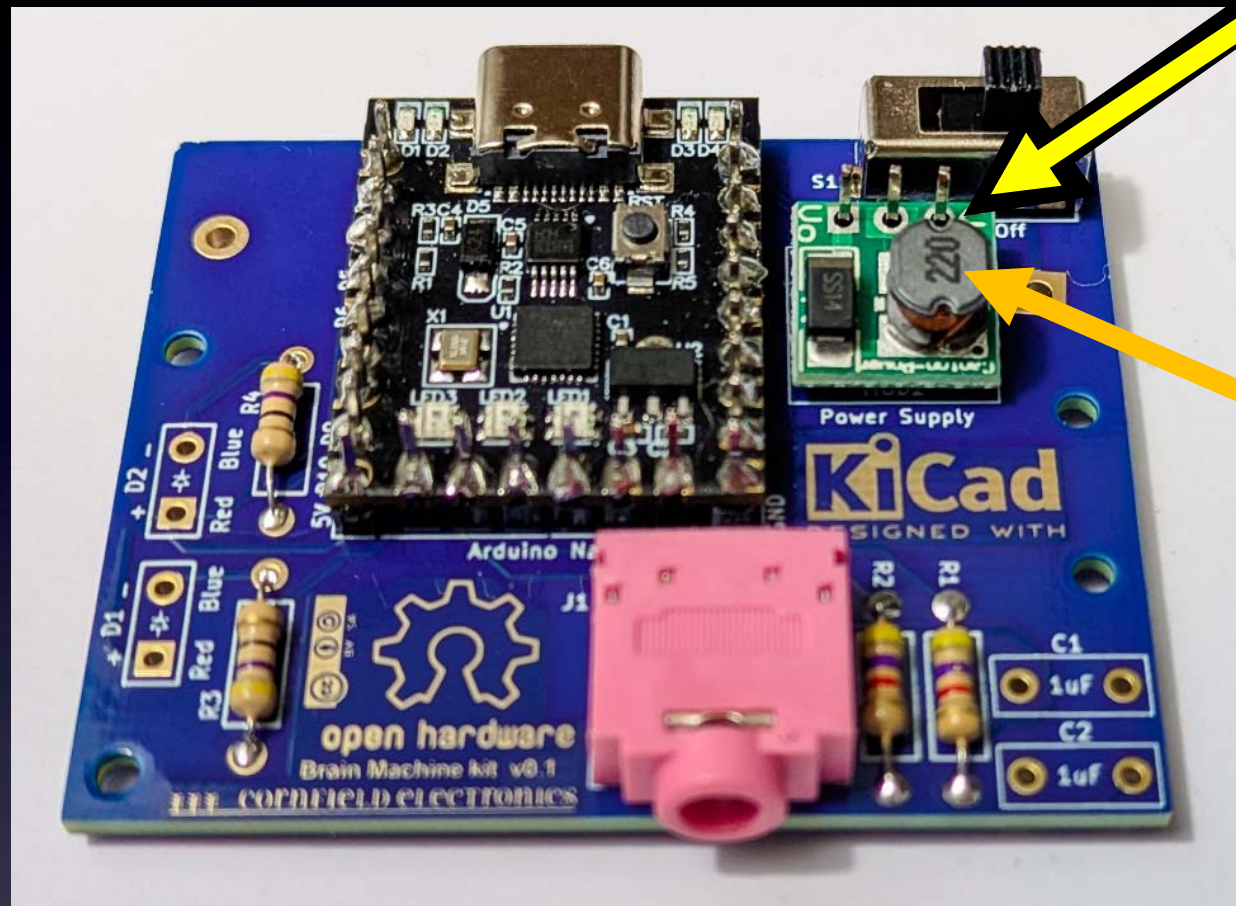
IMPORTANT!

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

Power Supply placed on its pins

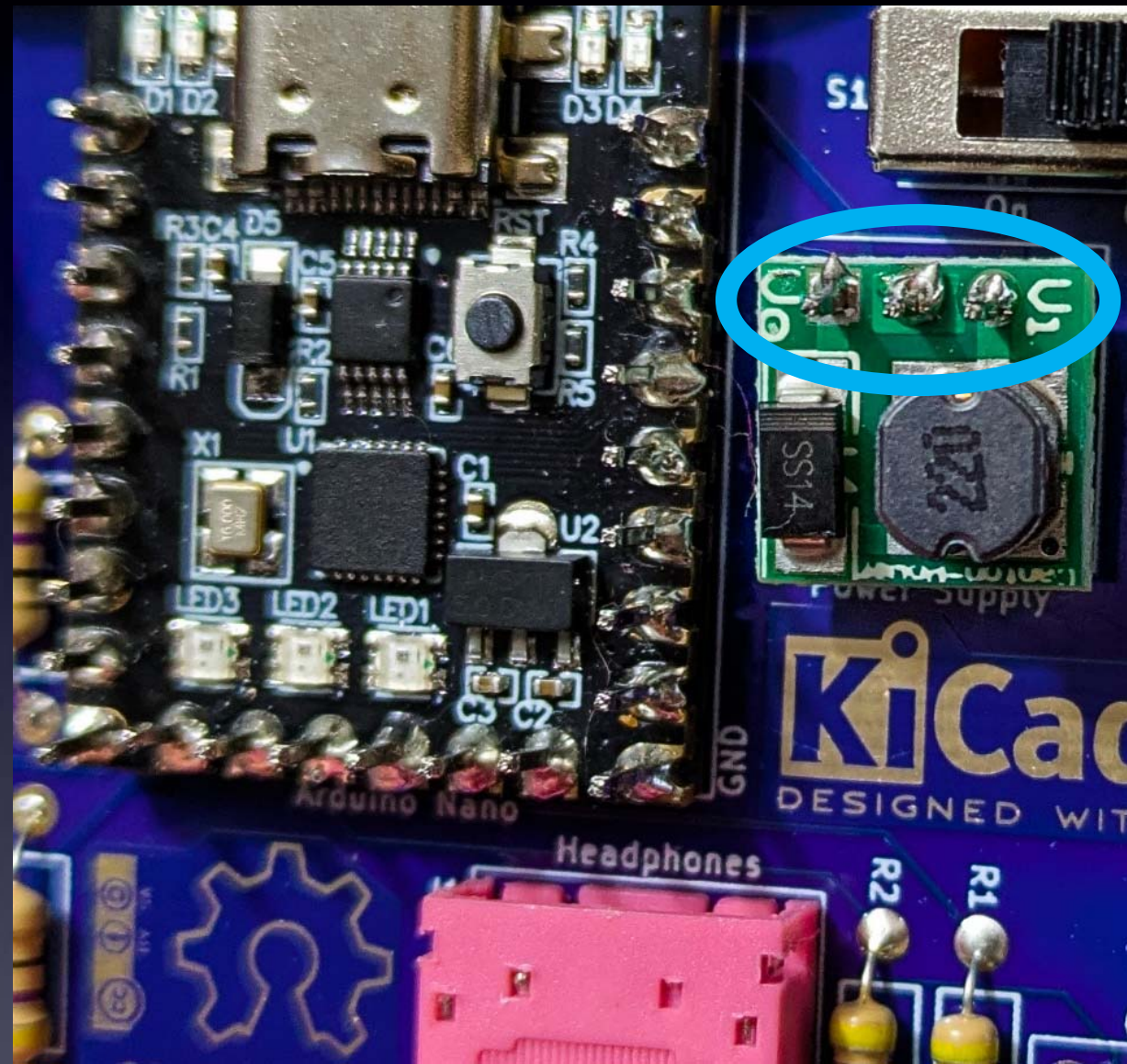
long pins sticking up



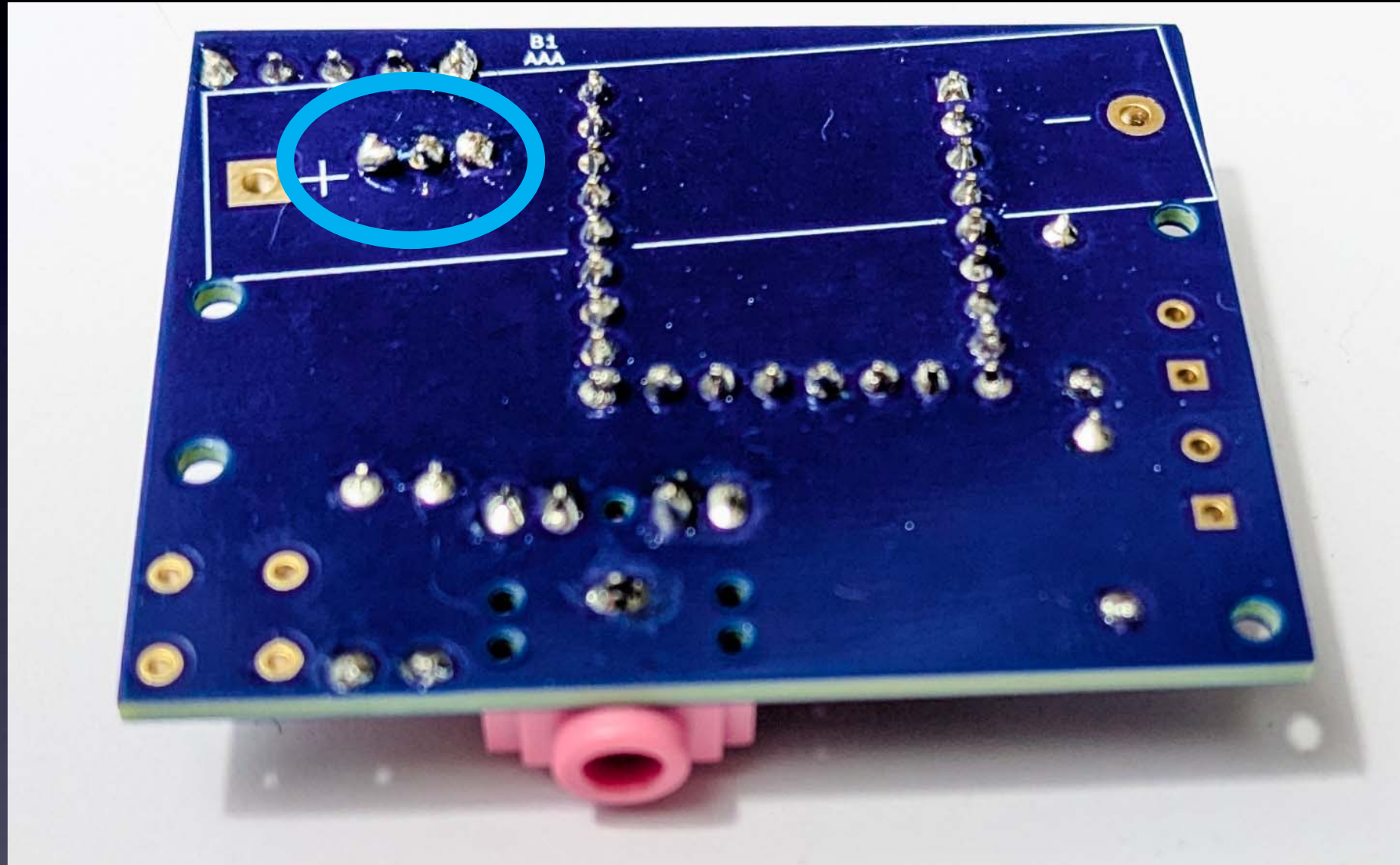
coil

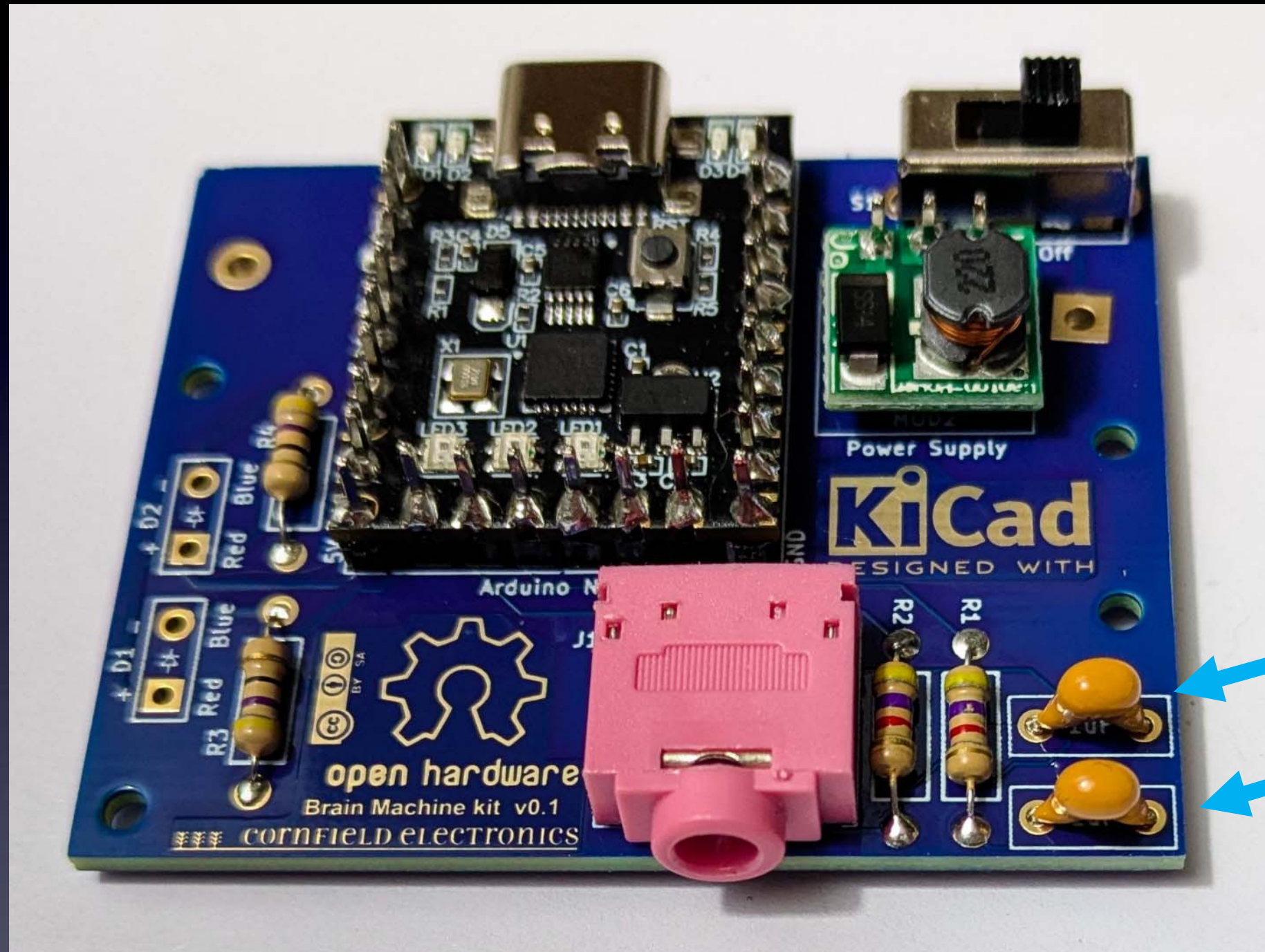
→ IMPORTANT: Power Supply must go in this way ! ←
(coil is facing up)

Power Supply soldered to its pins



Power Supply soldered to board





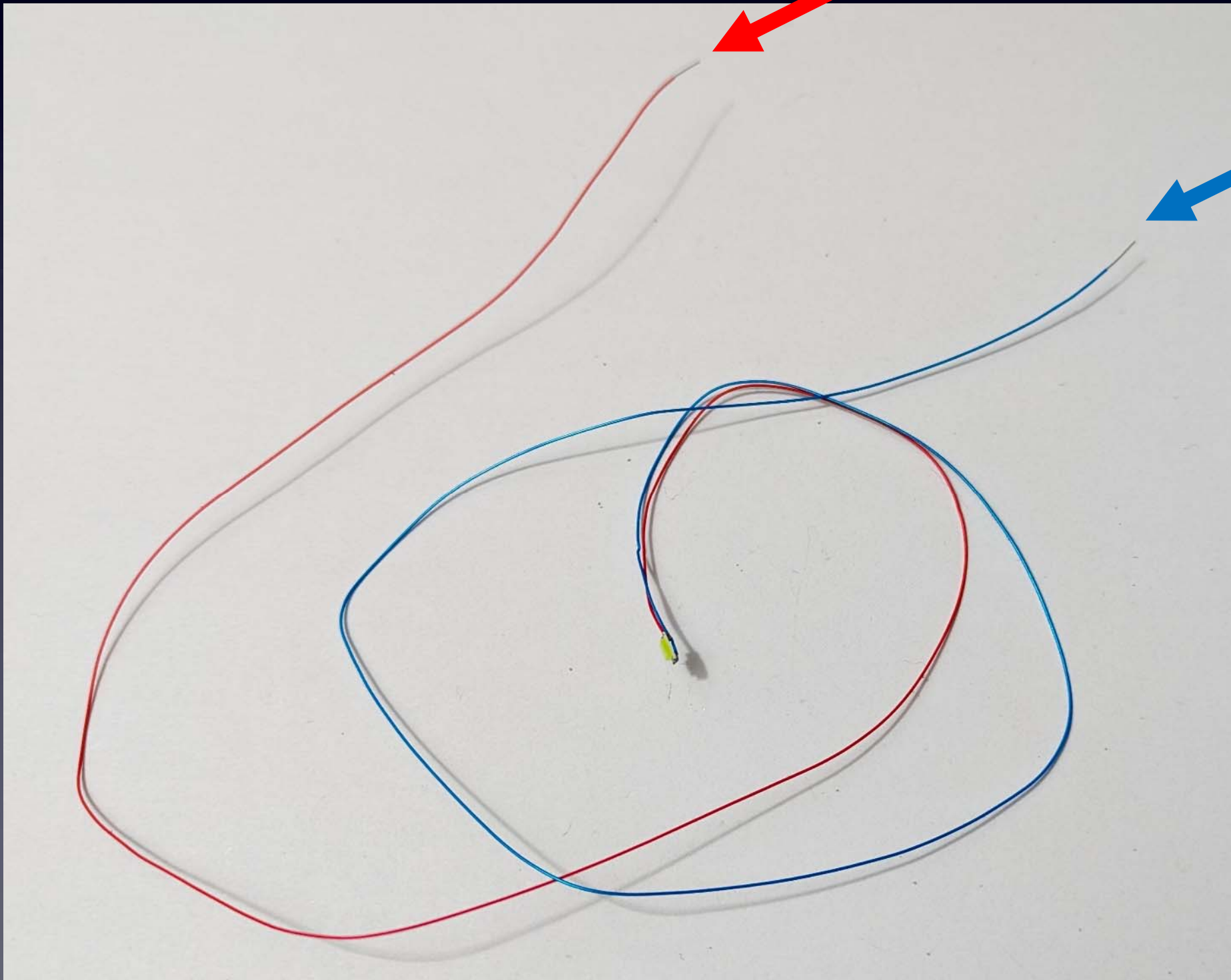
C1, C2

Direction does not matter

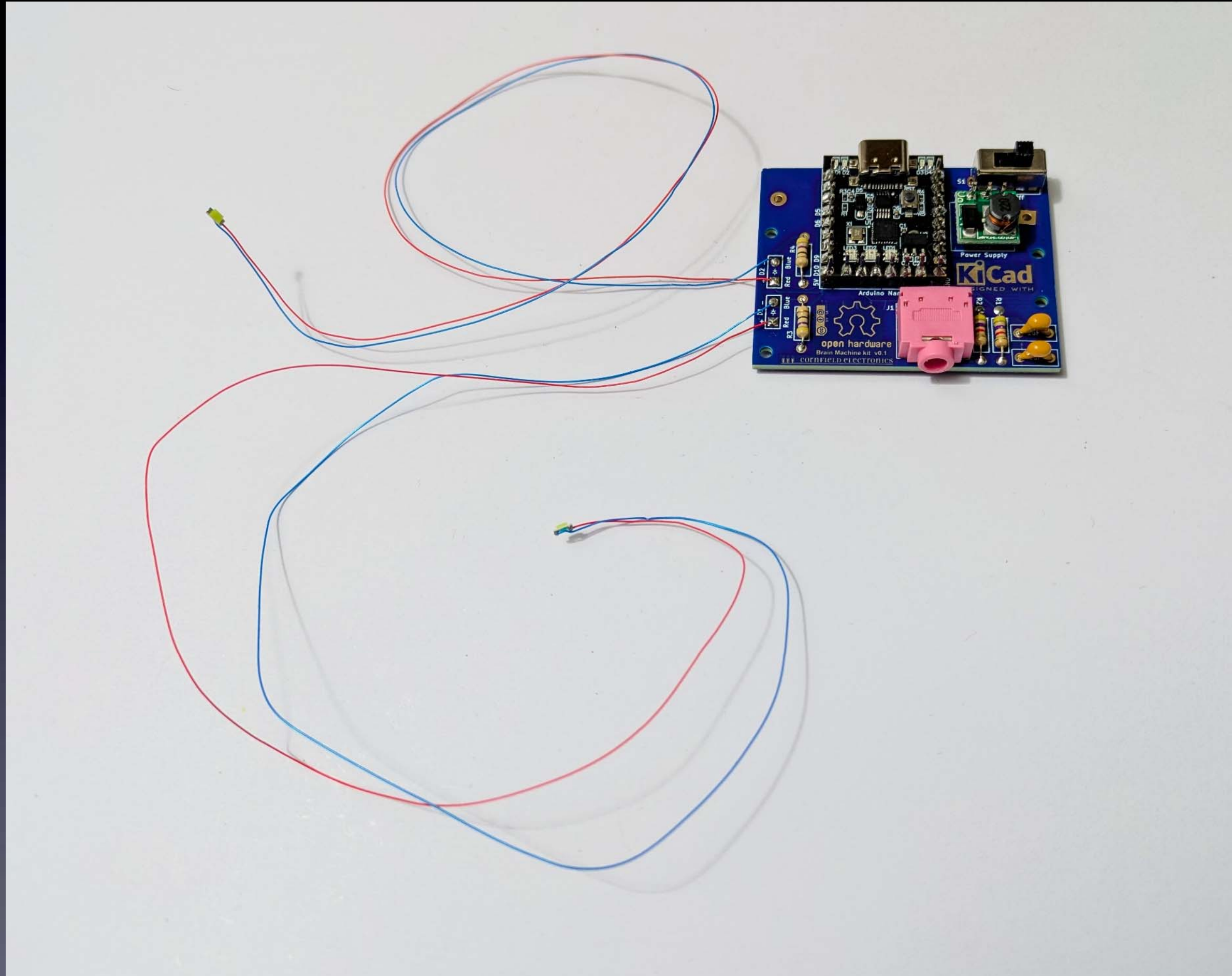
LED1 and LED2:

**Red wire
and
Blue wire**

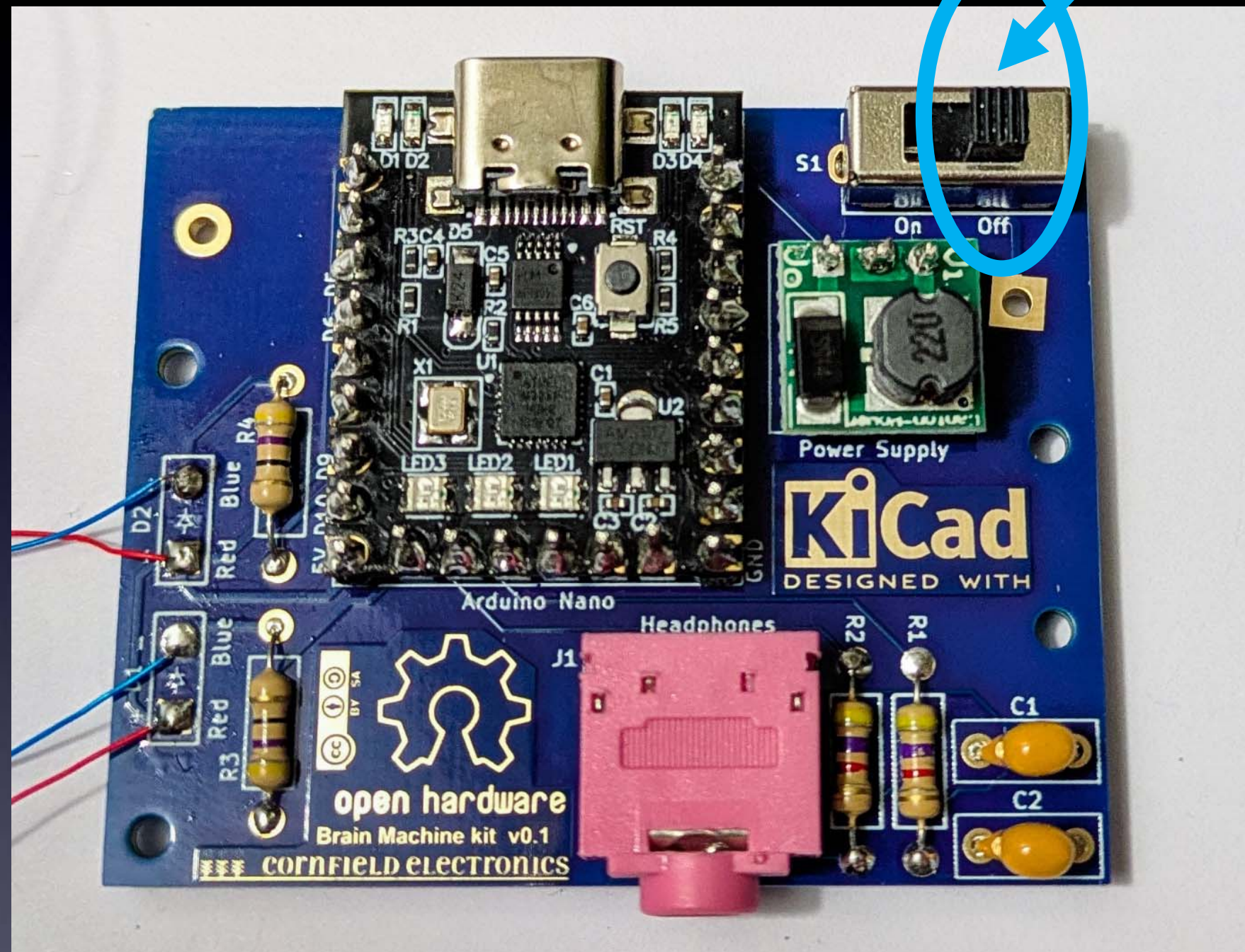
Blue wire



LED1, LED2 soldered to board



Let's Test !



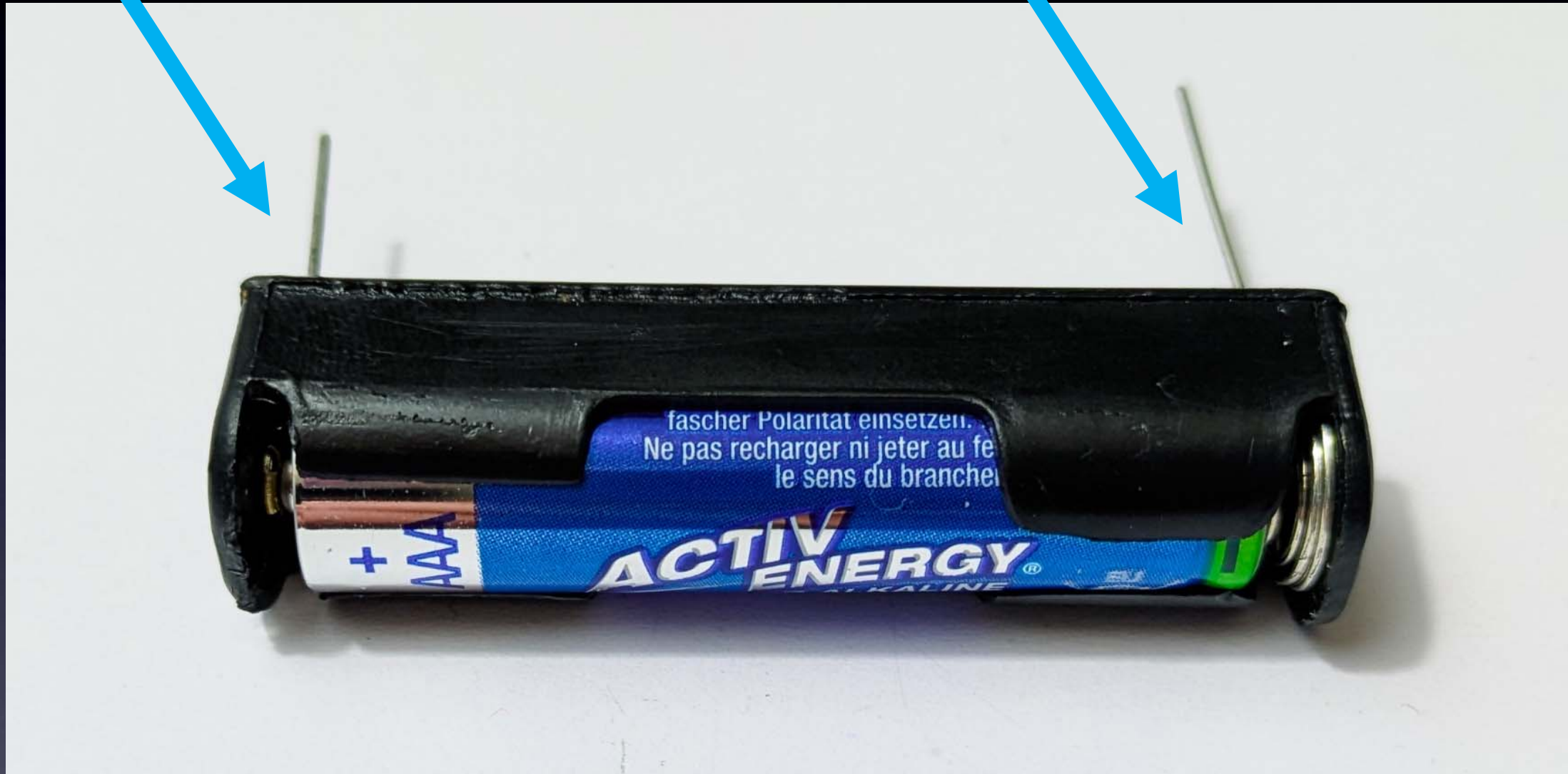
S1 in OFF position

Let's Test !

“+”

“-”

(spring)

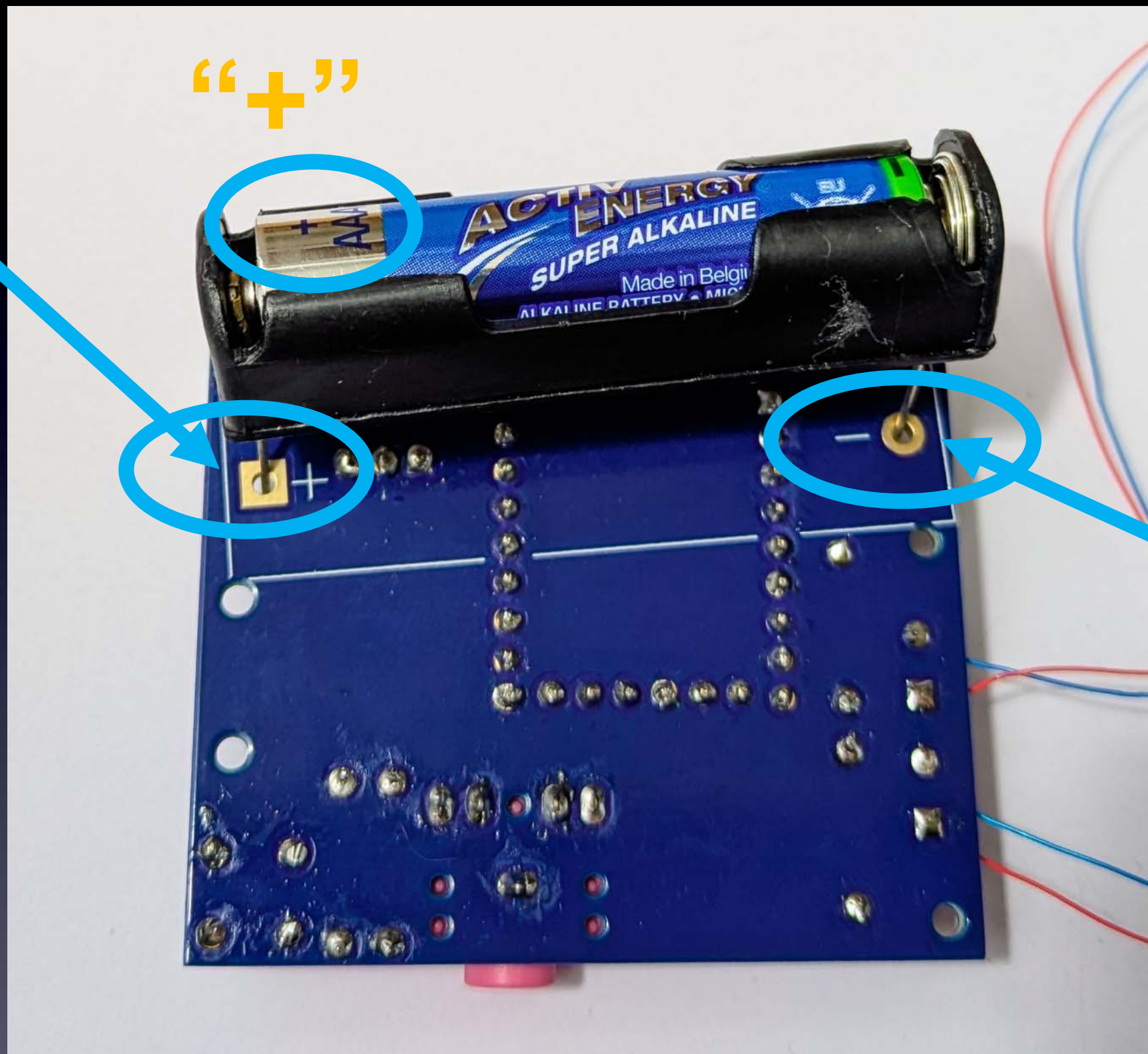


AAA Battery in its holder

Let's Test !

“+”

“+”

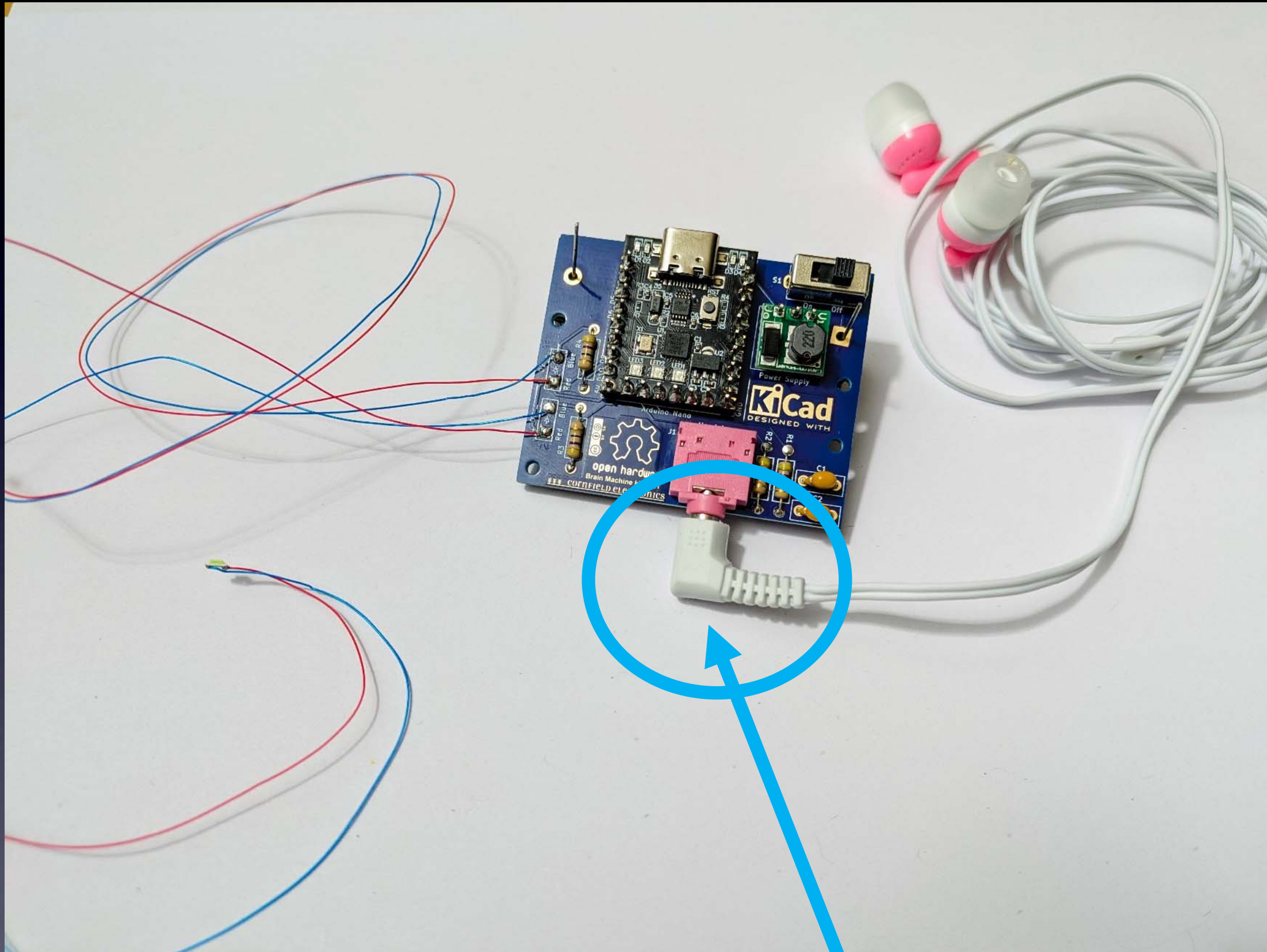


“-”

Place AAA Battery holder in place

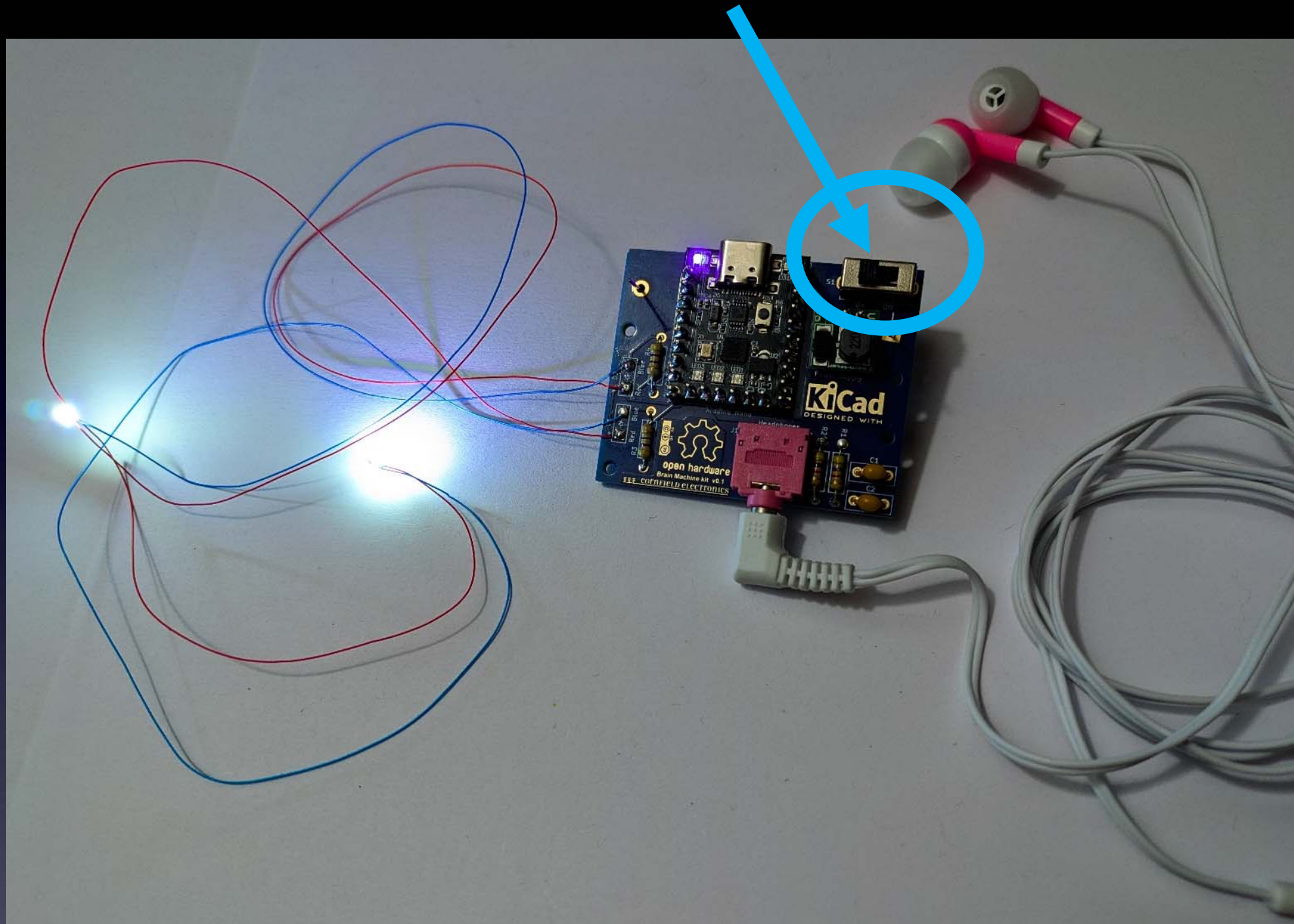
→ Do Not solder, yet ←

Let's Test !



Insert Earbuds

Let's Test !



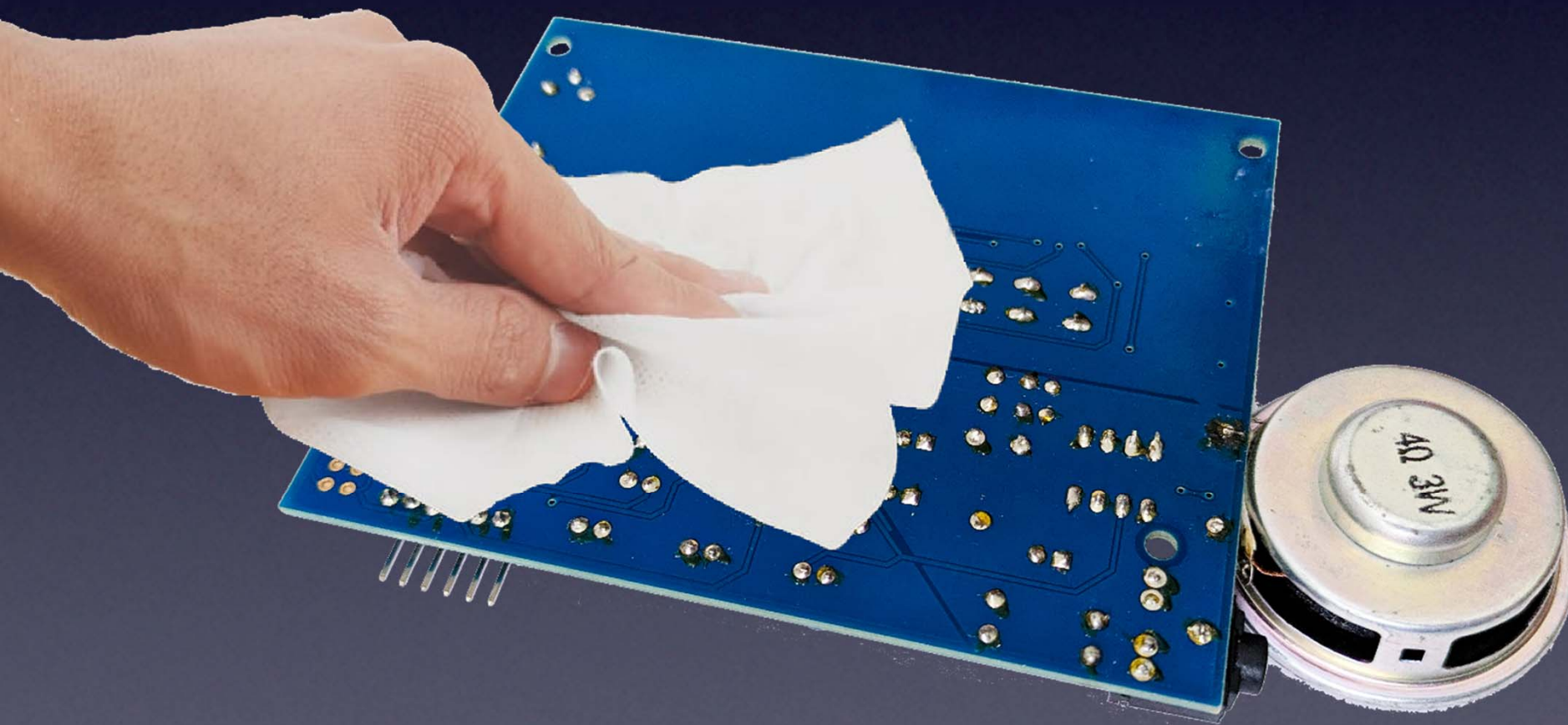
Turn ON

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

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

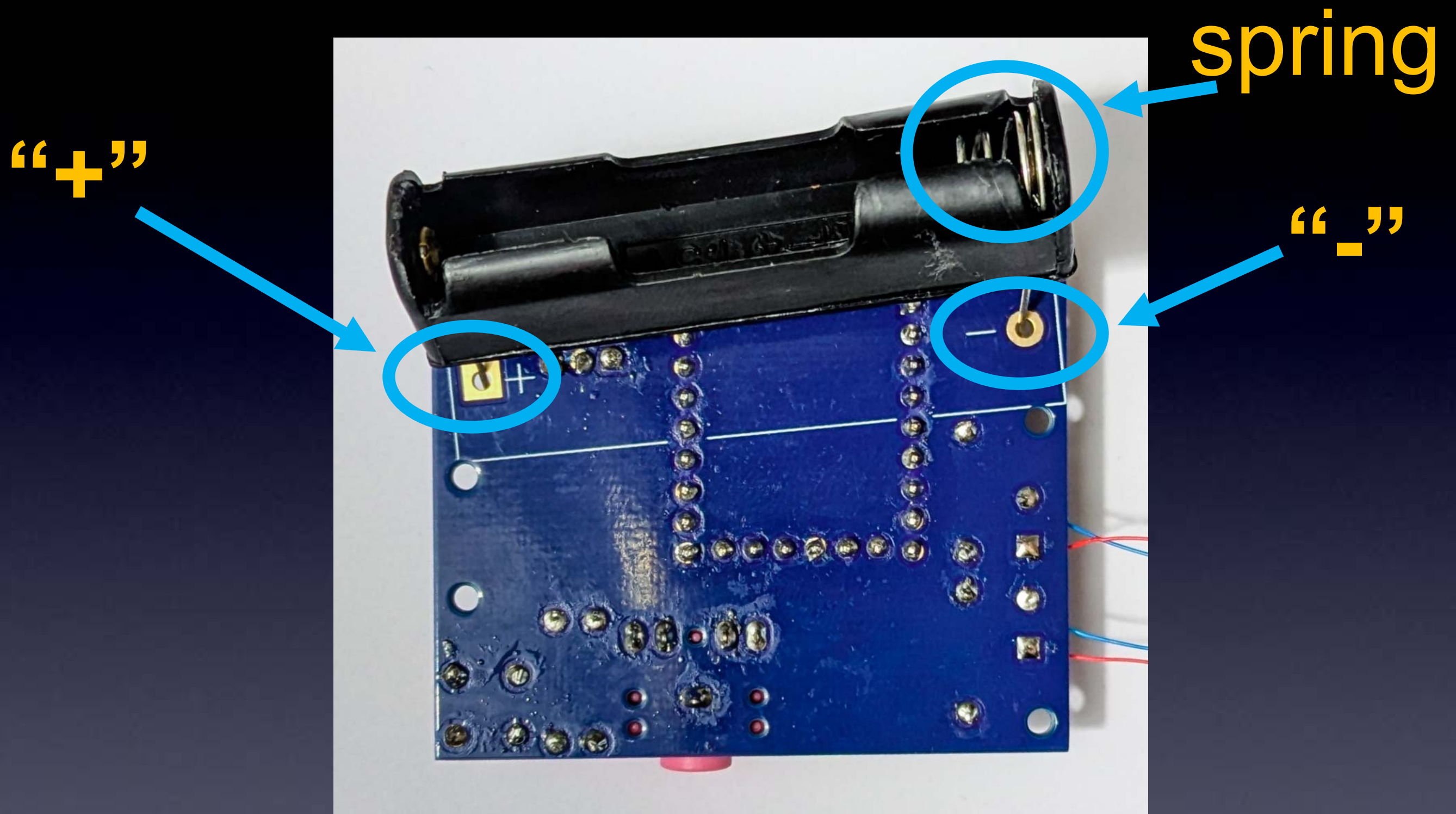


The bottom of the PCB will be sticky from the flux

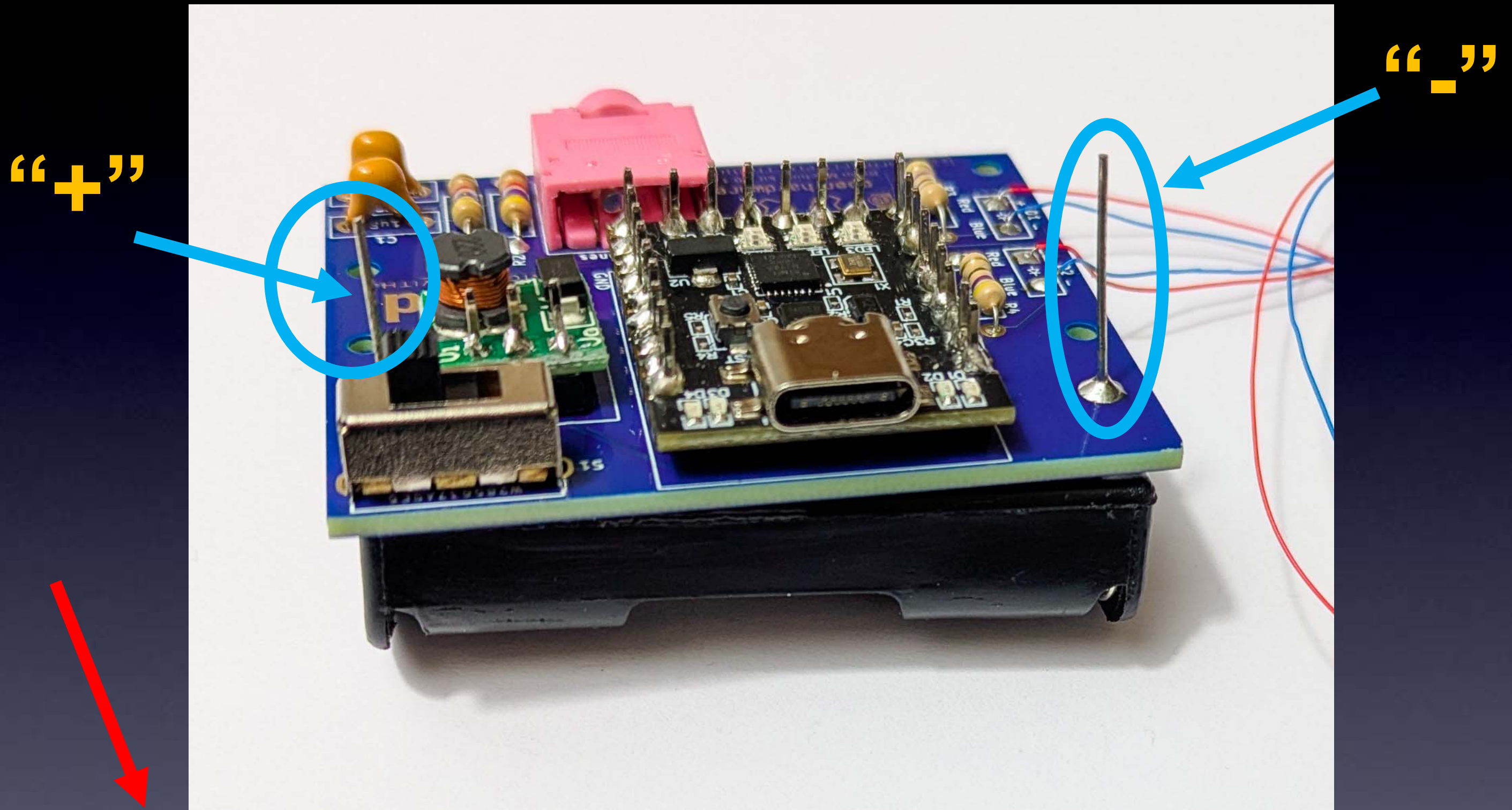


You can clean it with a cloth wet with *Isopropyl Alcohol*

Insert Battery Holder



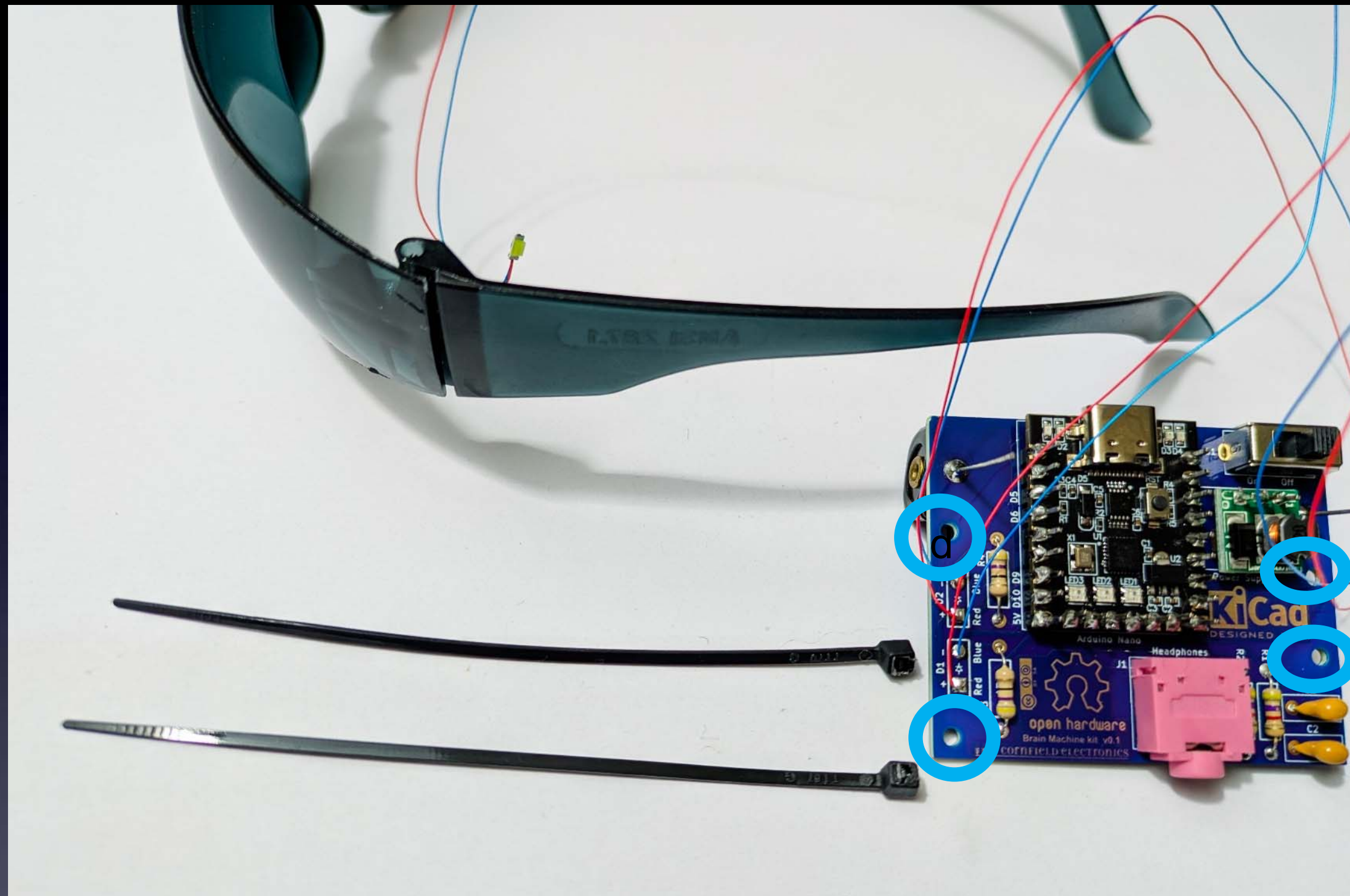
Battery Holder Soldered



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

(That will destroy the wire cutters)

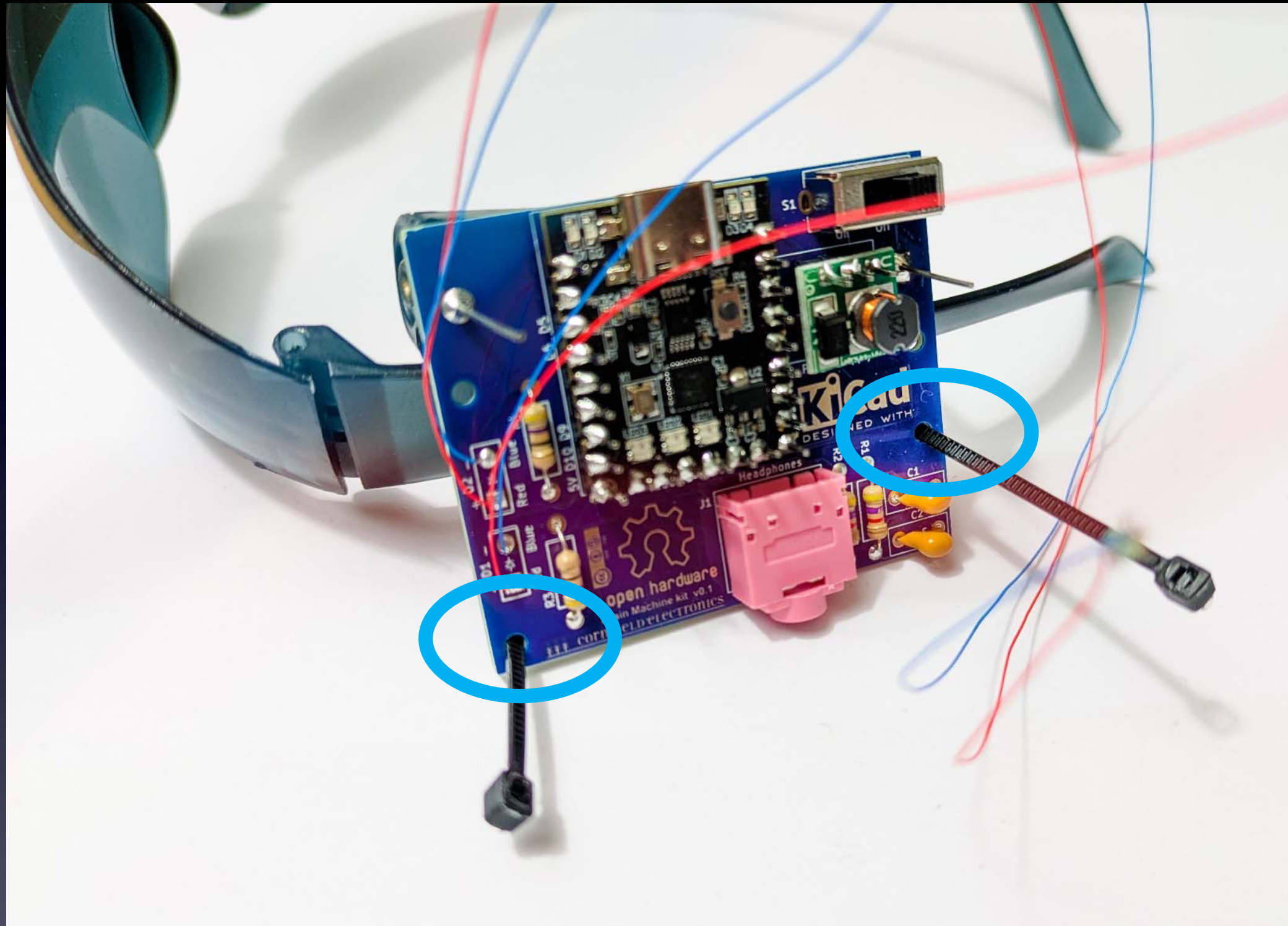
Attach Board to Glasses



Notice the 4 holes in the board
for the zip ties

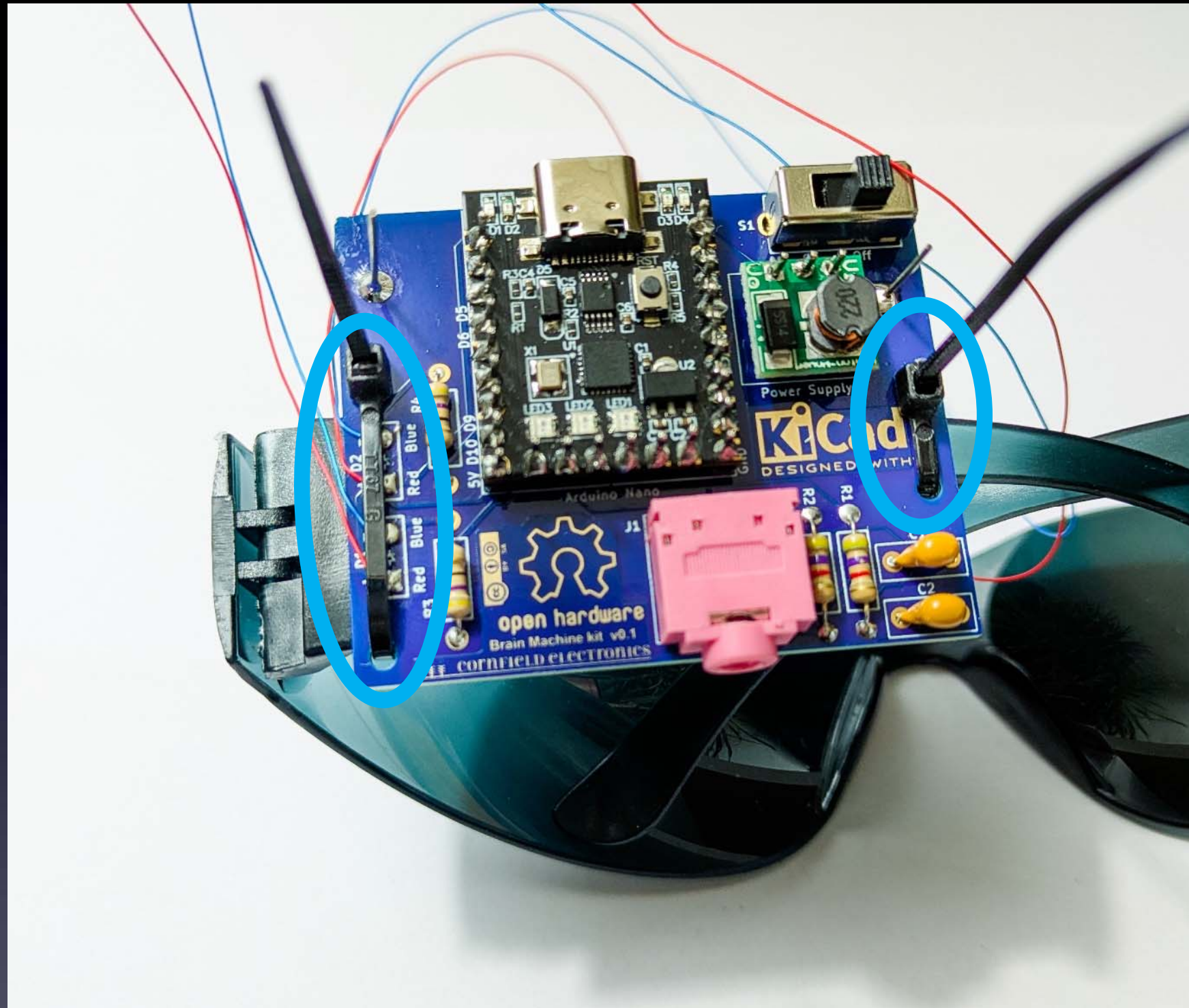
→ Use left side of glasses ←

Attach Board to Glasses



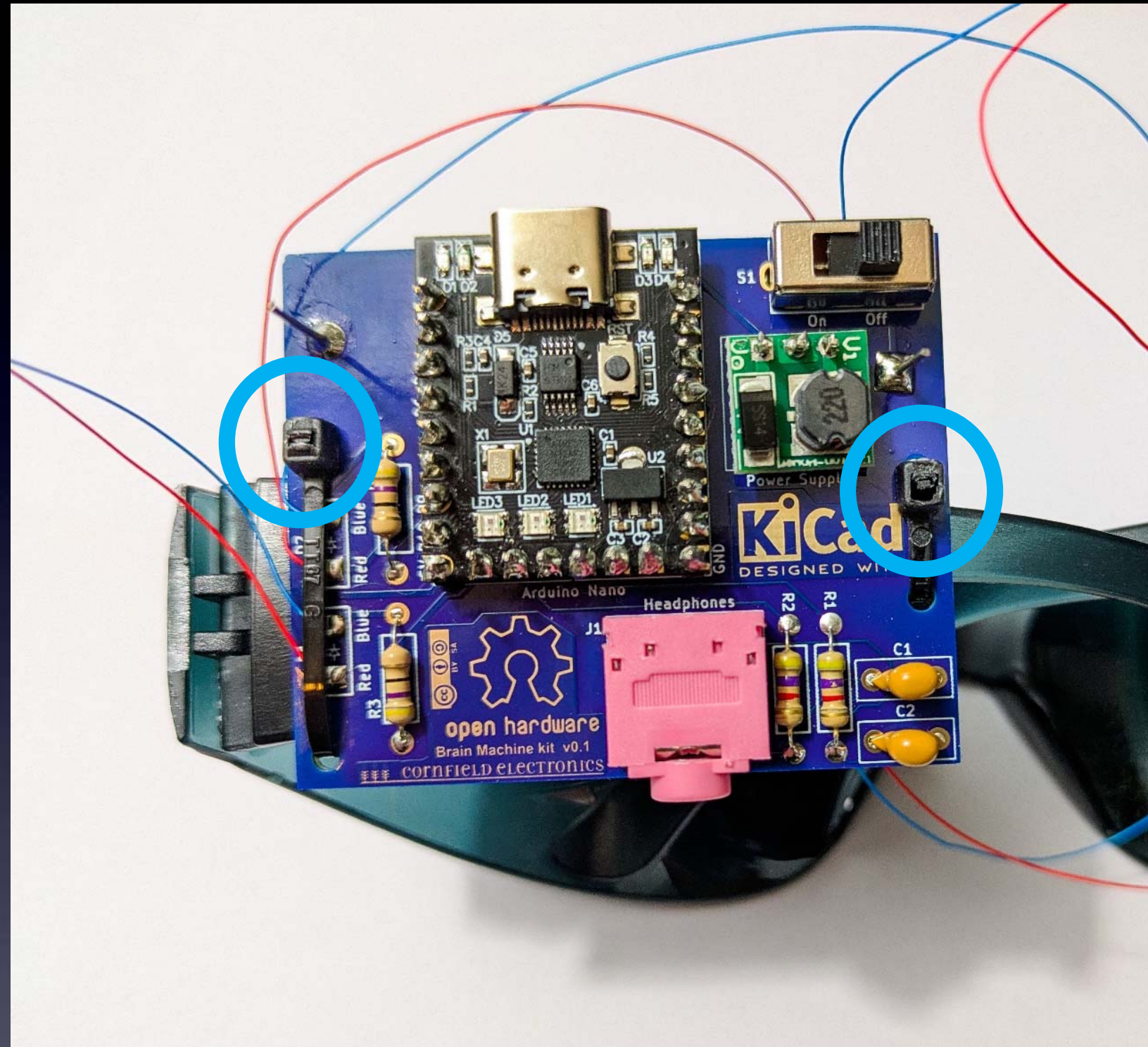
Insert zip-ties into lower mounting holes

Attach Board to Glasses



Wrap zip-ties around, and secure

Attach Board to Glasses



Cut zip-ties short

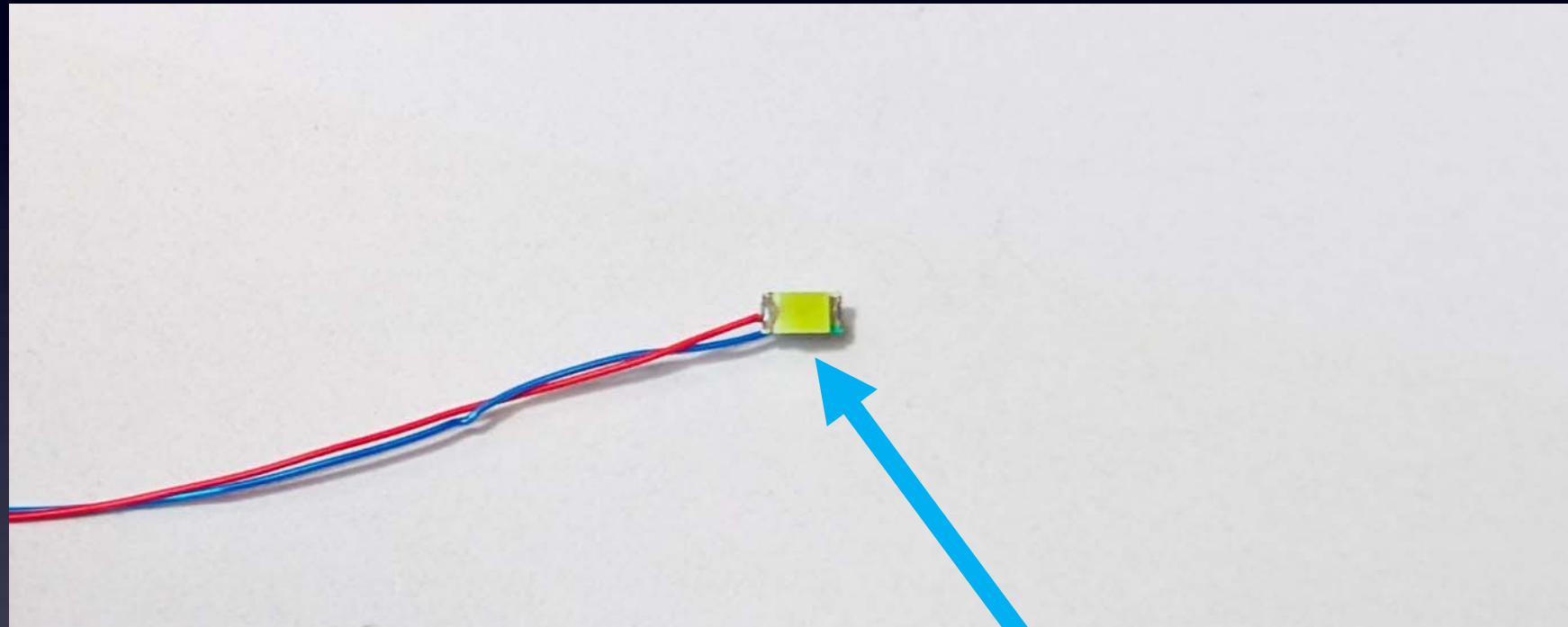
Mark where LEDs will go



For each eye:

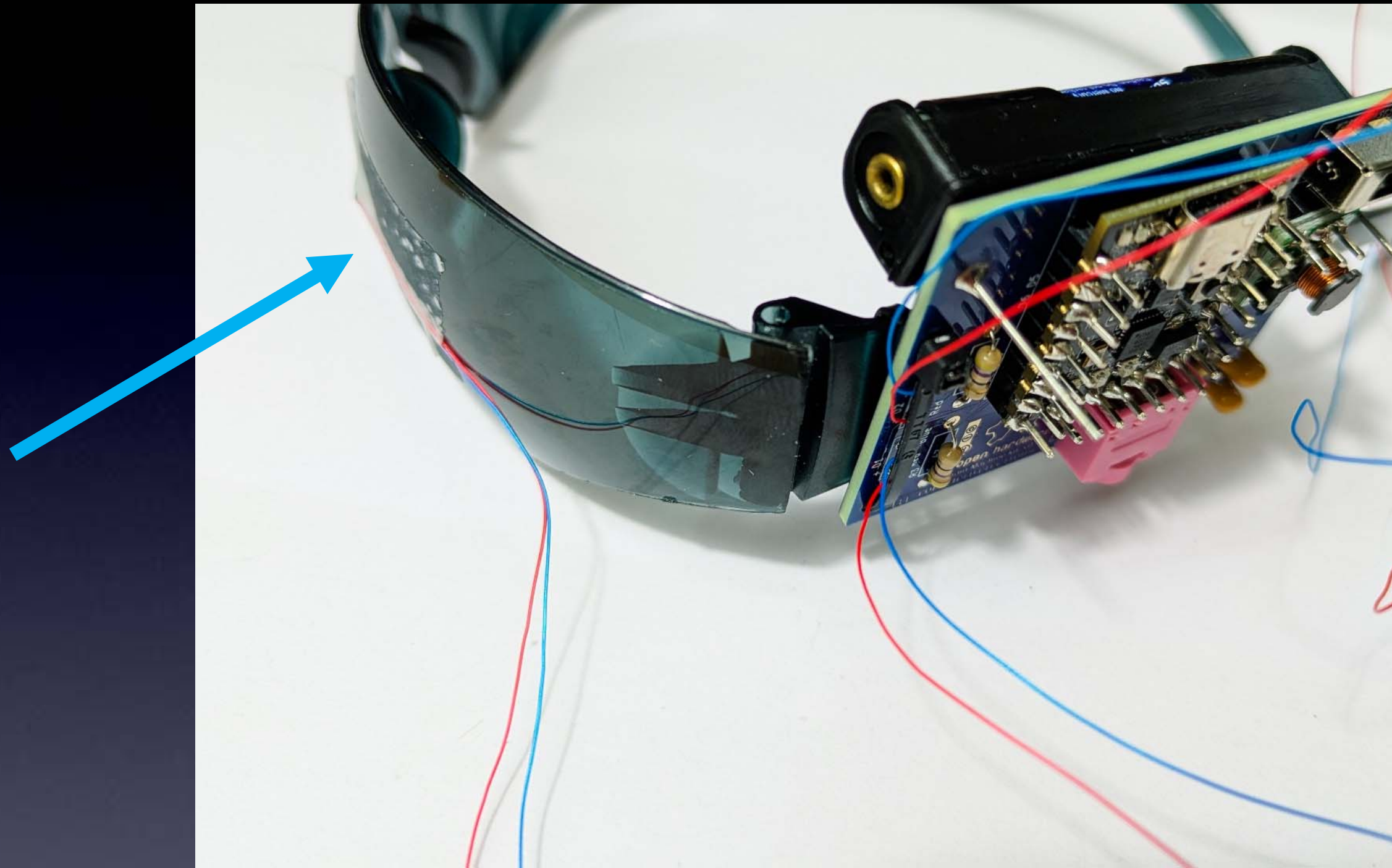
Slowly move the marker toward your eye to make a mark directly in front of your eye.

LEDs light up on one side



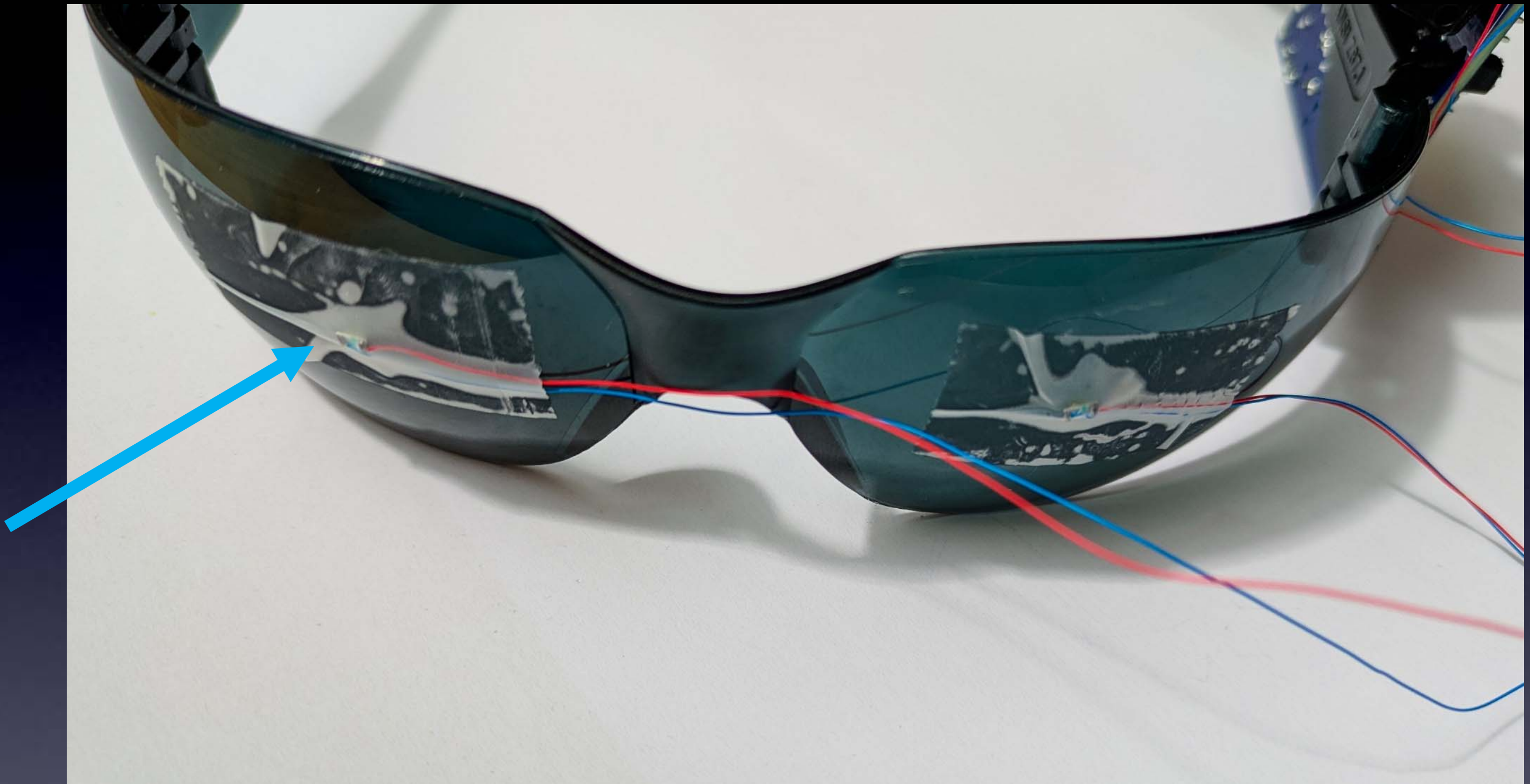
The LEDs light up on the flat white side

Tape Left LED to Glasses



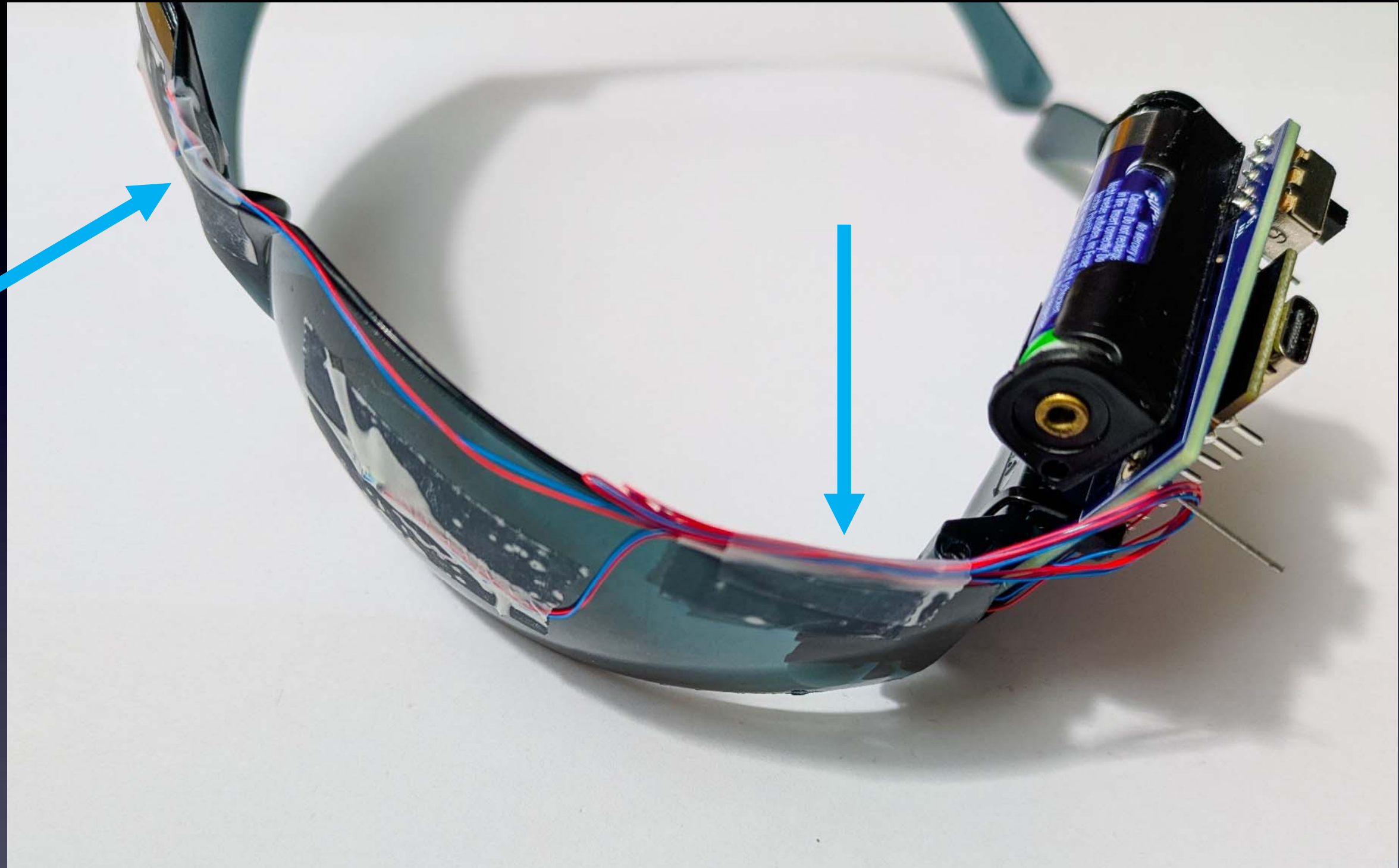
Tape the flat white side of D1 over the left mark
(so the light will shine on your eye)

Tape Right LED to Glasses



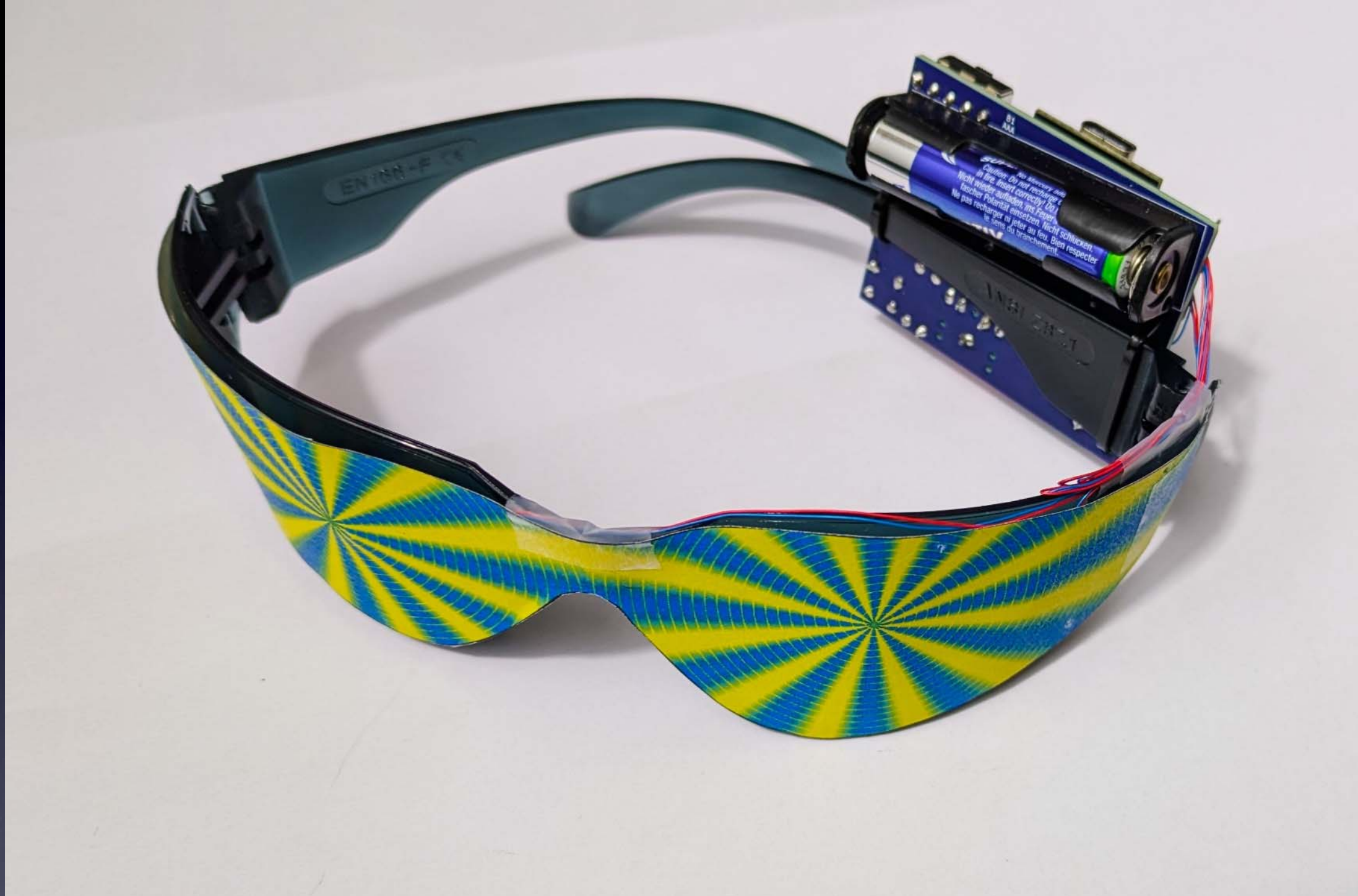
Tape the flat white side of D2 over the right mark
(so the light will shine on your eye)

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>>

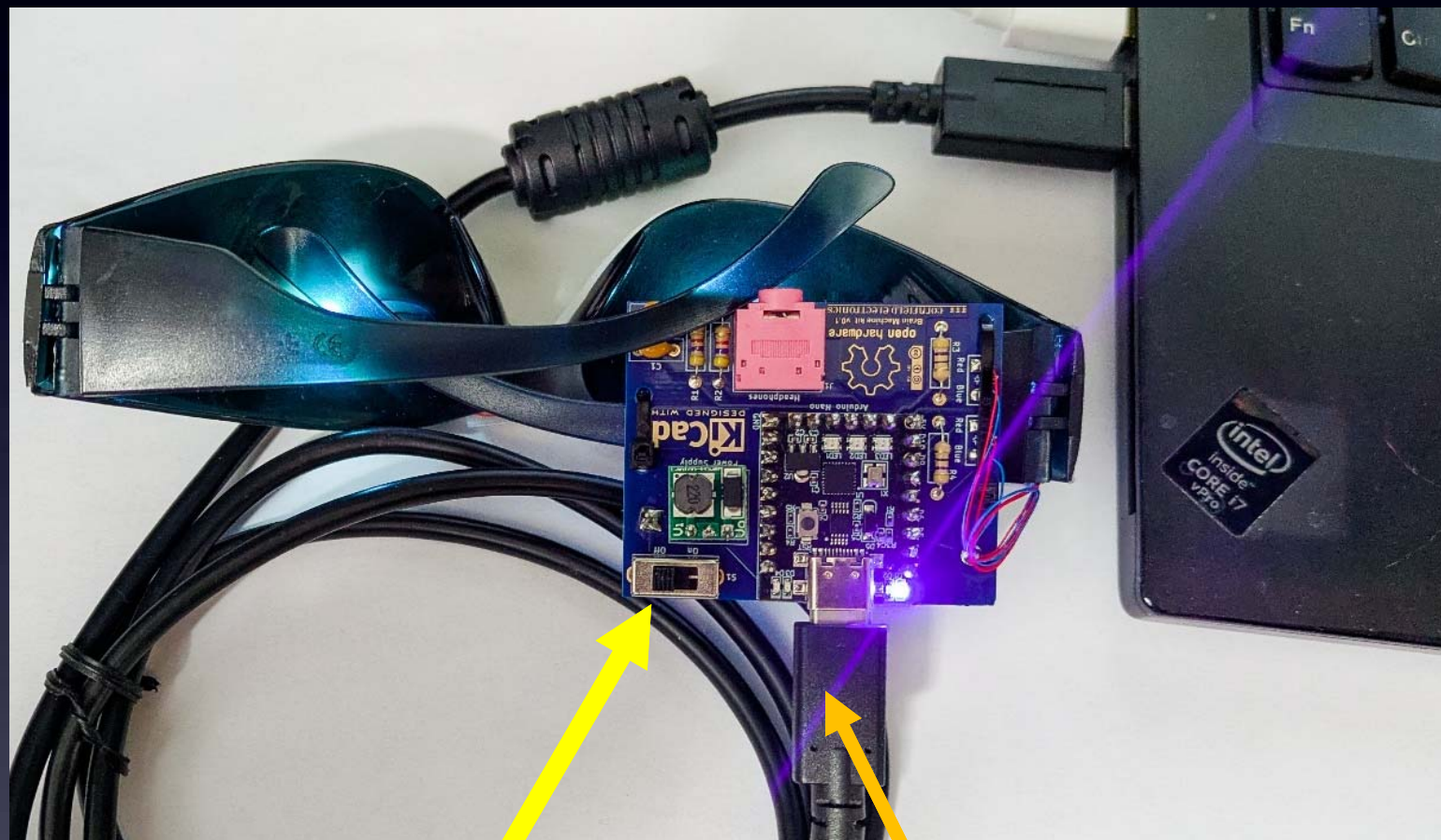
Store it on your computer anywhere you like.

(details on this soon)



Connecting your Brain Machine to your computer

USB-C cable

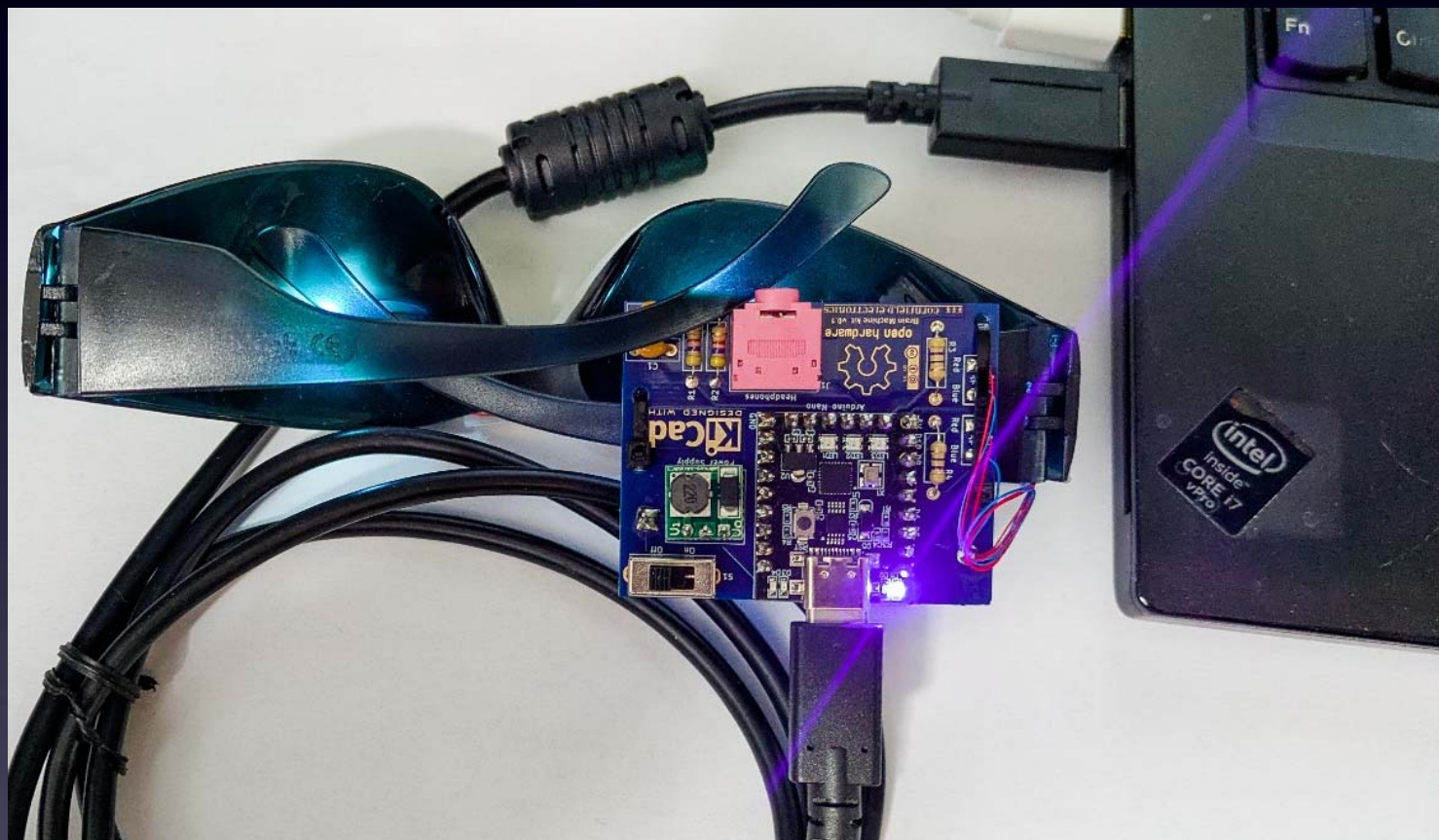


IMPORTANT:
Make sure the
Switch on your
Brain Machine
is *OFF*

to computer's USB

Connecting your Brain Machine to your computer

USB-C cable



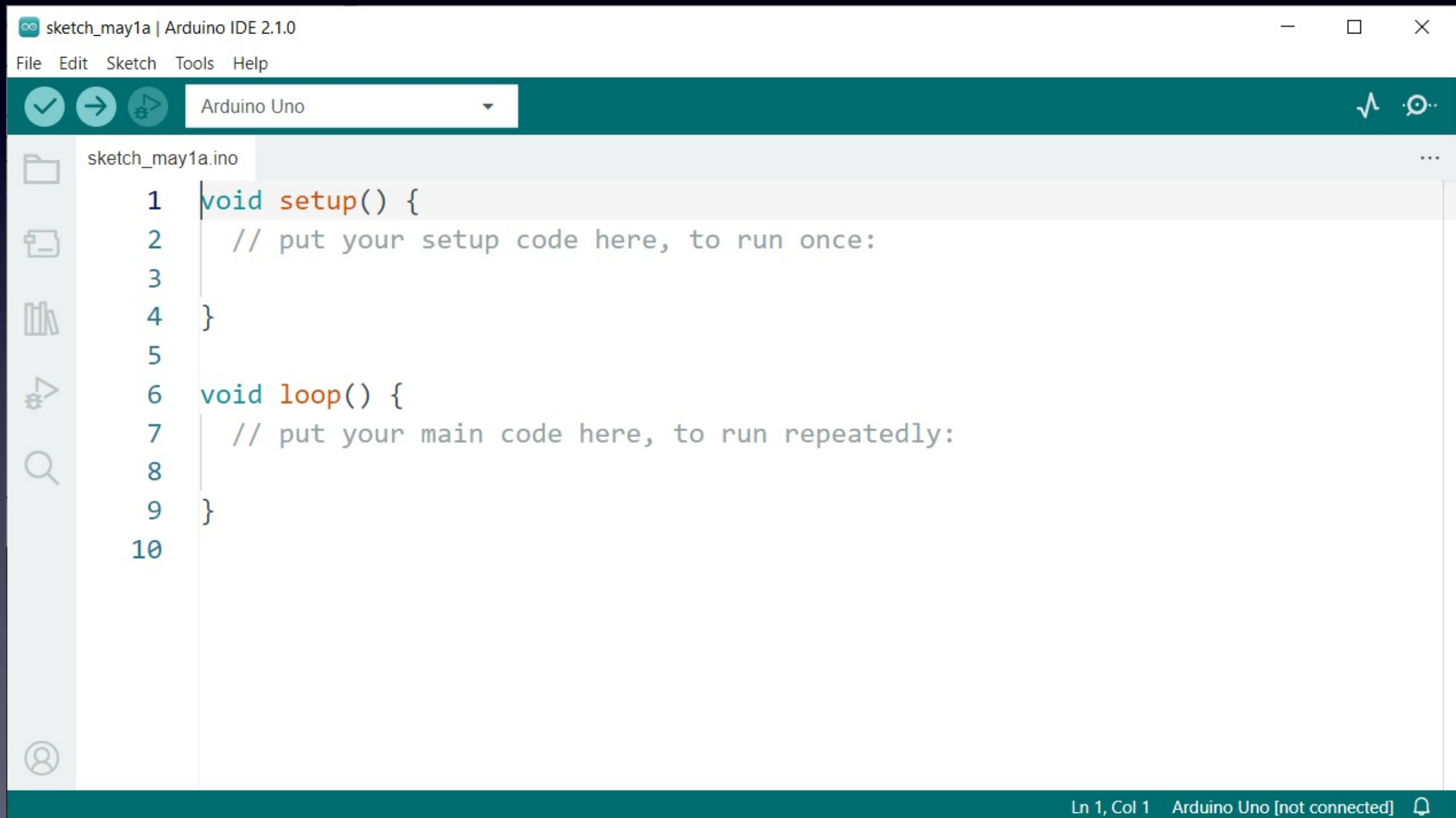
**You may need to download and install a driver
for your Operating System (Windows, MacOS, or Linux):**

[<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

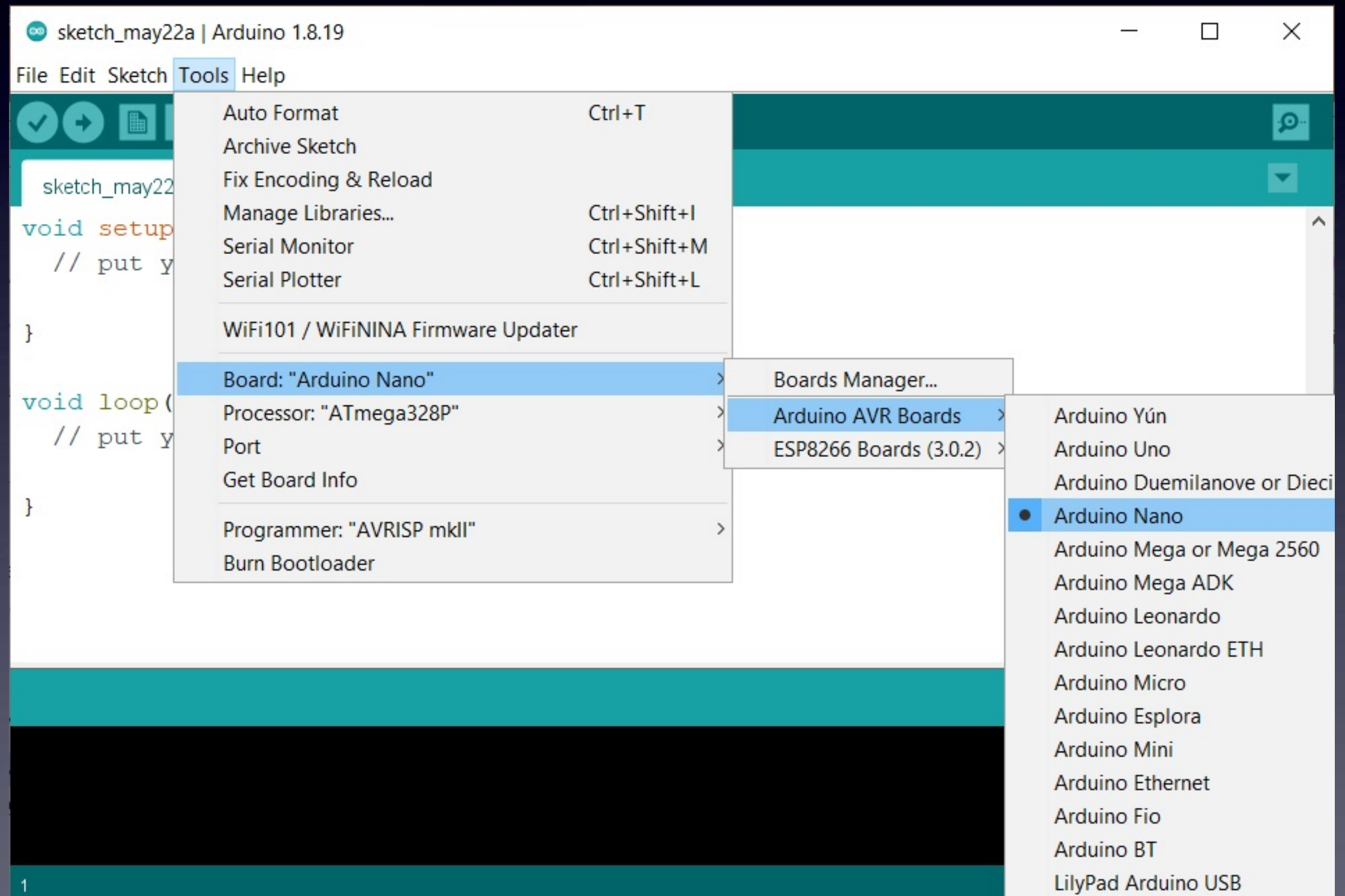
After you download and install the Arduino software start it, and you will see a screen that looks like this:



Arduino

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

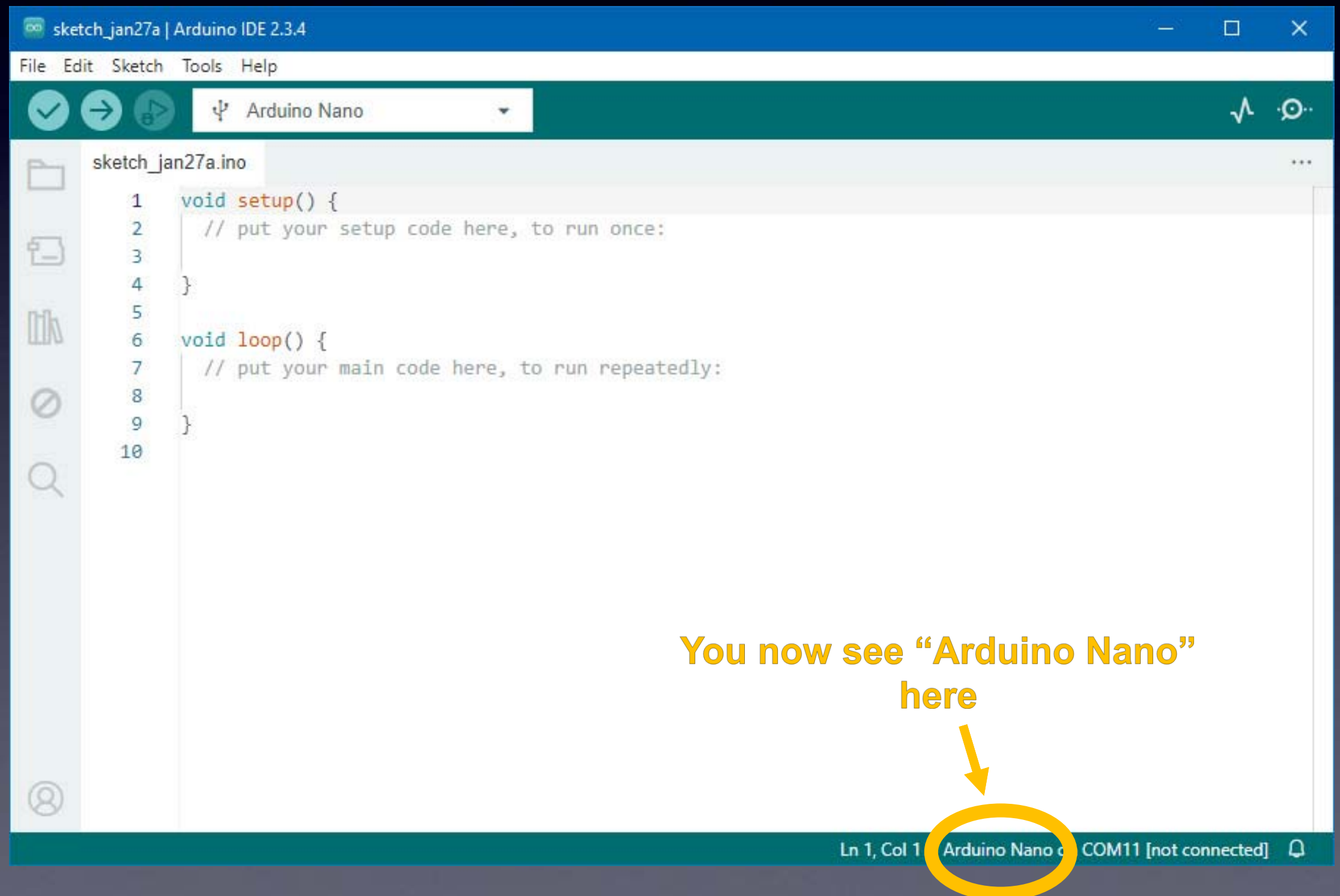
(1)
Choose
“Arduino Nano”
as the Board



Arduino

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

(1)
Choose
“Arduino Nano”
as the Board



Arduino

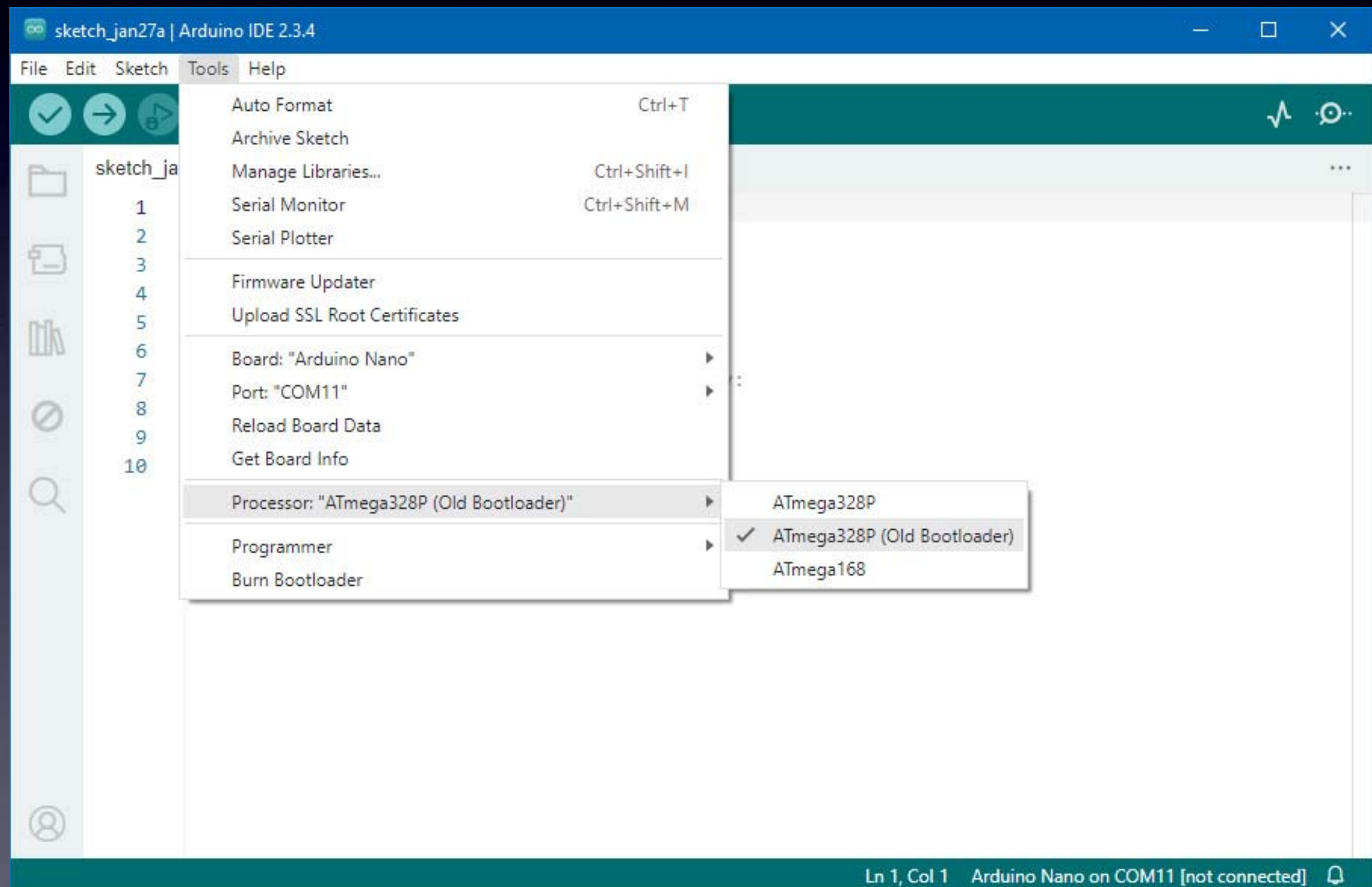
The first time you start your Arduino software
you need to set things up

(2)
Choose
your Processor

“ATmega328P (Old Bootloader)”



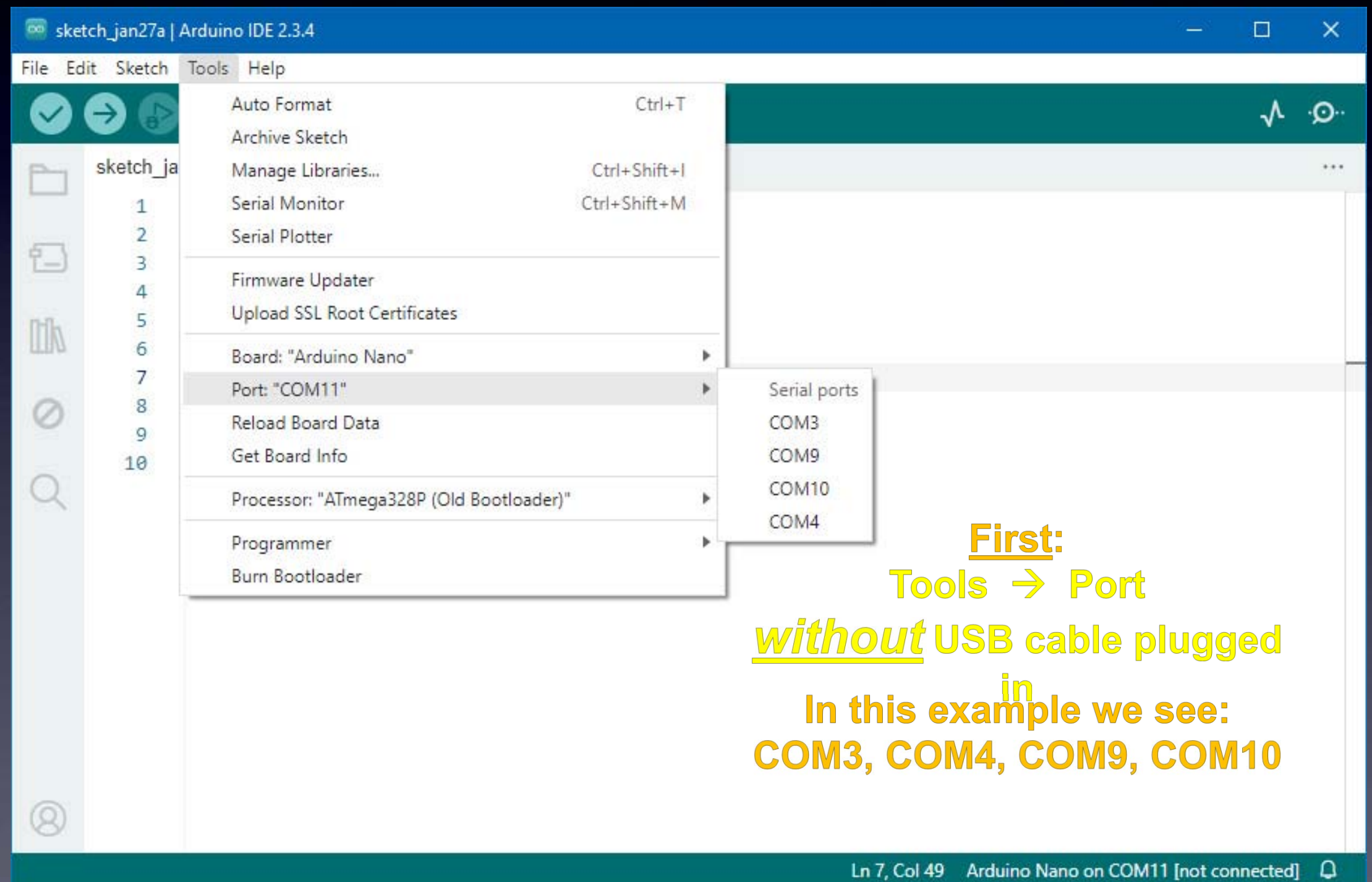
If this one doesn't work,
then
choose
“ATmega328P”



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

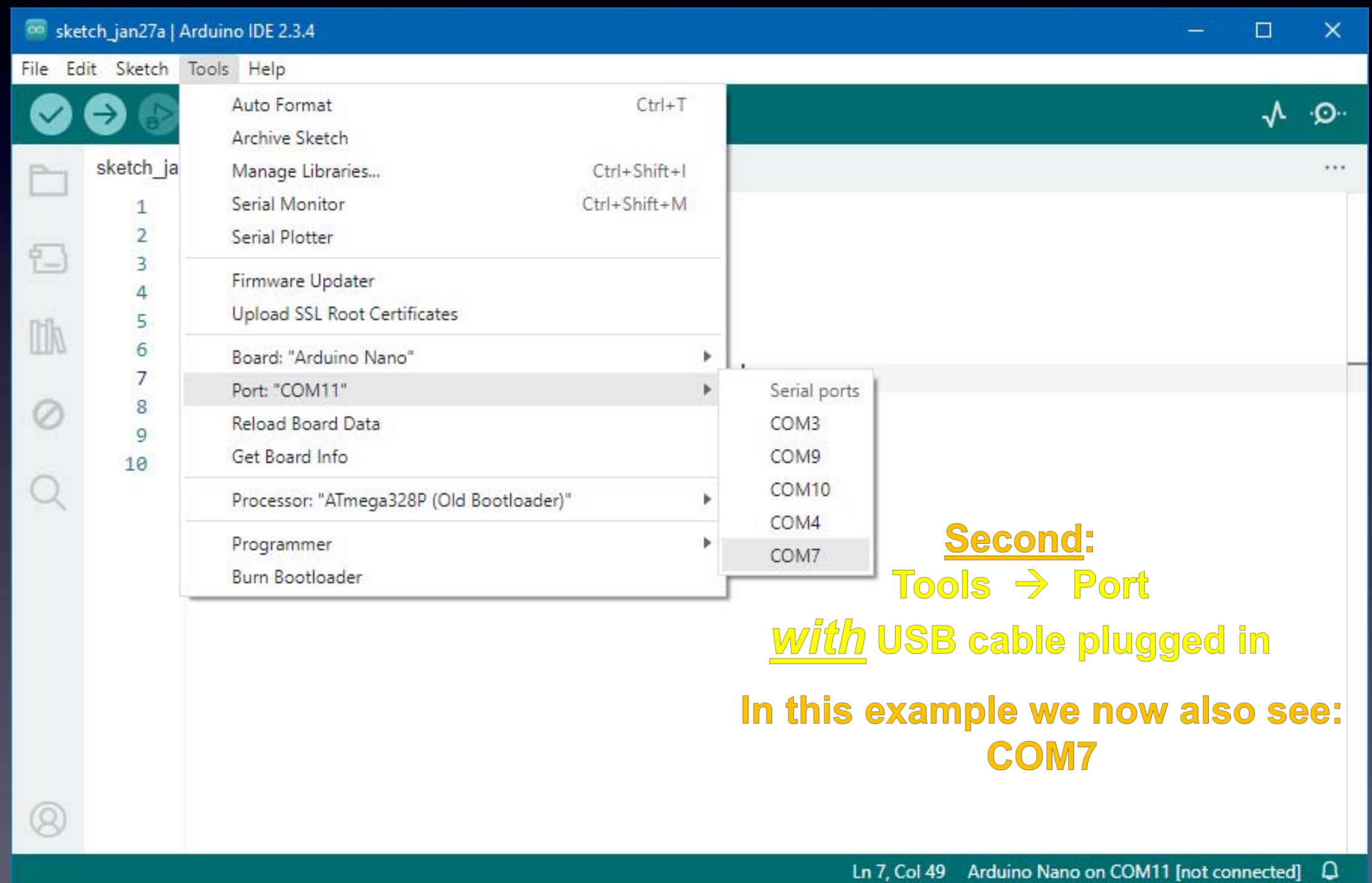
Arduino

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

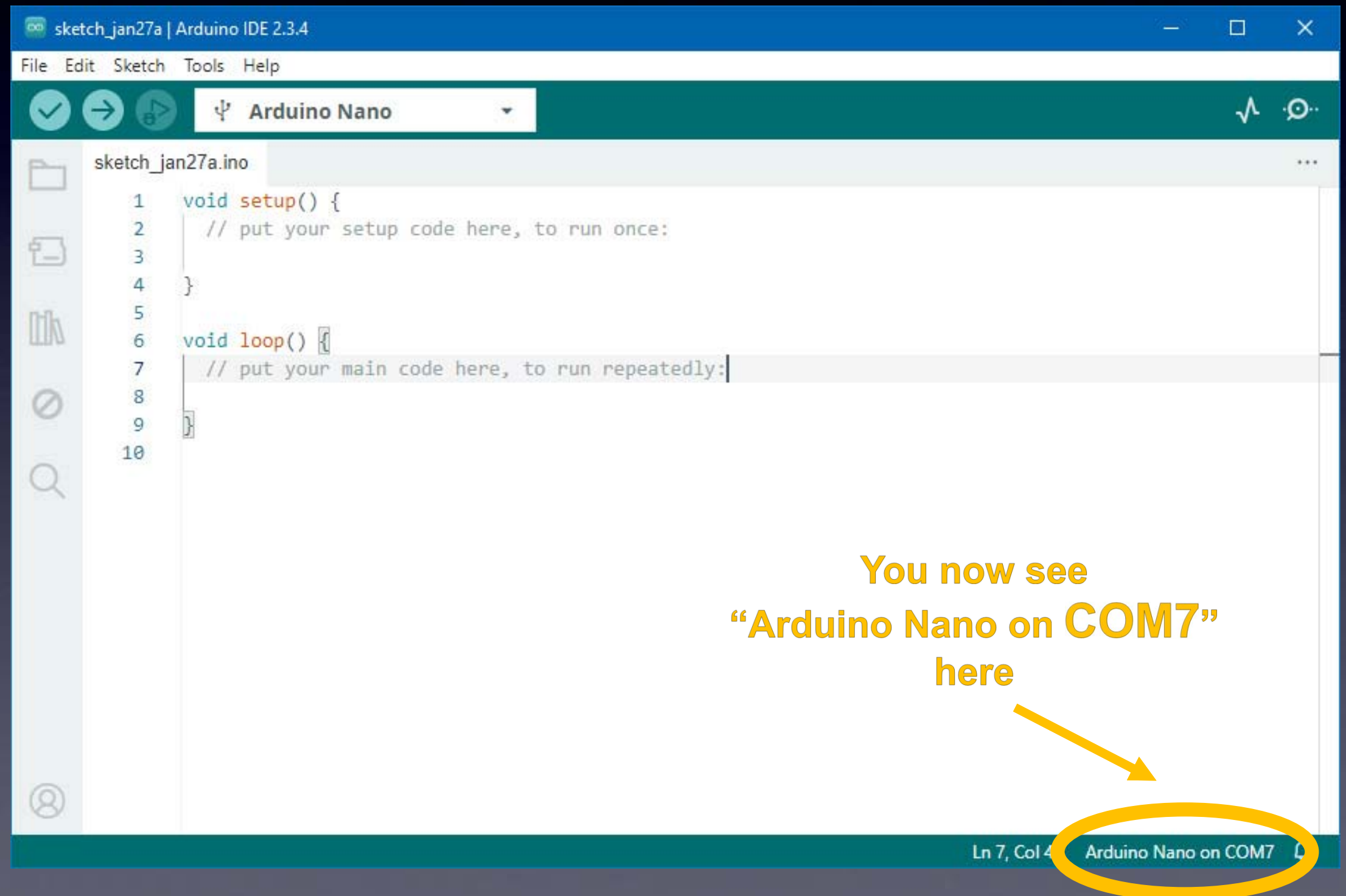
Arduino

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)

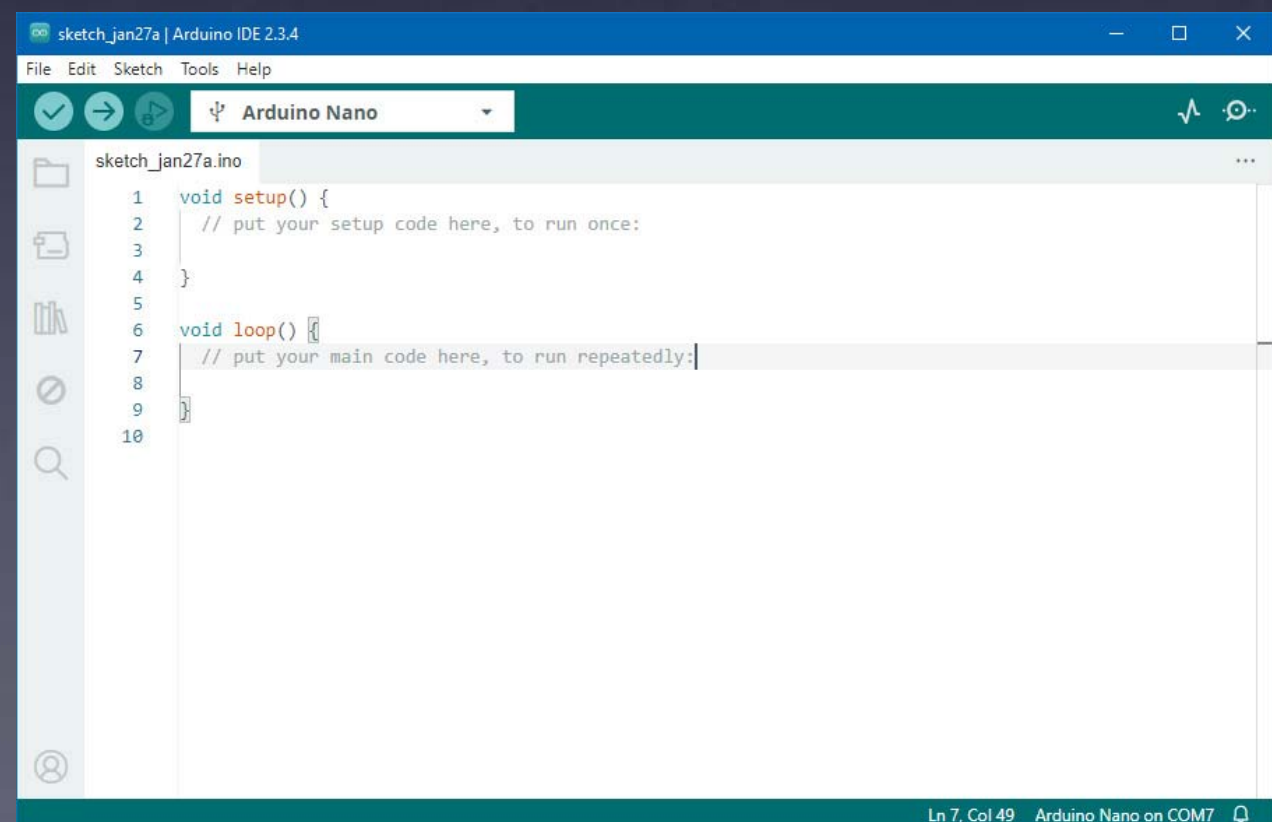
(After installing
the driver
for your Arduino
(USB-Serial adapter),
with your Arduino
plugged in,
your operating system
will see a serial port
and it appears here.)



Arduino

Your Arduino software is now ready

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

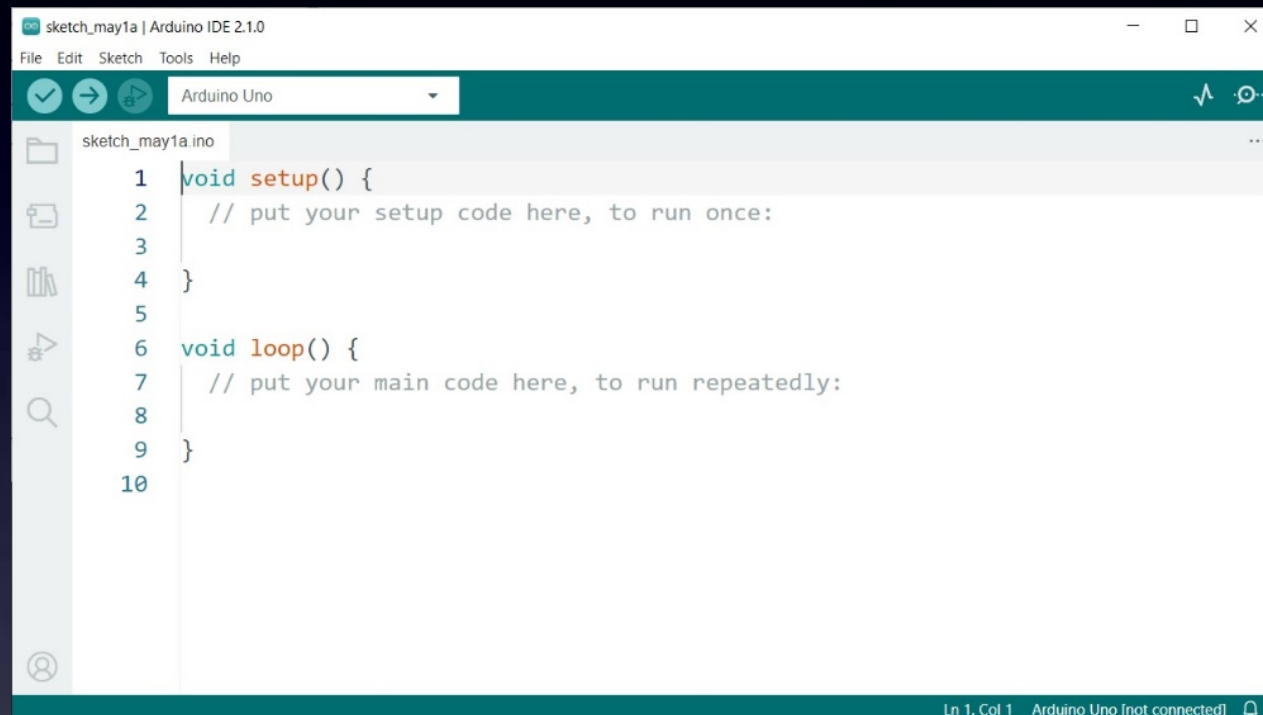


```
sketch_jan27a | Arduino IDE 2.3.4
File Edit Sketch Tools Help
ψ Arduino Nano
sketch_jan27a.ino
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }
10
```

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

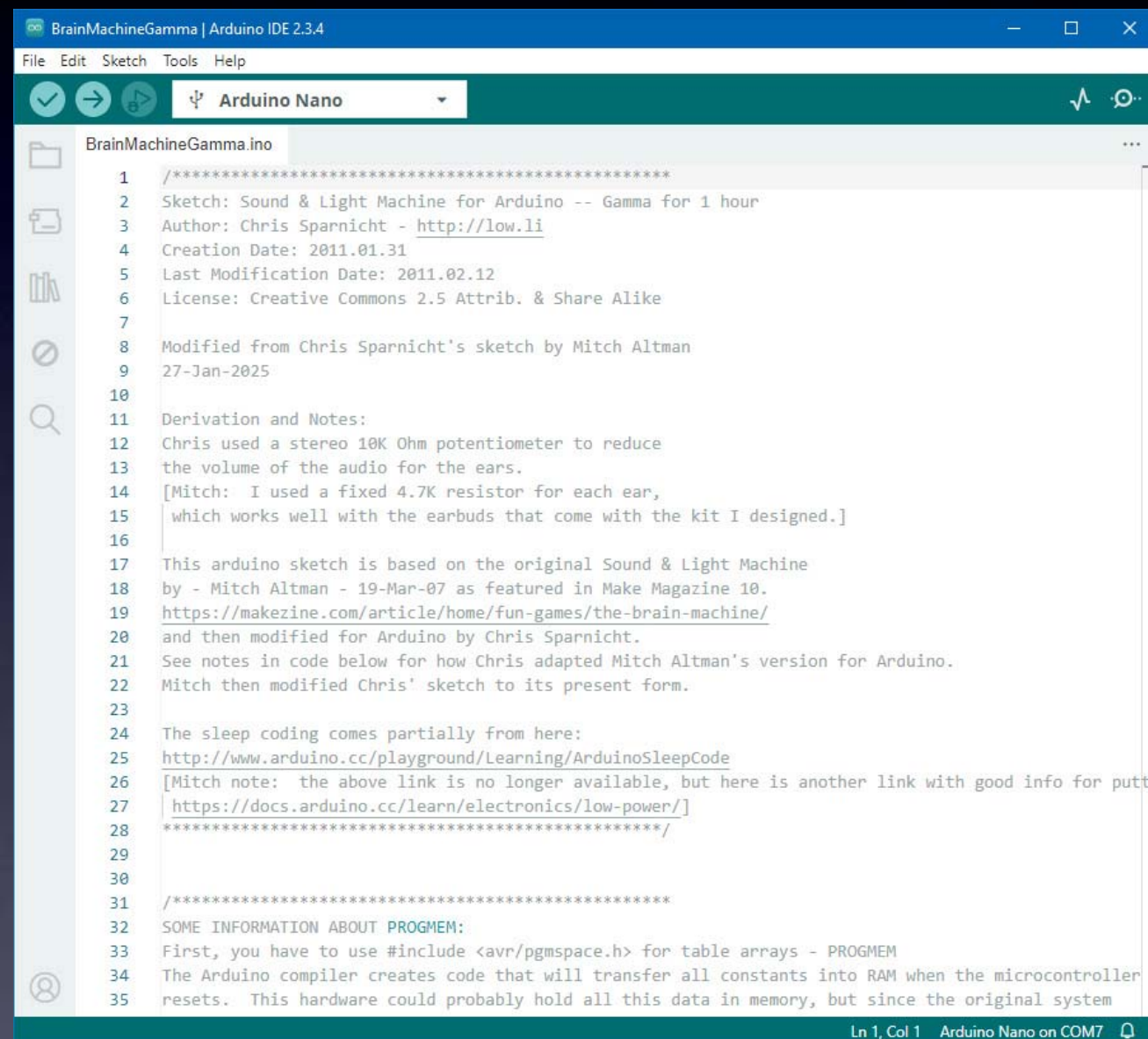
“Sketch” :

an Arduino program

Arduino

Designed for non-geeky artists

Download
the new
Gamma
“sketch”



```
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”

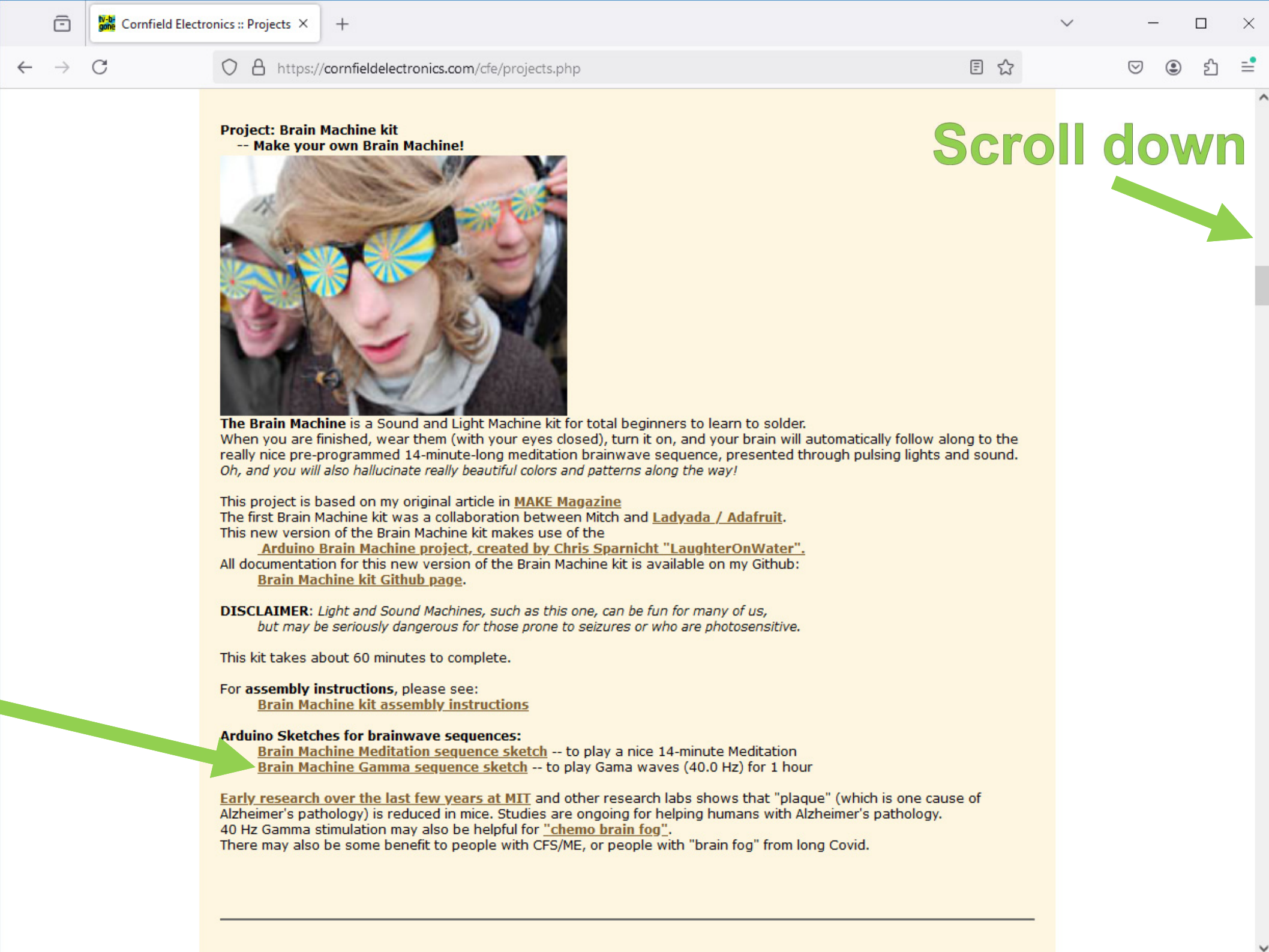


“Projects” tab

Arduino

Download a new brainwave sequence “sketch”

Click here to
download the
Gamma wave
sequence
sketch



The screenshot shows a web browser window with the URL <https://cornfieldelectronics.com/cfe/projects.php>. The page title is "Cornfield Electronics :: Projects". The main content is for a project titled "Project: Brain Machine kit -- Make your own Brain Machine!". It features a photo of three people wearing colorful, circular, light-up glasses. The text describes the kit as a Sound and Light Machine for beginners, with a 14-minute meditation sequence. It includes links to the original article in MAKE Magazine, the first kit's collaboration with Ladyada / Adafruit, and the Arduino Brain Machine project by Chris Sparnicht. A disclaimer states that light and sound machines can be fun but dangerous for those prone to seizures or photosensitive. It also mentions that the kit takes about 60 minutes to complete. Under "Arduino Sketches for brainwave sequences:", there are two links: "Brain Machine Meditation sequence sketch" and "Brain Machine Gamma sequence sketch". The latter is highlighted with a green arrow pointing from the text "Click here to download the Gamma wave sequence sketch". At the bottom, there is a link to "Early research over the last few years at MIT" and a note about the benefits of 40 Hz Gamma stimulation for Alzheimer's pathology and chemo brain fog.

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](#)

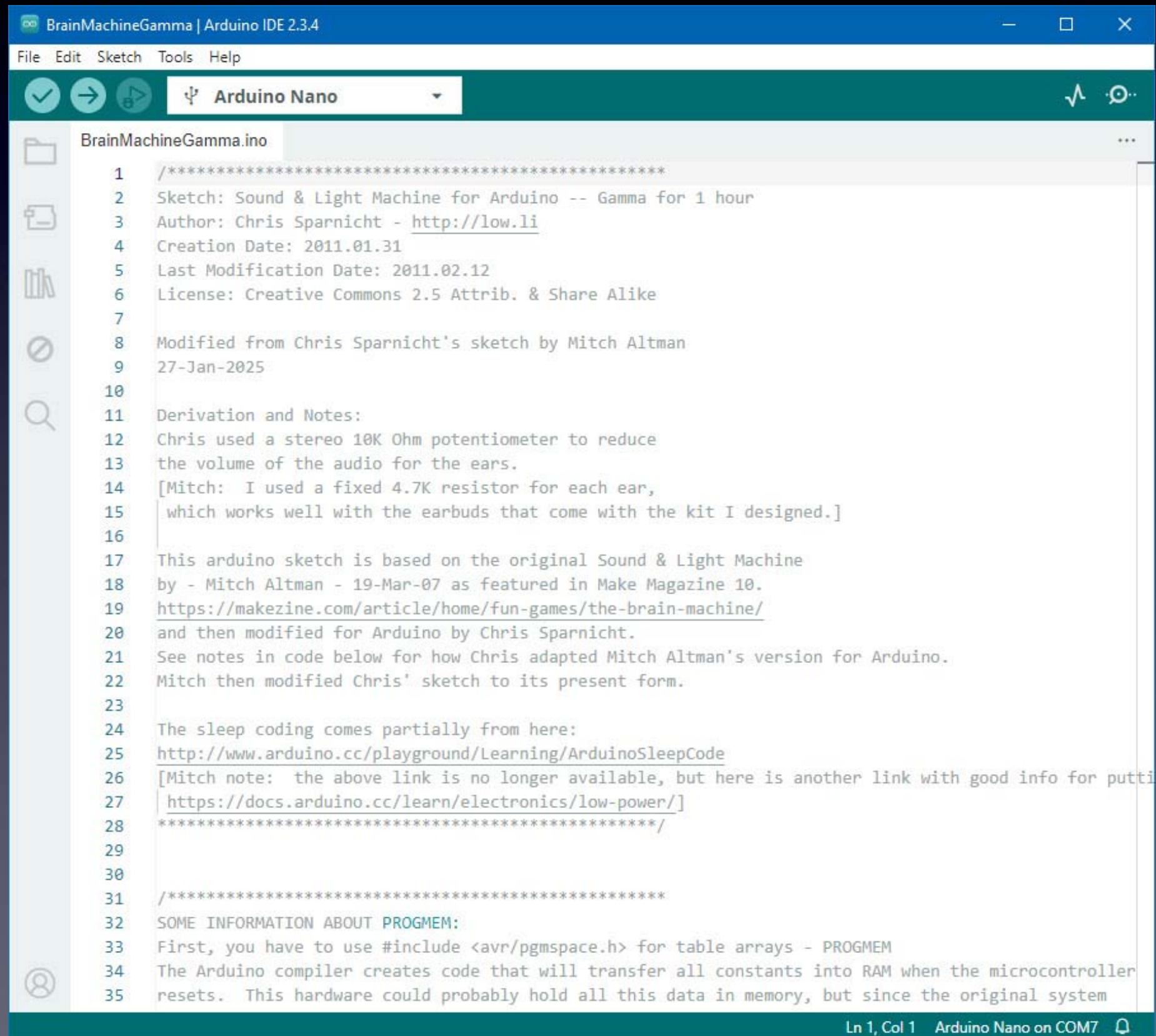
Arduino Sketches for brainwave sequences:
[Brain Machine Meditation sequence sketch](#) -- to play a nice 14-minute Meditation
[Brain Machine Gamma sequence sketch](#) -- to play Gama waves (40.0 Hz) for 1 hour

[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...

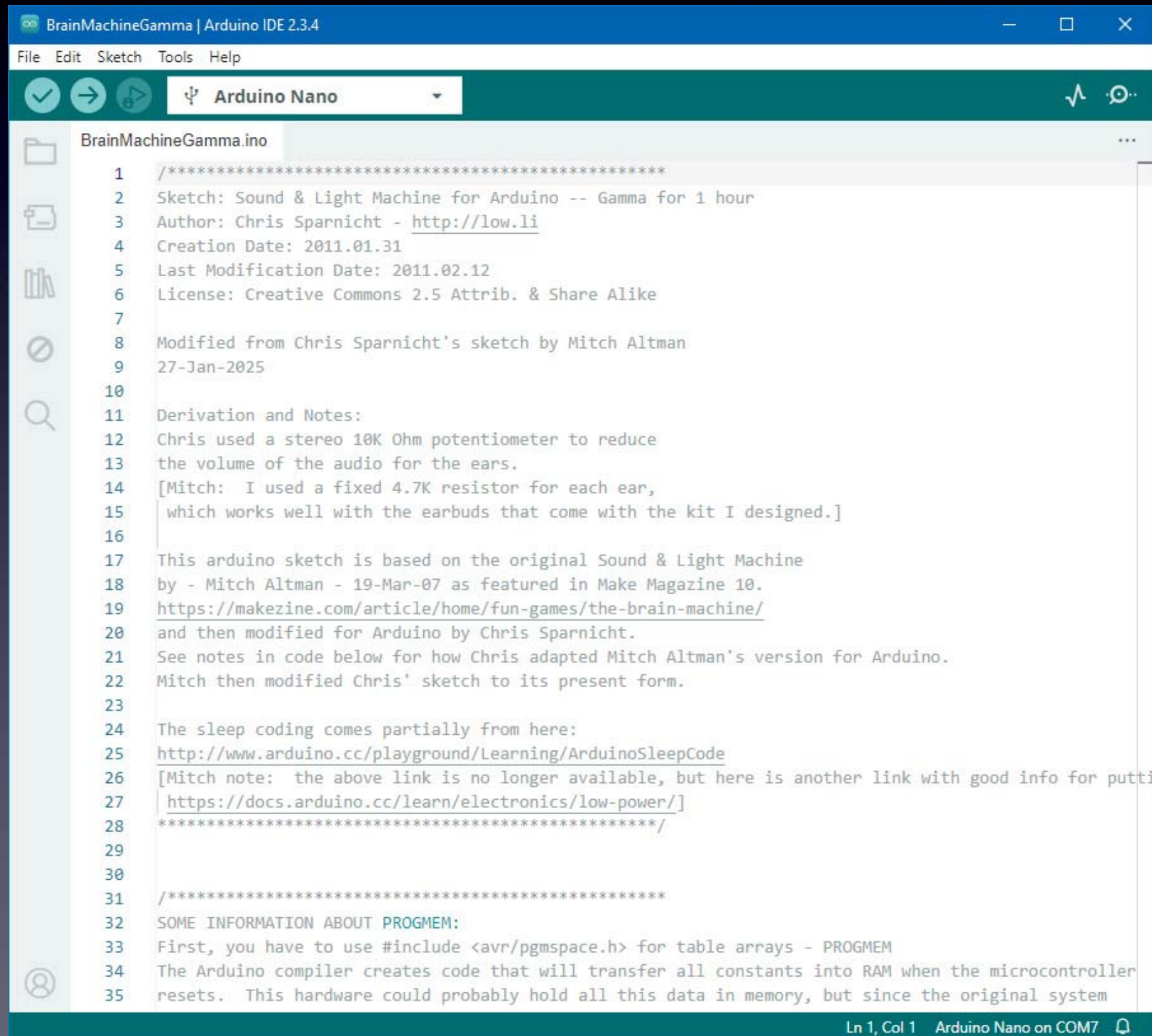


```
BrainMachineGamma.ino
1  /*****
2  Sketch: Sound & Light Machine for Arduino -- Gamma for 1 hour
3  Author: Chris Sparnicht - http://low.li
4  Creation Date: 2011.01.31
5  Last Modification Date: 2011.02.12
6  License: Creative Commons 2.5 Attrib. & Share Alike
7
8  Modified from Chris Sparnicht's sketch by Mitch Altman
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27 https://docs.arduino.cc/learn/electronics/low-power/]
28 *****/
29
30
31 /*****
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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
```

Ln 1, Col 1 Arduino Nano on COM7

Arduino

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

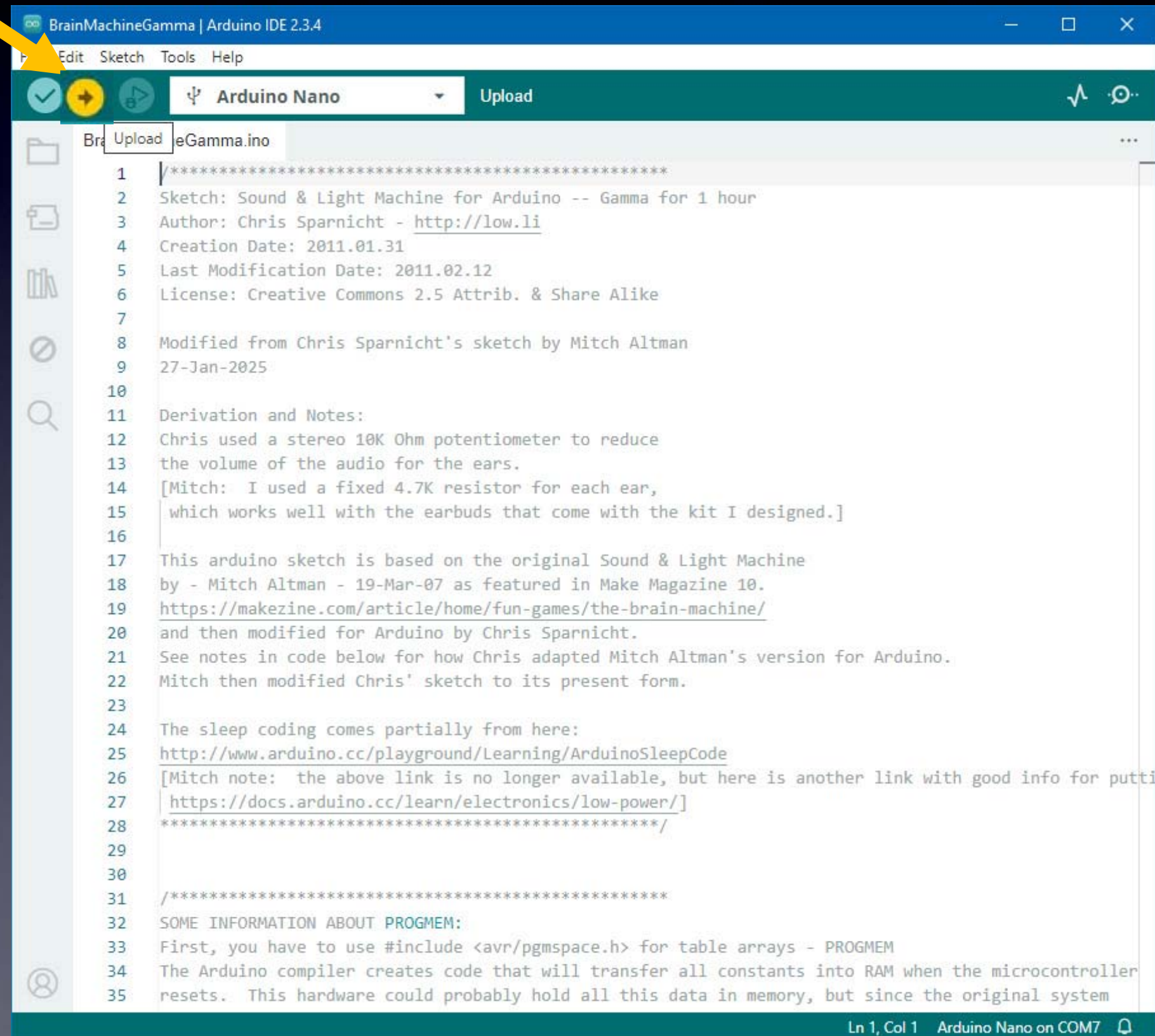


```
BrainMachineGamma | Arduino IDE 2.3.4
File Edit Sketch Tools Help
Arduino Nano
BrainMachineGamma.ino
1 /*****
2 Sketch: Sound & Light Machine for Arduino -- Gamma for 1 hour
3 Author: Chris Sparnicht - http://low.li
4 Creation Date: 2011.01.31
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6 License: Creative Commons 2.5 Attrib. & Share Alike
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8 Modified from Chris Sparnicht's sketch by Mitch Altman
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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.
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35 resets. This hardware could probably hold all this data in memory, but since the original system
```

Ln 1, Col 1 Arduino Nano on COM7

Arduino

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

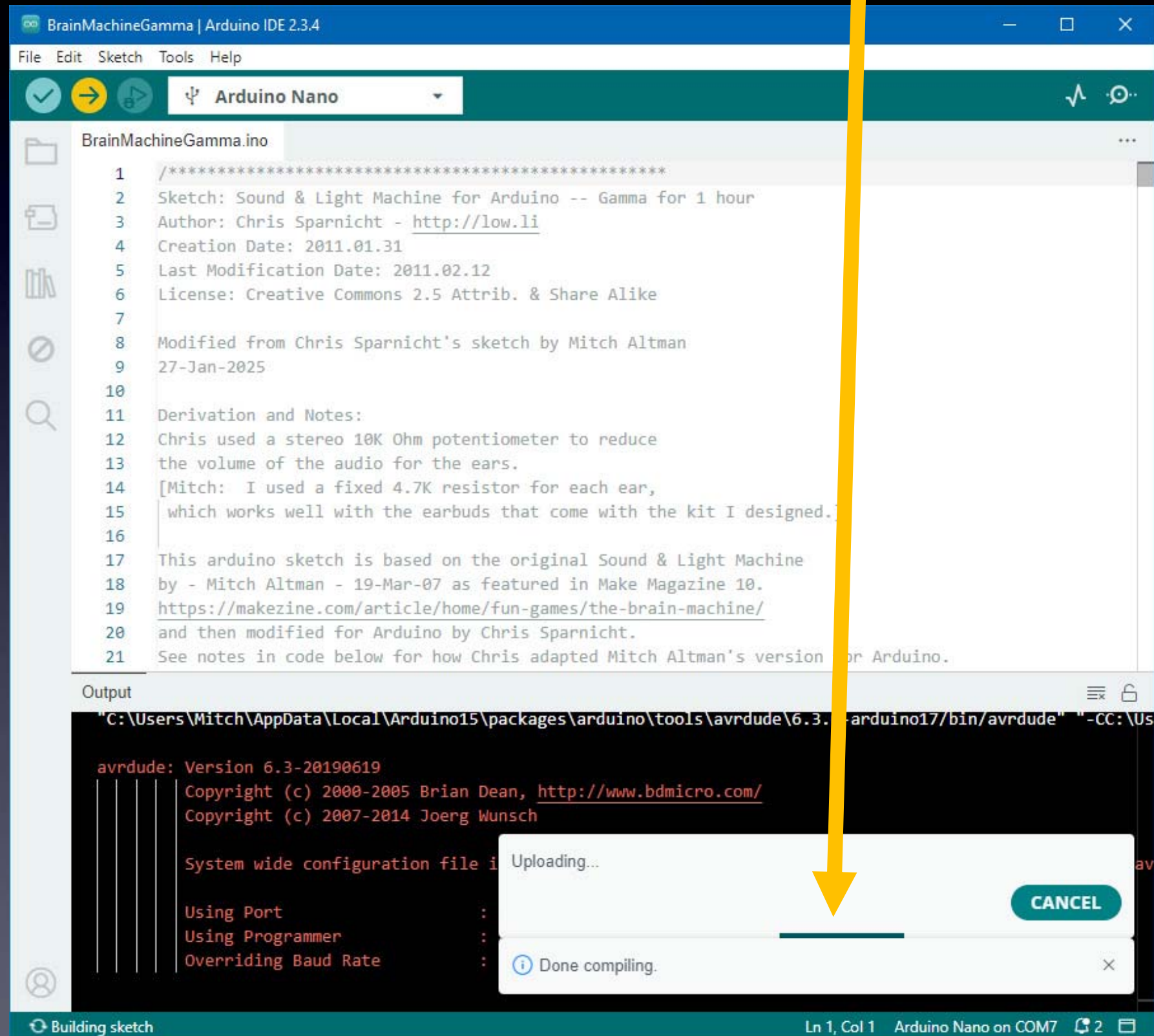


The screenshot shows the Arduino IDE 2.3.4 interface. The title bar reads 'BrainMachineGamma | Arduino IDE 2.3.4'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. The toolbar contains several icons, including a yellow 'Upload' button (a right-pointing arrow) which is highlighted by a yellow arrow from the text above. To the right of the toolbar, a dropdown menu shows 'Arduino Nano' and an 'Upload' button. The main editor area displays the code for 'BrainMachineGamma.ino'. The code includes a multi-line comment with metadata and a derivation/notes section. The status bar at the bottom indicates 'Ln 1, Col 1' and 'Arduino Nano on COM7'.

```
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  
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11  Derivation and Notes:  
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27  https://docs.arduino.cc/learn/electronics/low-power/  
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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
```


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

Assembly Instructions & Programming Instructions



open source
hardware



CC BY-SA 4.0 © 2025 Mitch Altman



CORNFIELD electronics