21-Apr-2025

Brain Machine kit

Assembly Instructions

& Programming Instructions

open source hardware

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

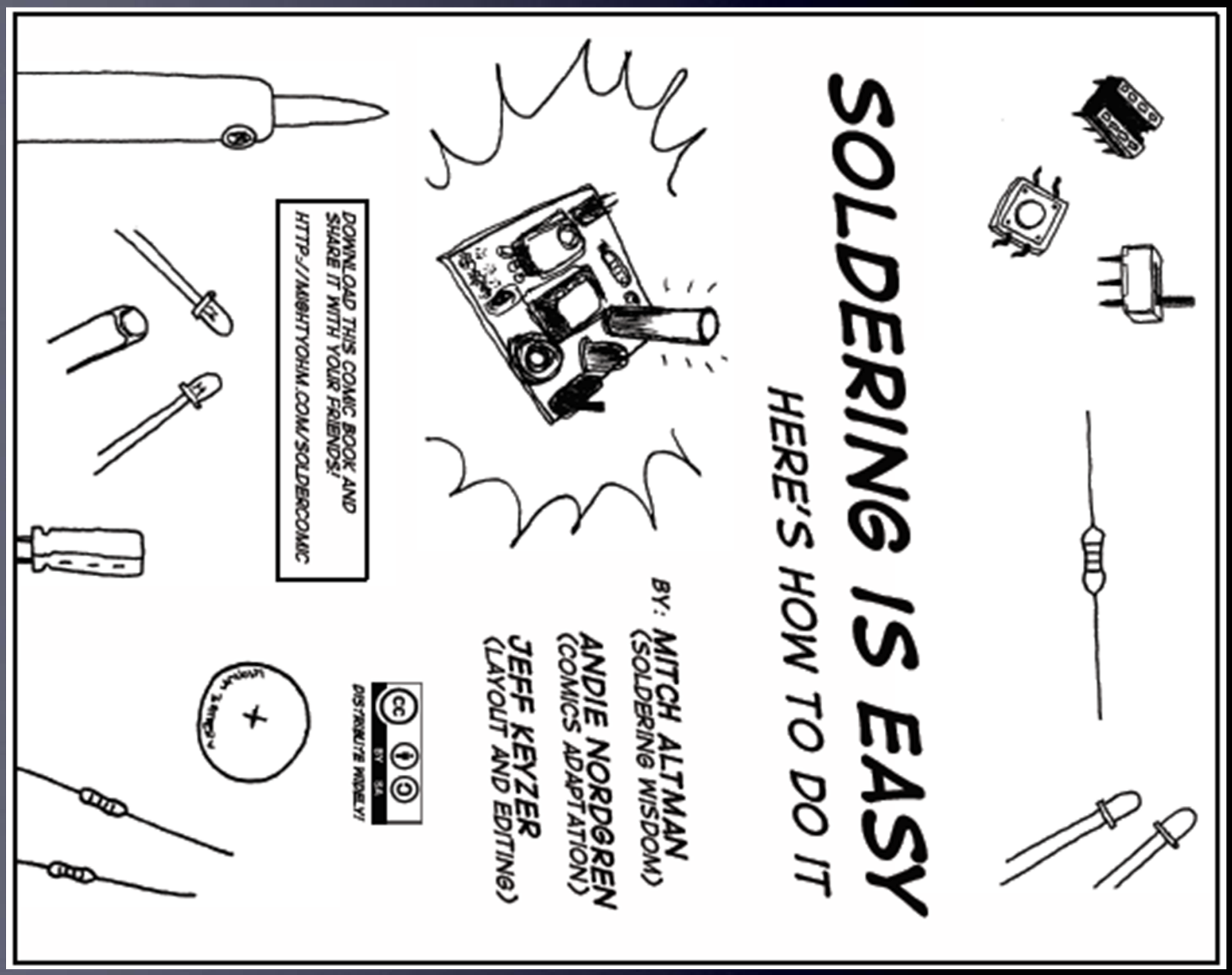
The following photos will
show you how to solder.

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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(In many different languages.)

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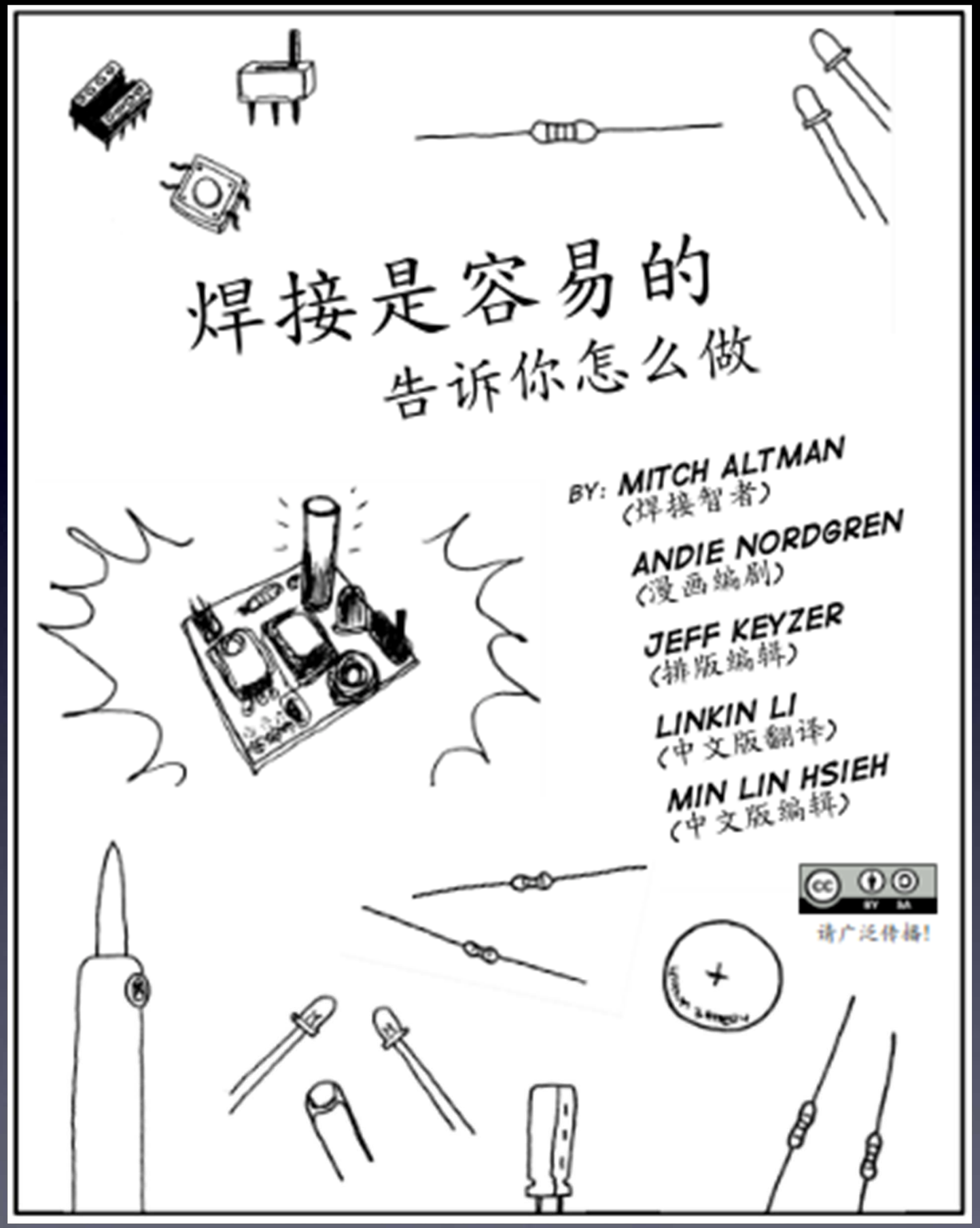

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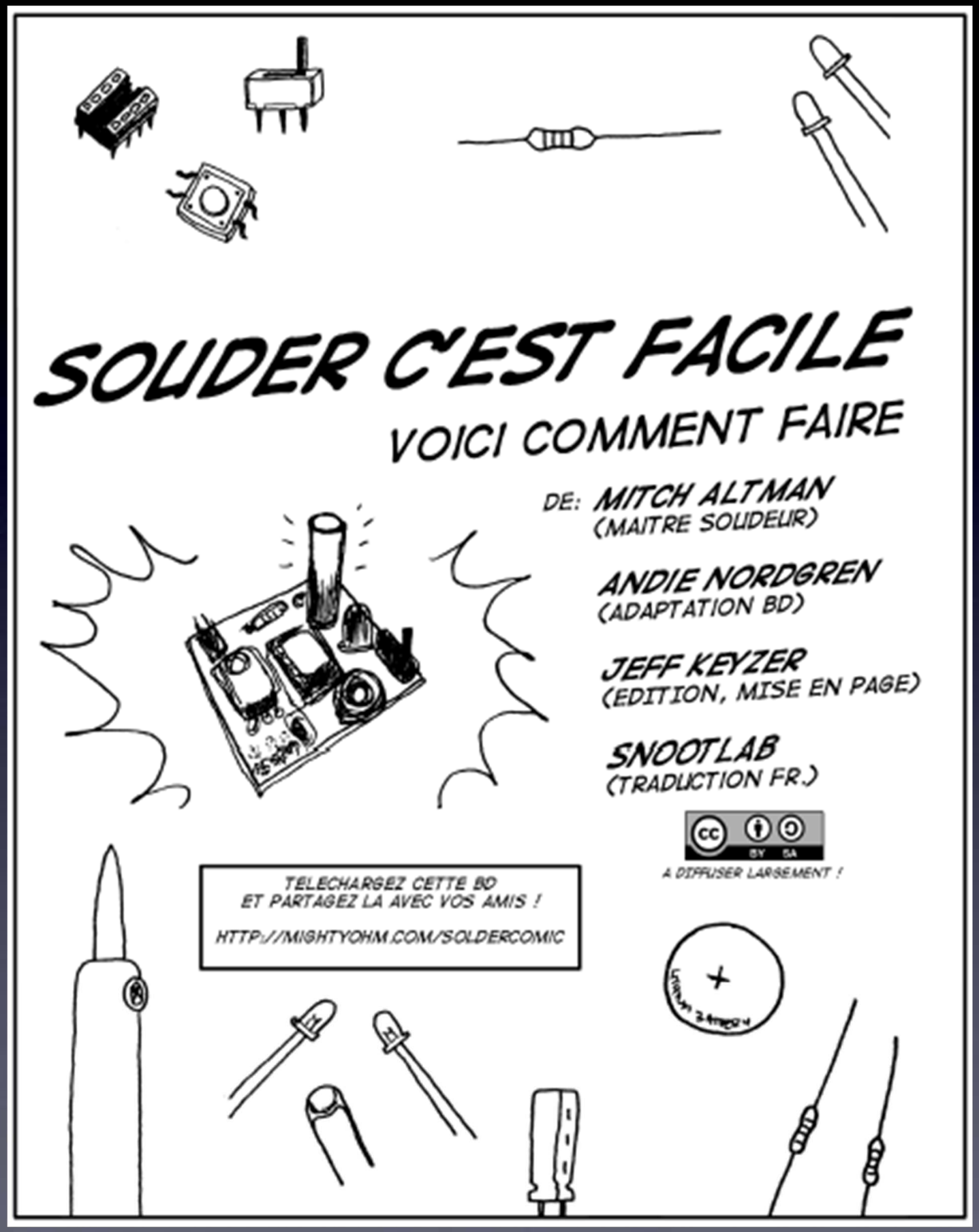

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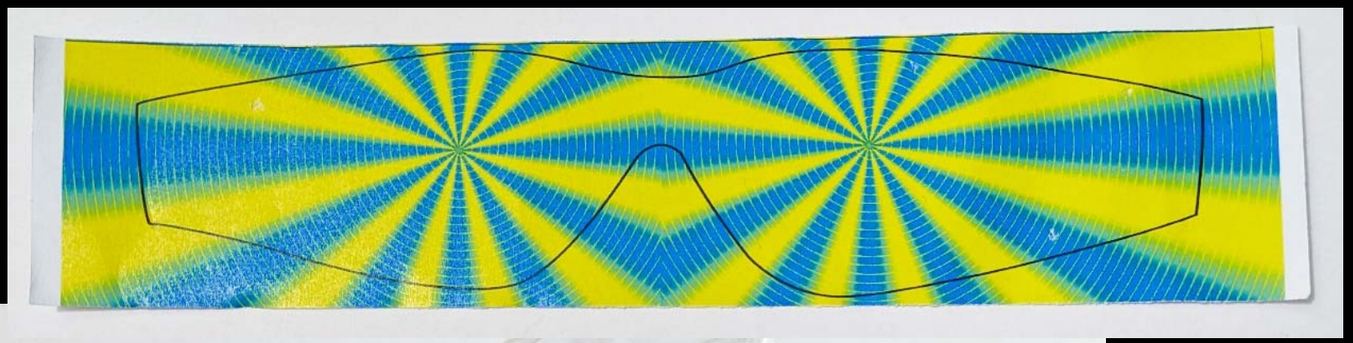
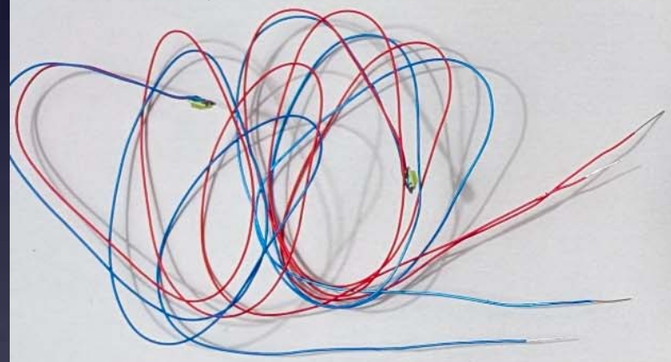
Trippy Graphix



Earbuds

Glasses

LED1, LED2



Arduino Nano

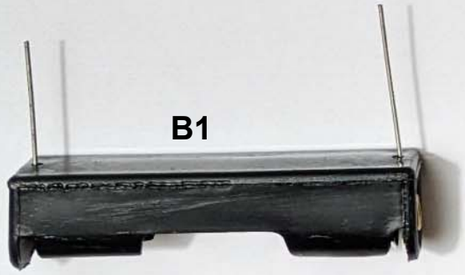
Power Supply

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

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

J1

C1, C2



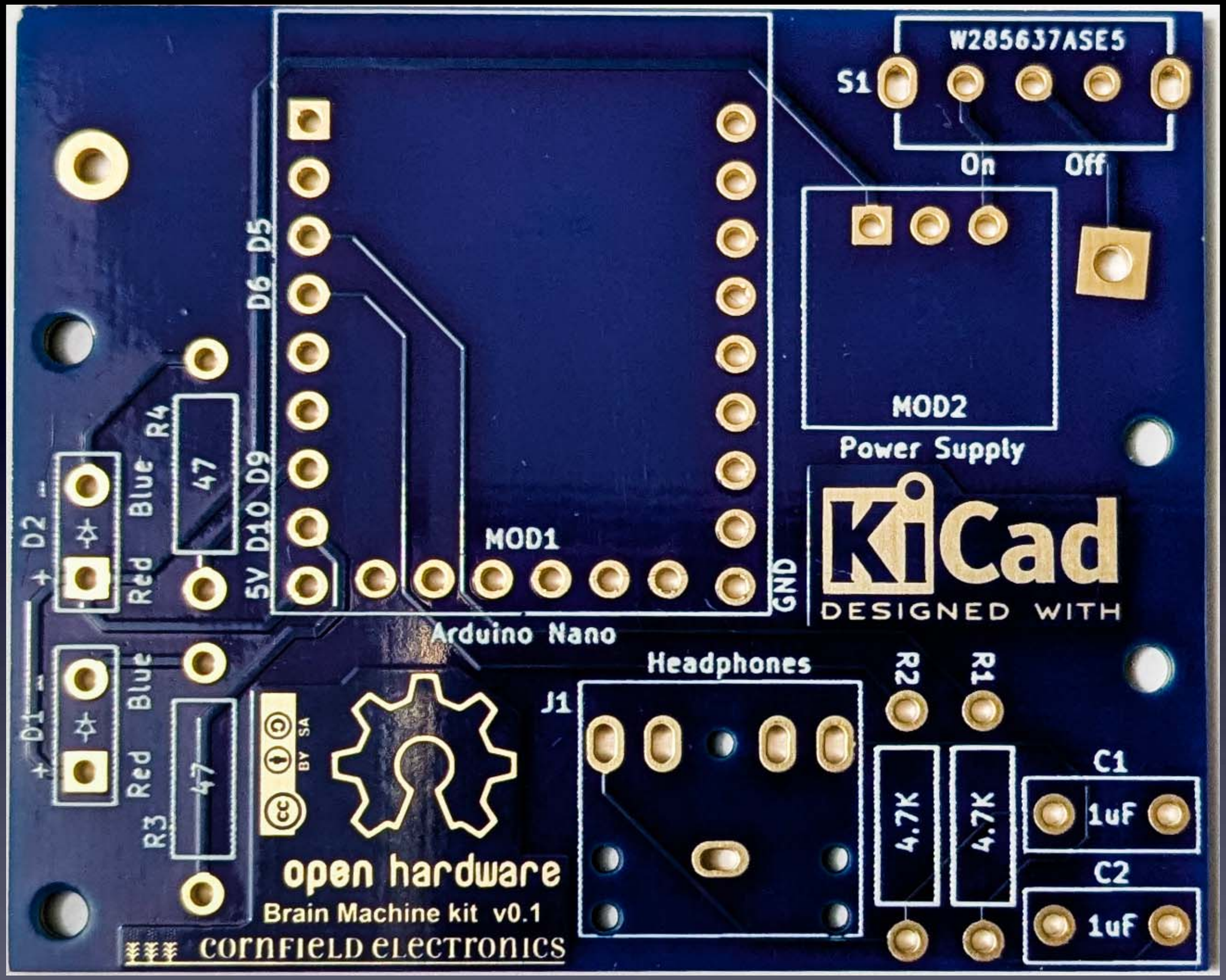
B1

S1

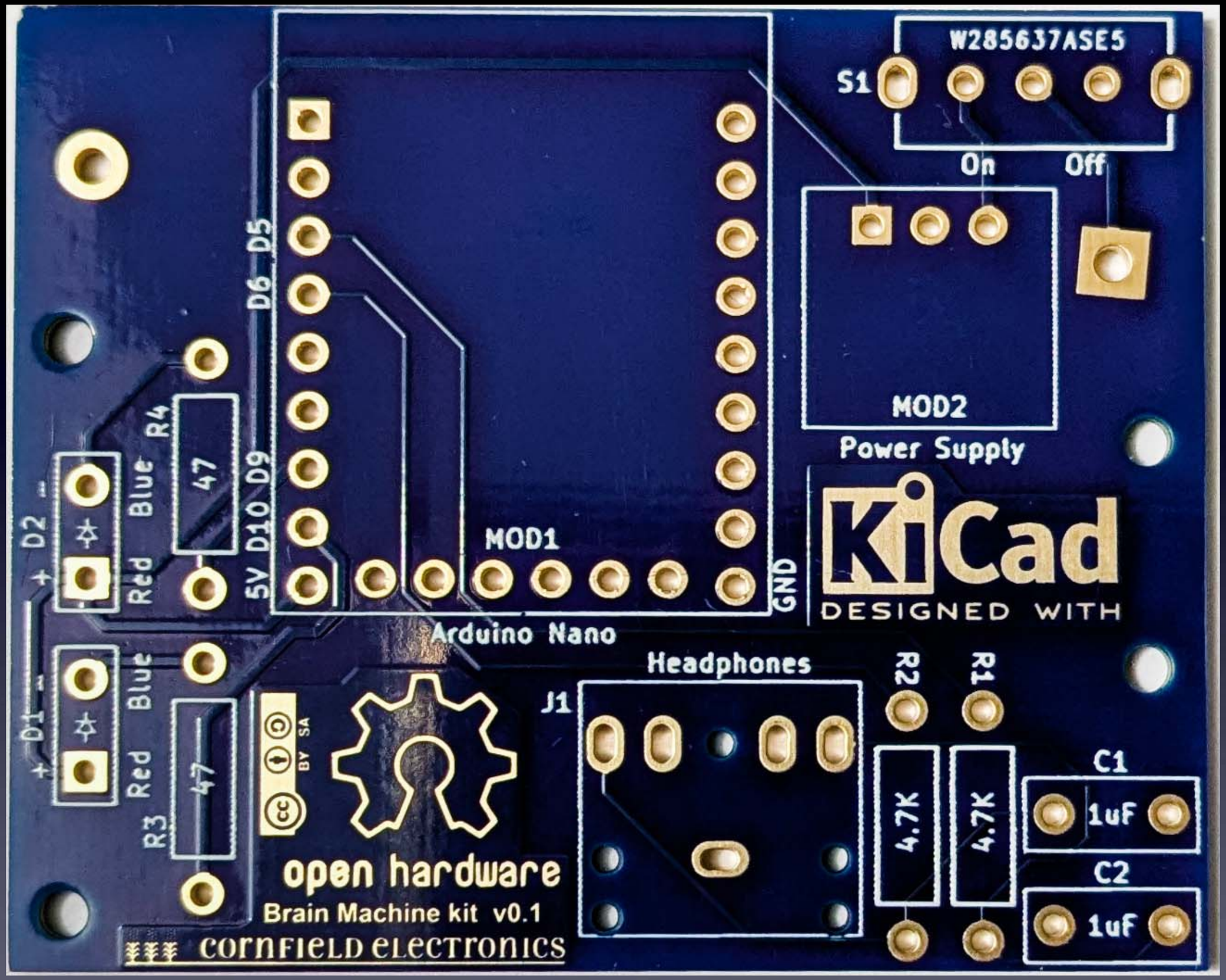
Header pins

Zip ties

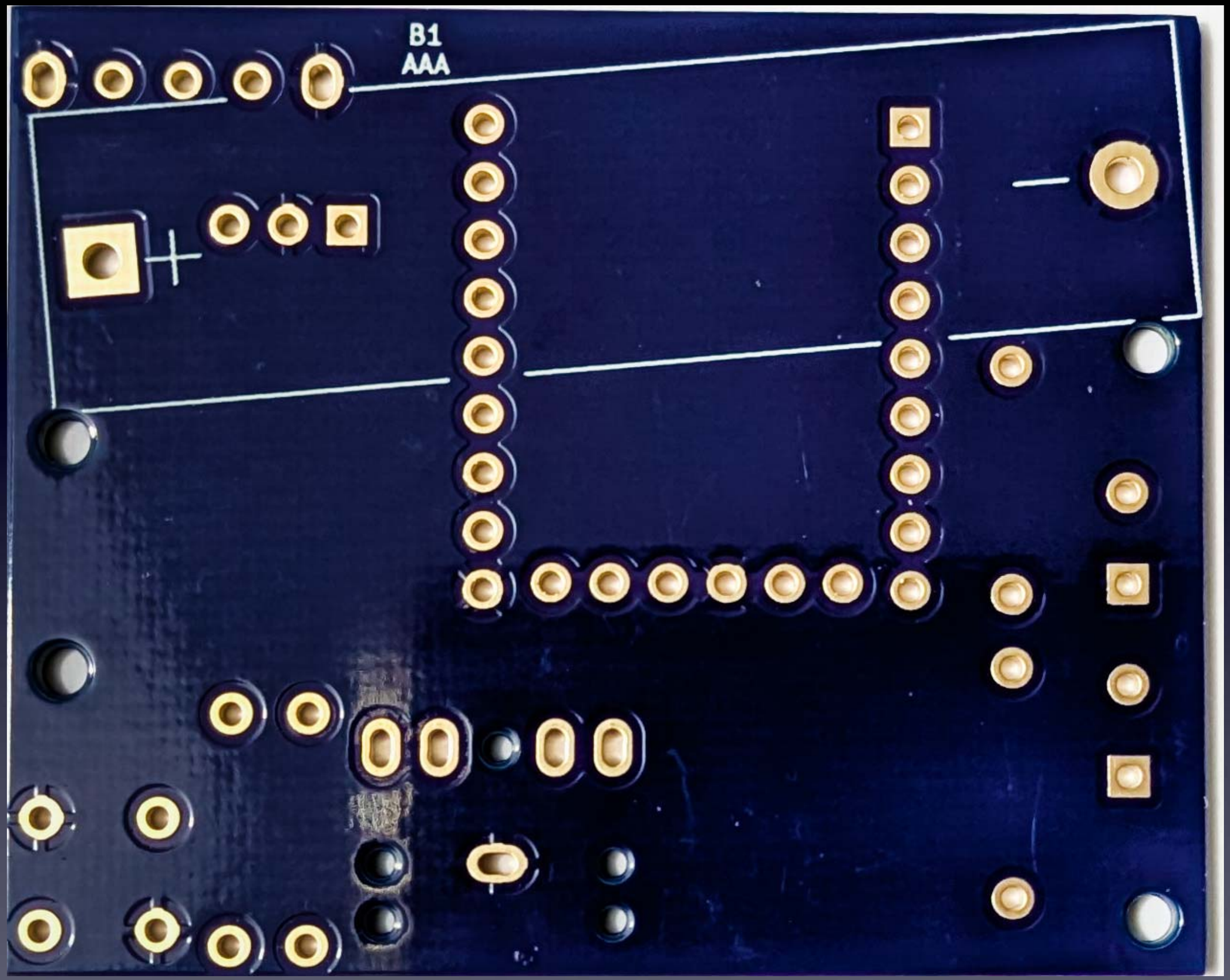
All of the parts



The board we'll solder the parts to



Front/Top of board



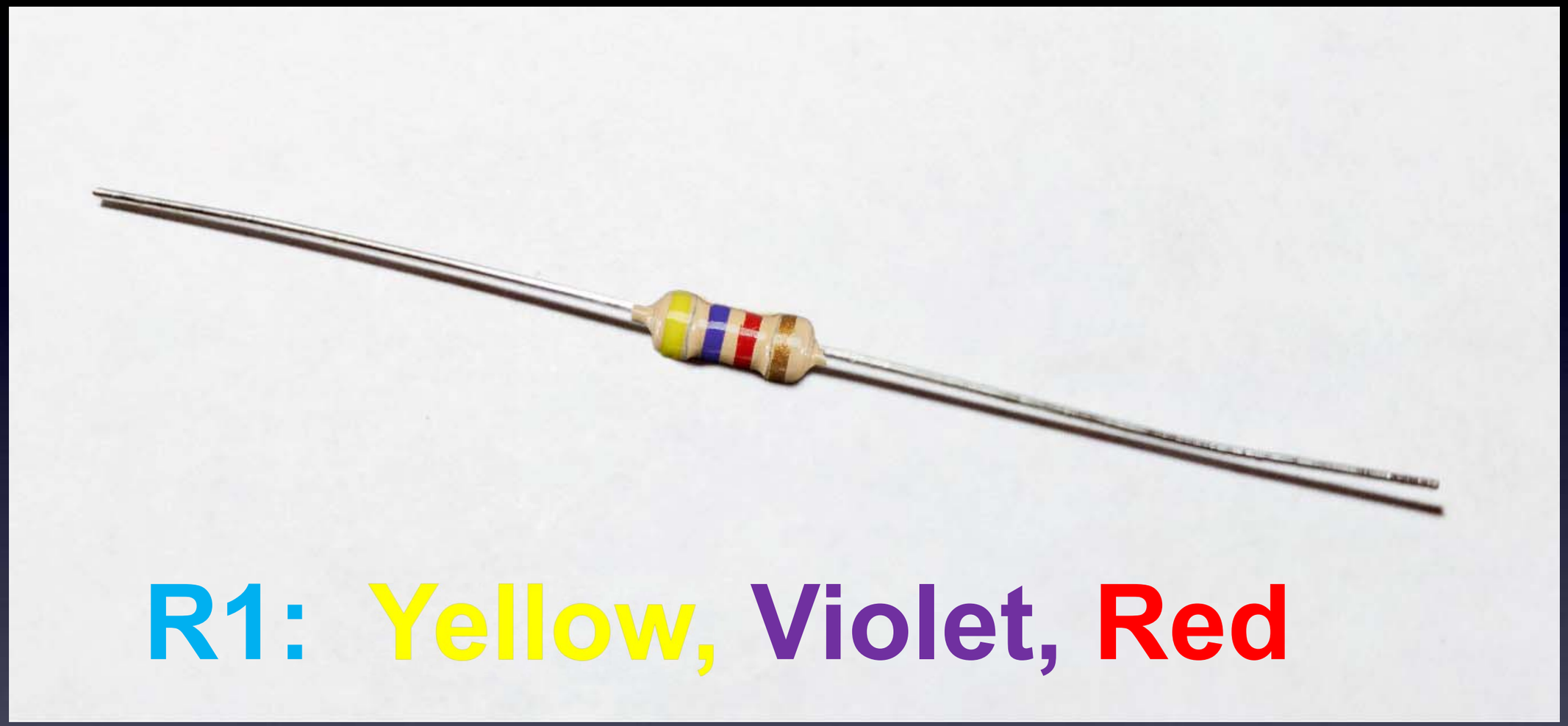
Back/Bottom of board

Note:
If you 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

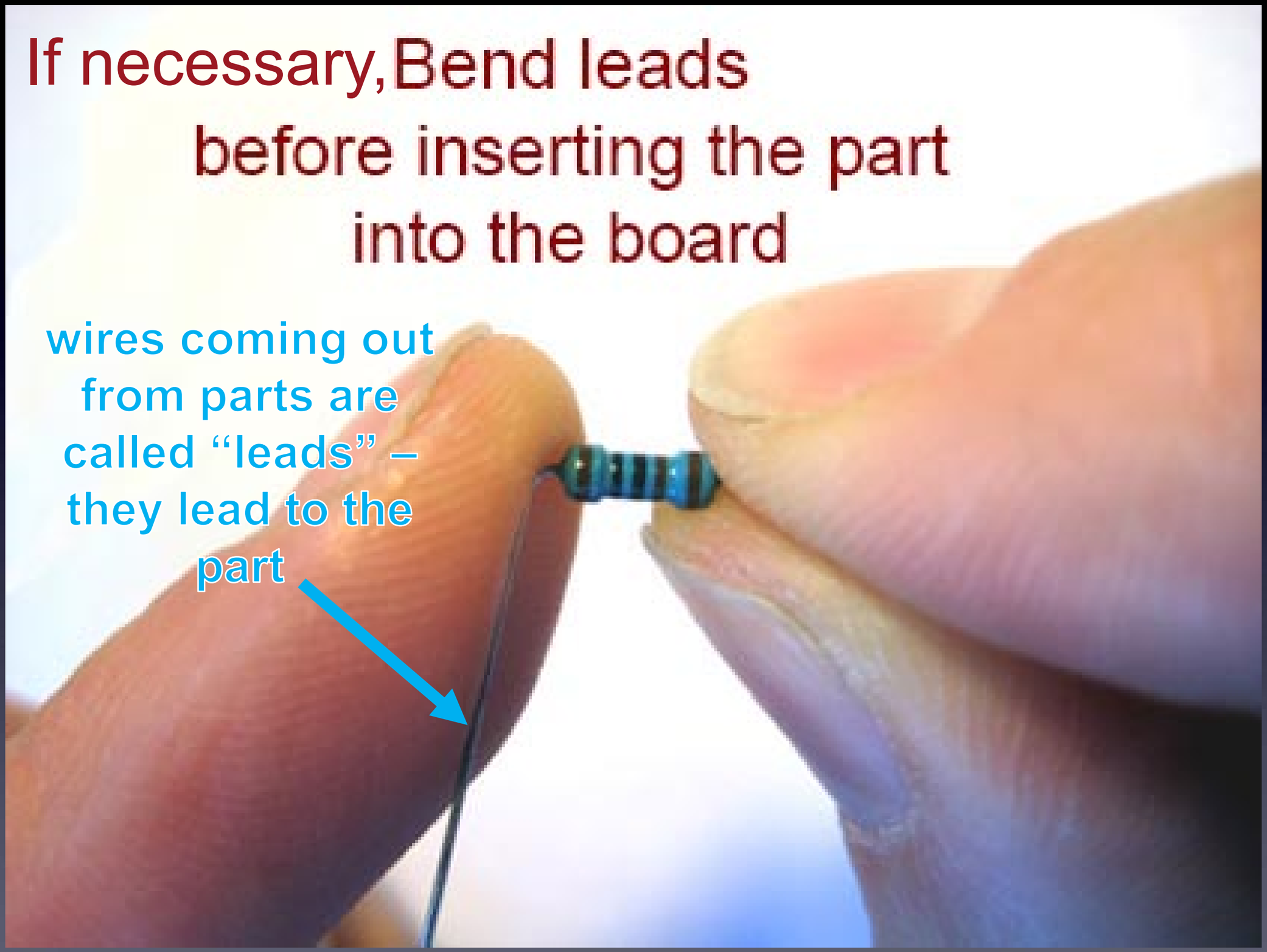
Our first part



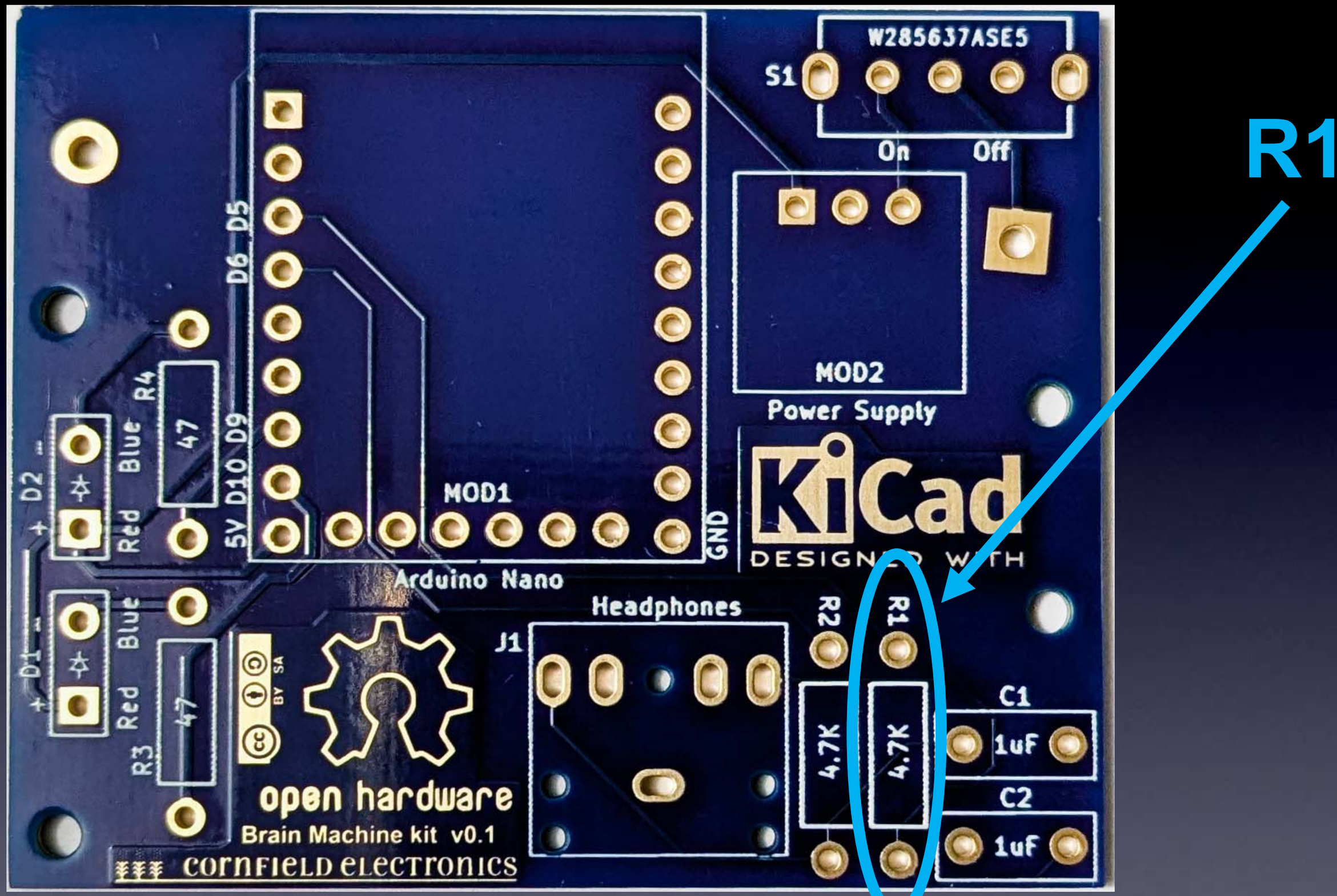
R1: Yellow, Violet, Red

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

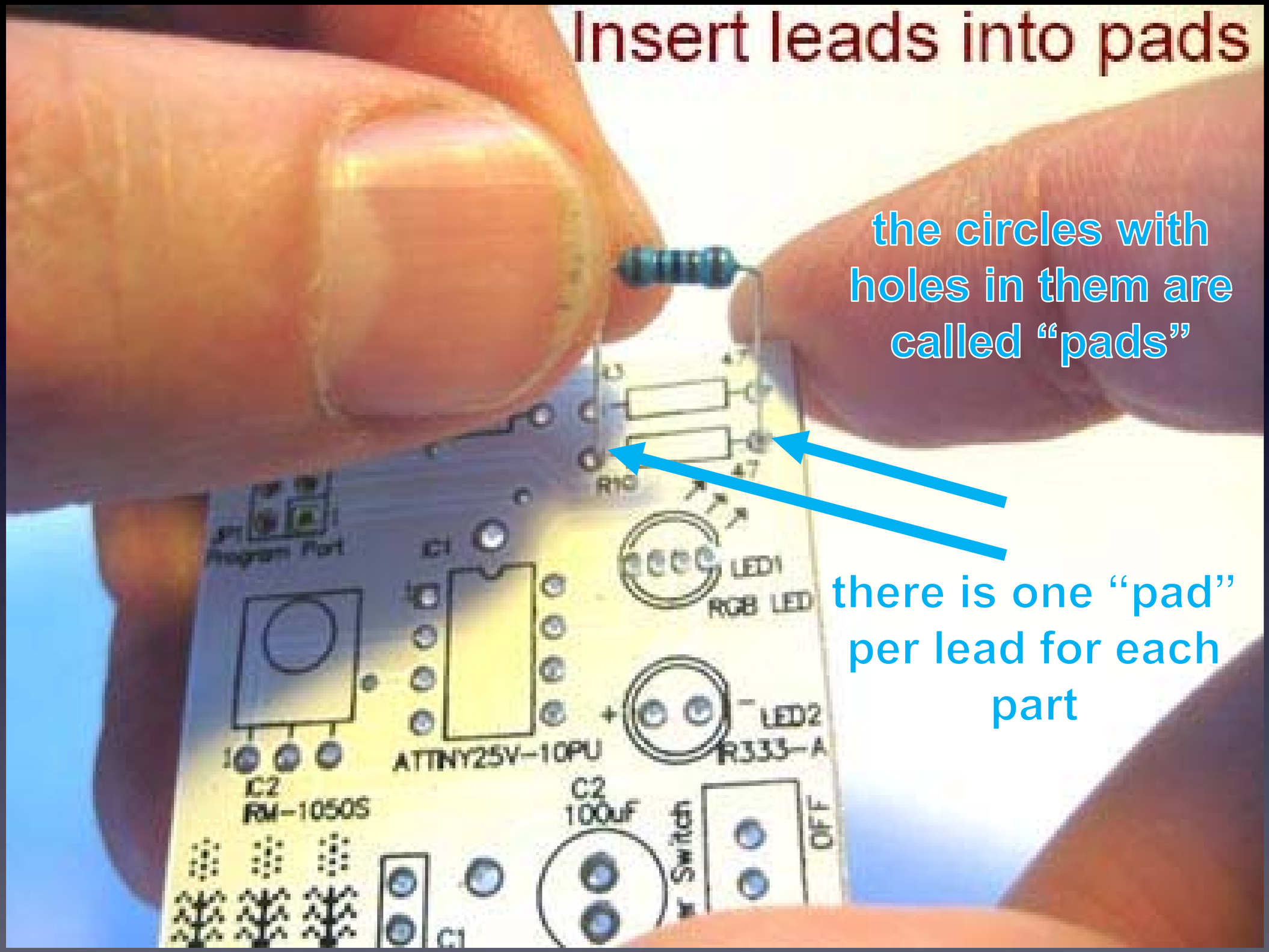
Some parts, such as resistors, need their leads bent first

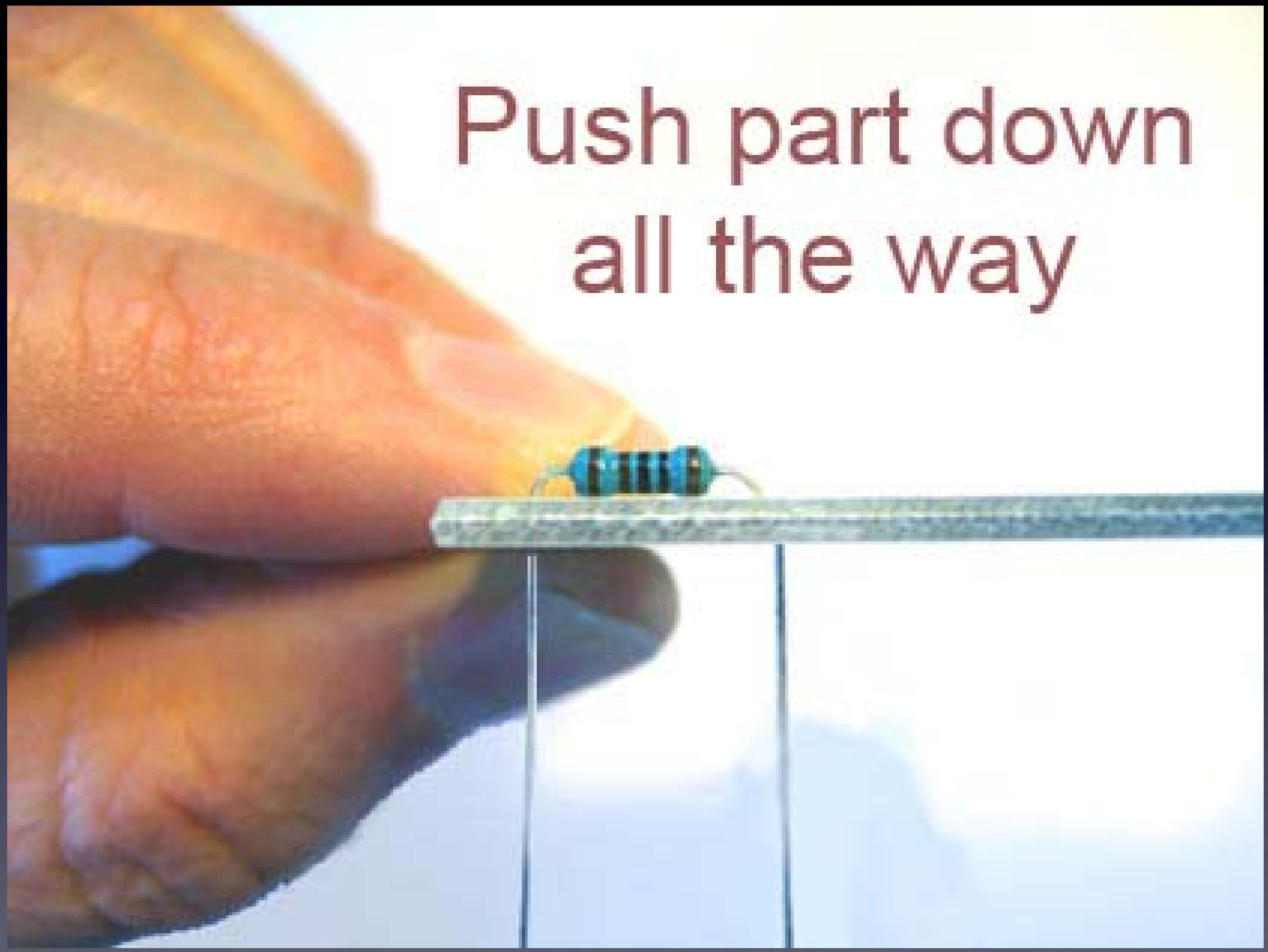


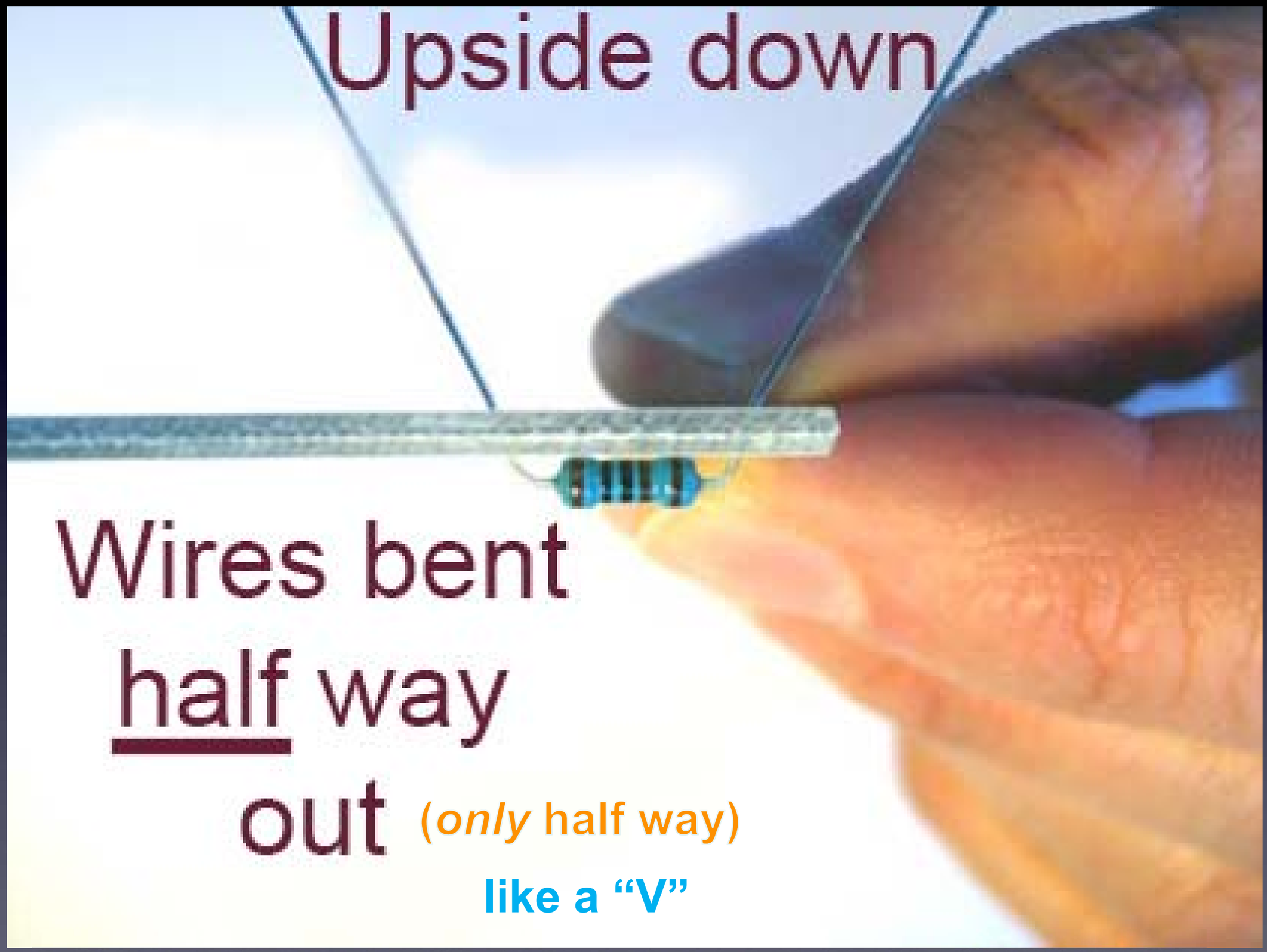
R1 – this is how it will look *before* inserting it into the board



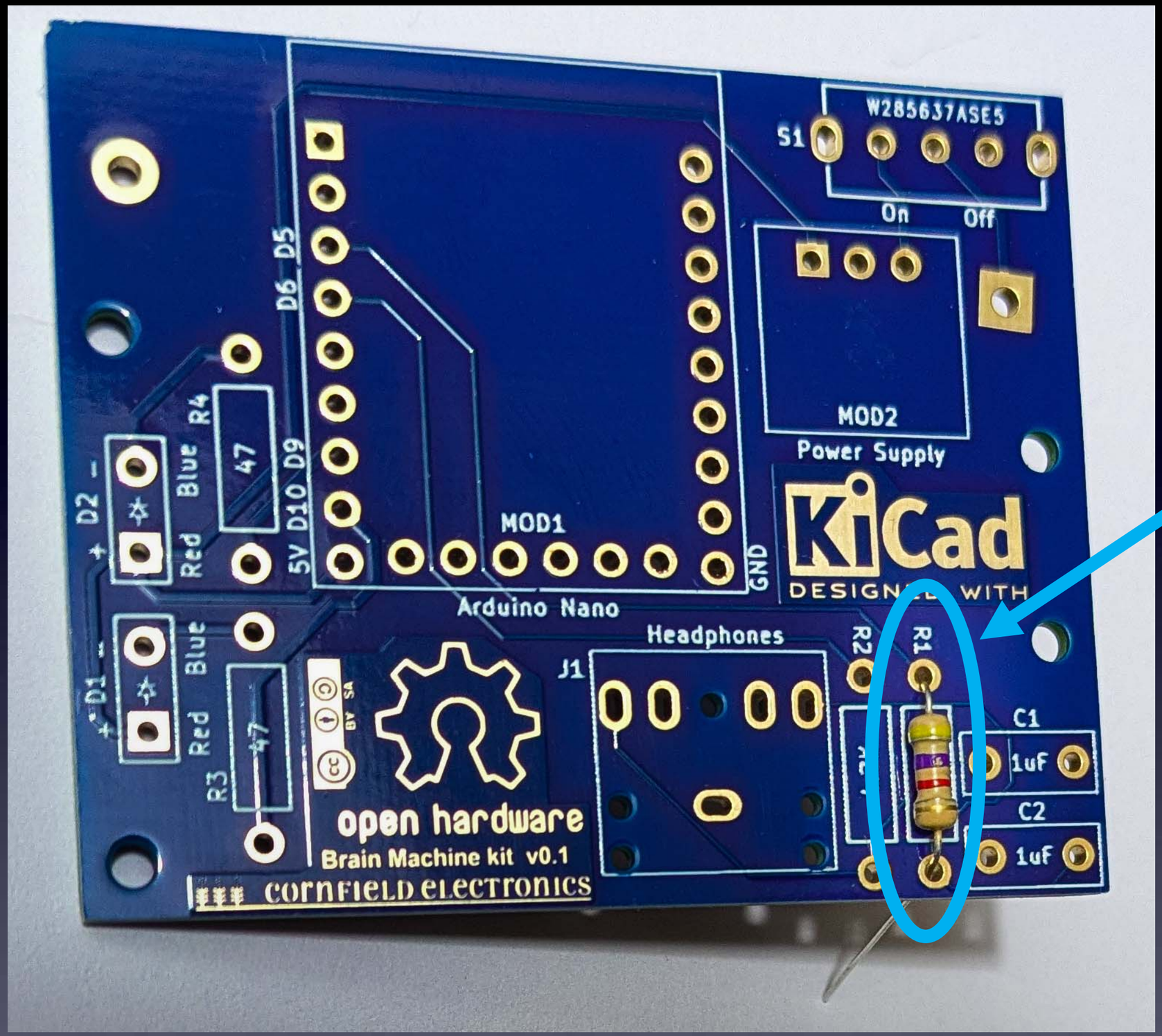
R1 – this is where it goes


Insert leads into pads
the circles with holes in them are called “pads”
there is one “pad” per lead for each part
R10
47
LED1
RGB LED
IC1
ATTINY25V-10PU
LED2
R333-A
IC2
RM-1050S
C2
100uF
C1
OFF


Push part down
all the way



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)

(60/40 is also good)

63/37 rosin core,

0.031” (0.8mm) diameter (or smaller)

<u>Note</u>:

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
(<u>not</u> "No Clean")
0.031" diameter (0.8mm)

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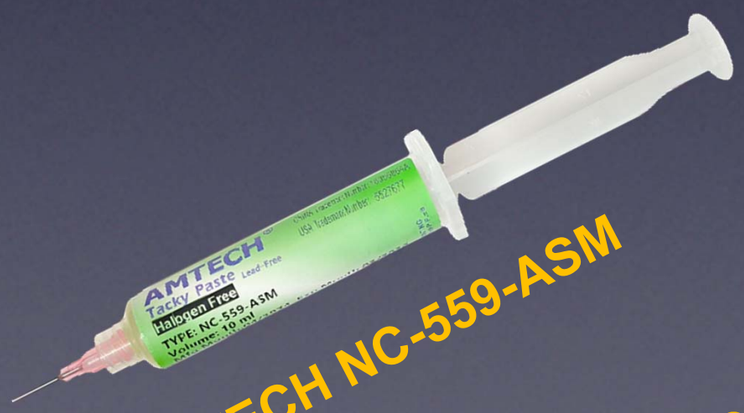


AMTECH NC-559-ASM

99%

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)

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)

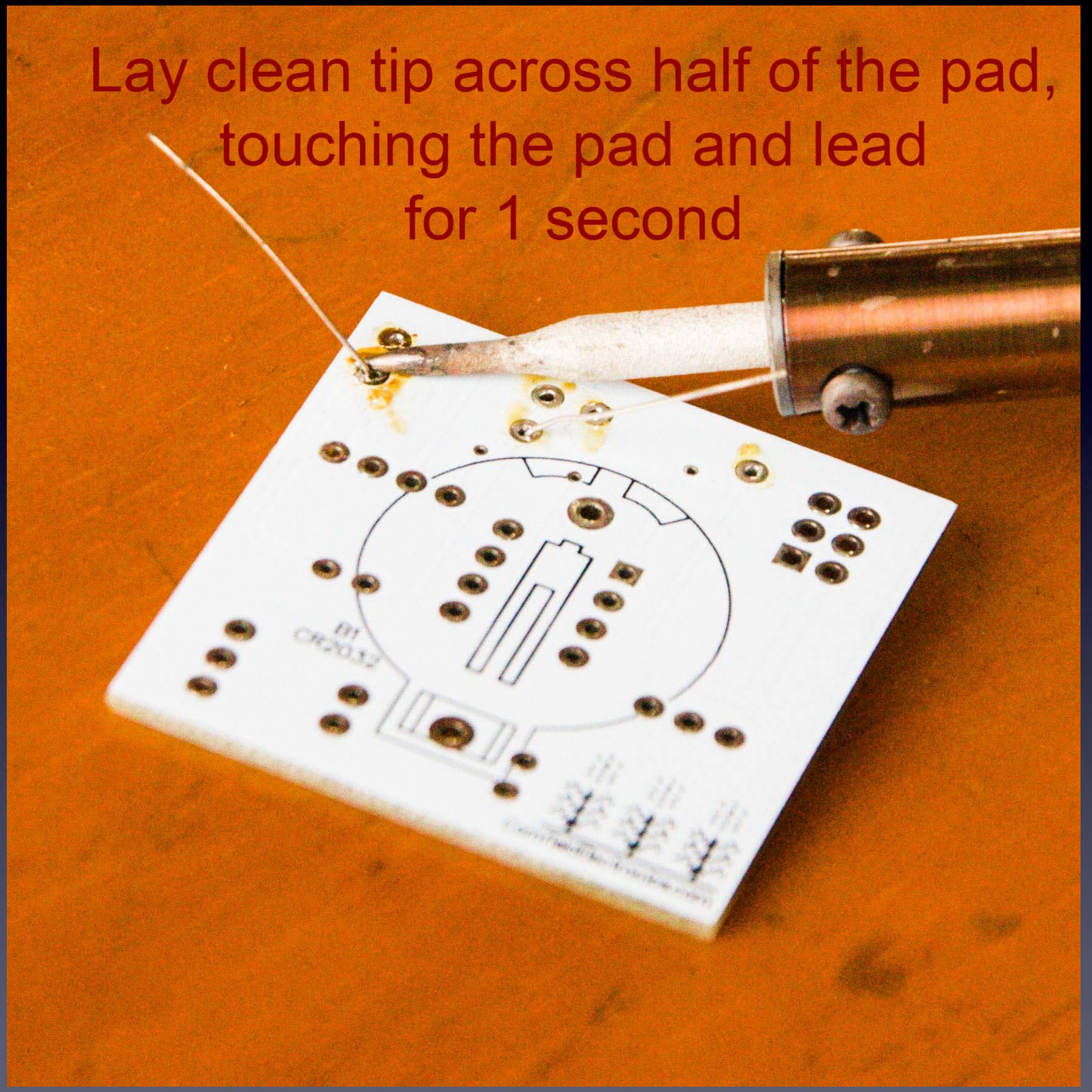
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

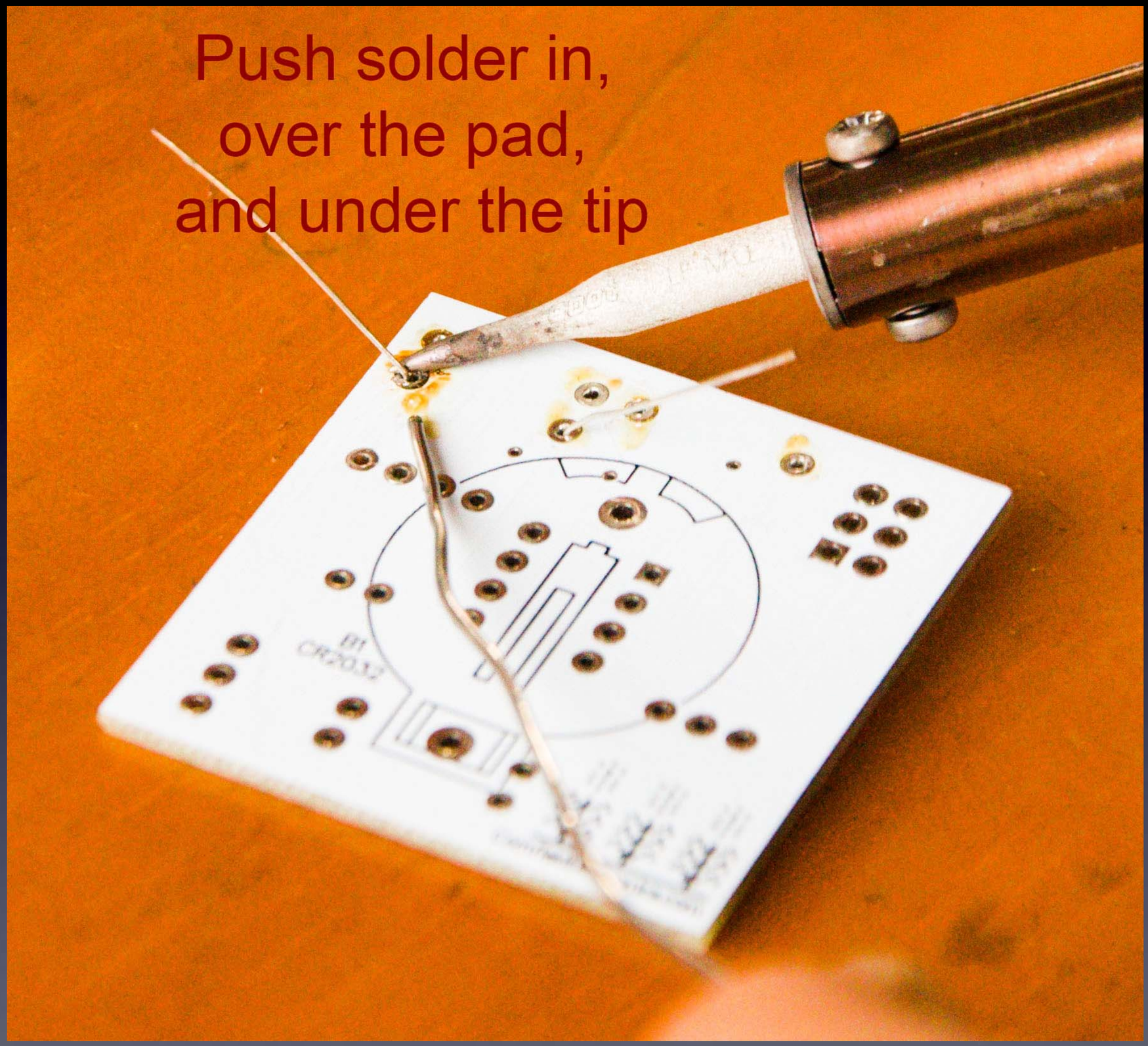
<u>Keep the tip shiny silver!</u>

knock solder off the tip

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

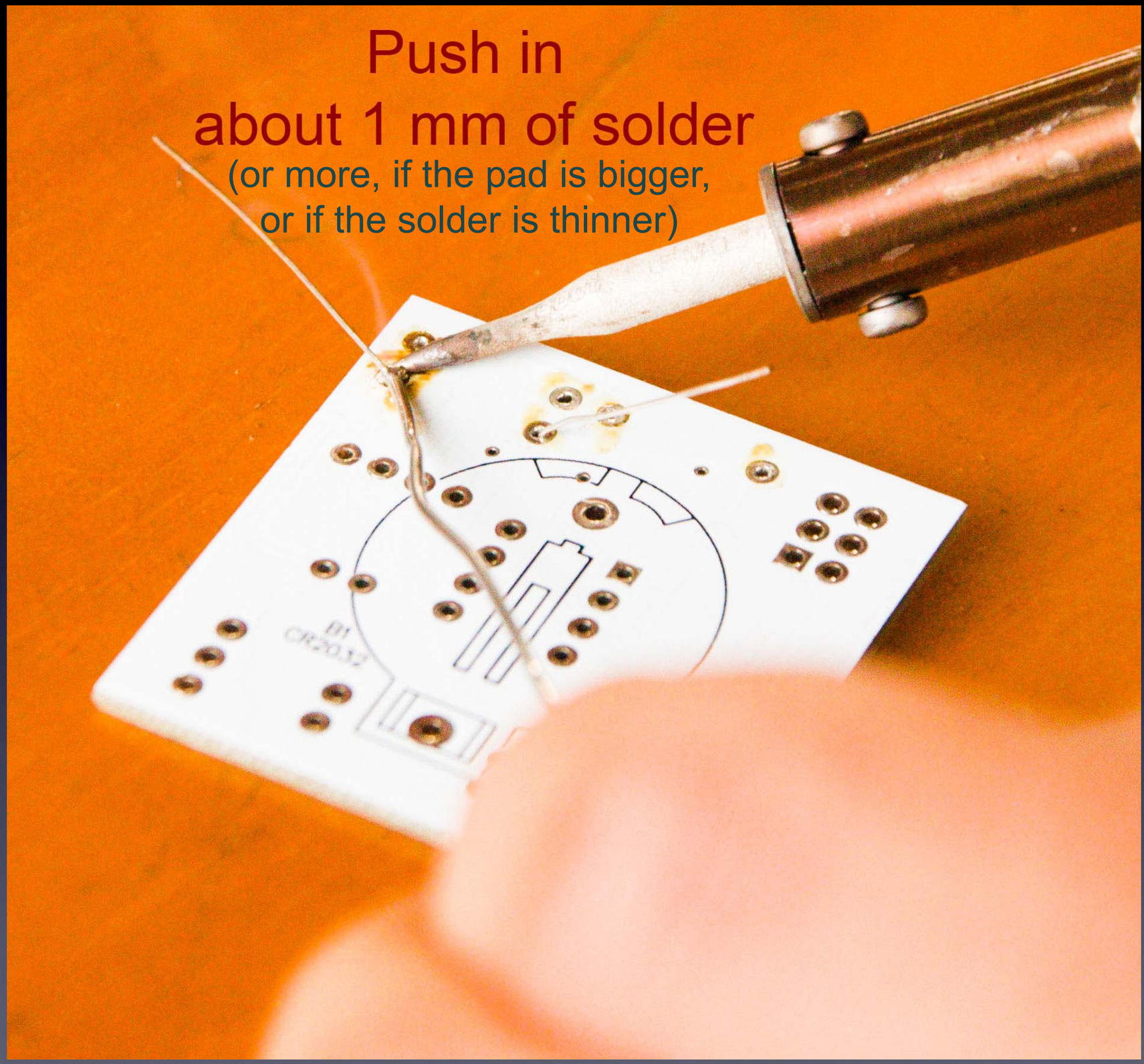


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second



Make sure solder melts on the <u>underside</u> 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



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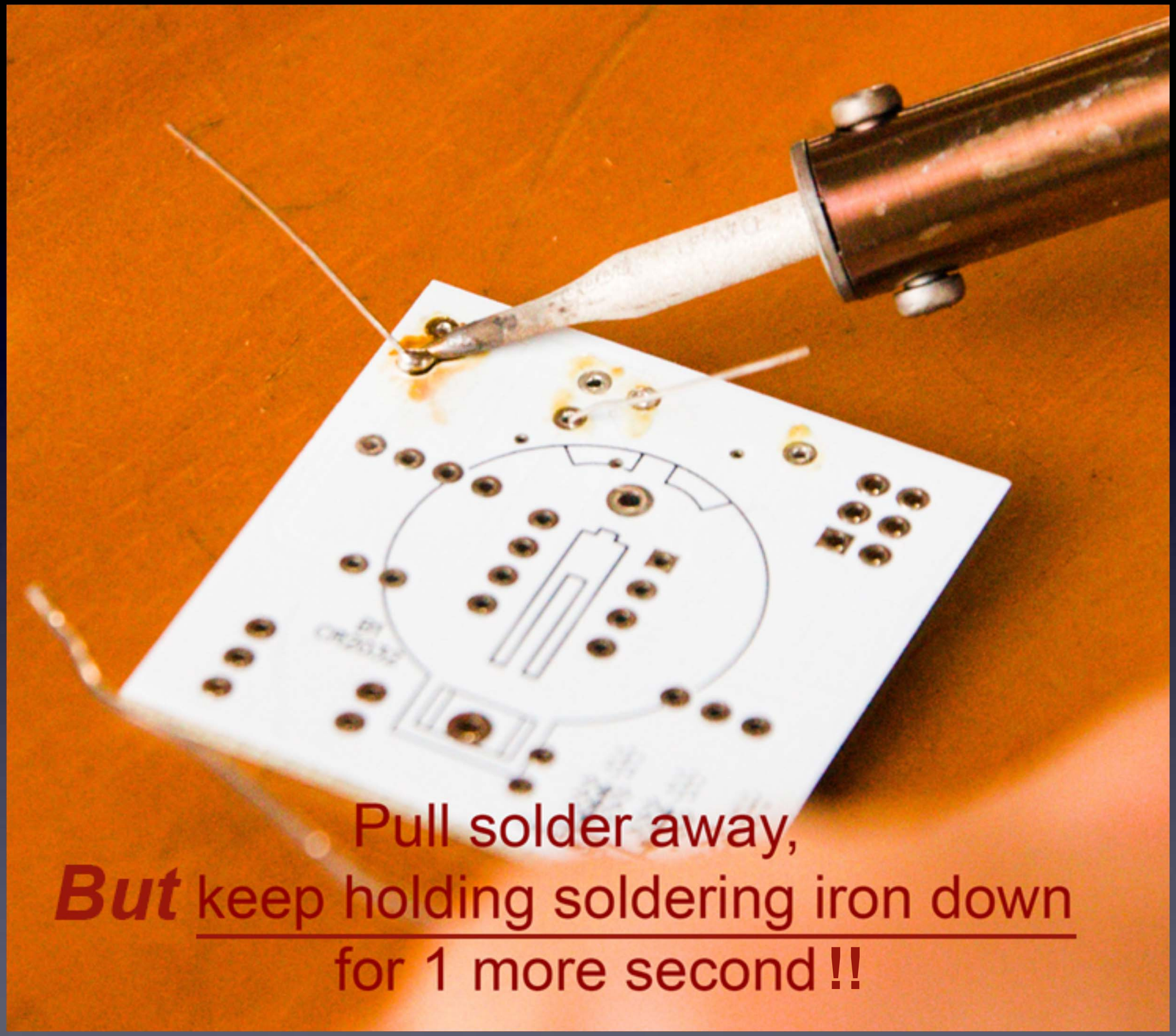
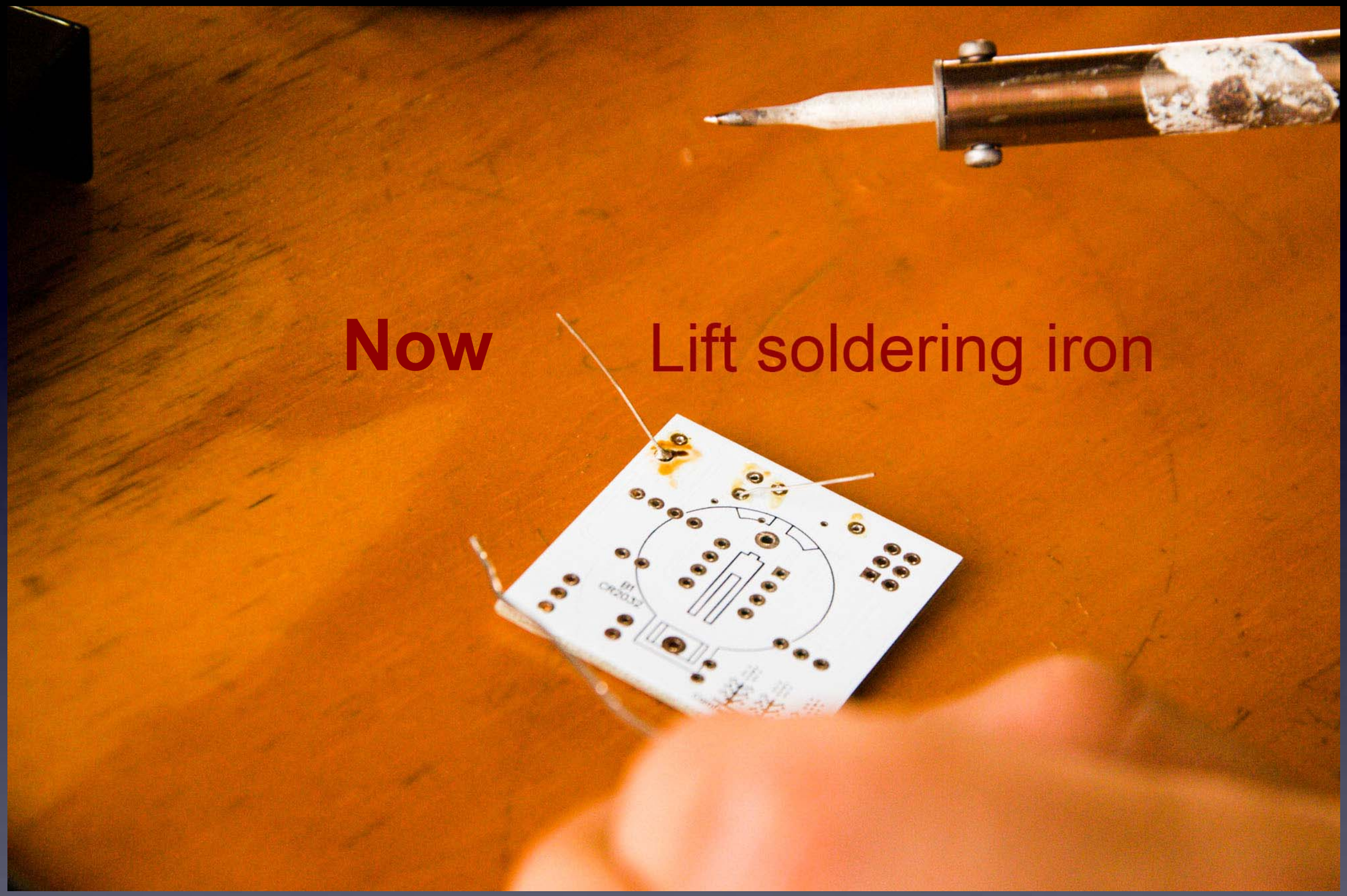
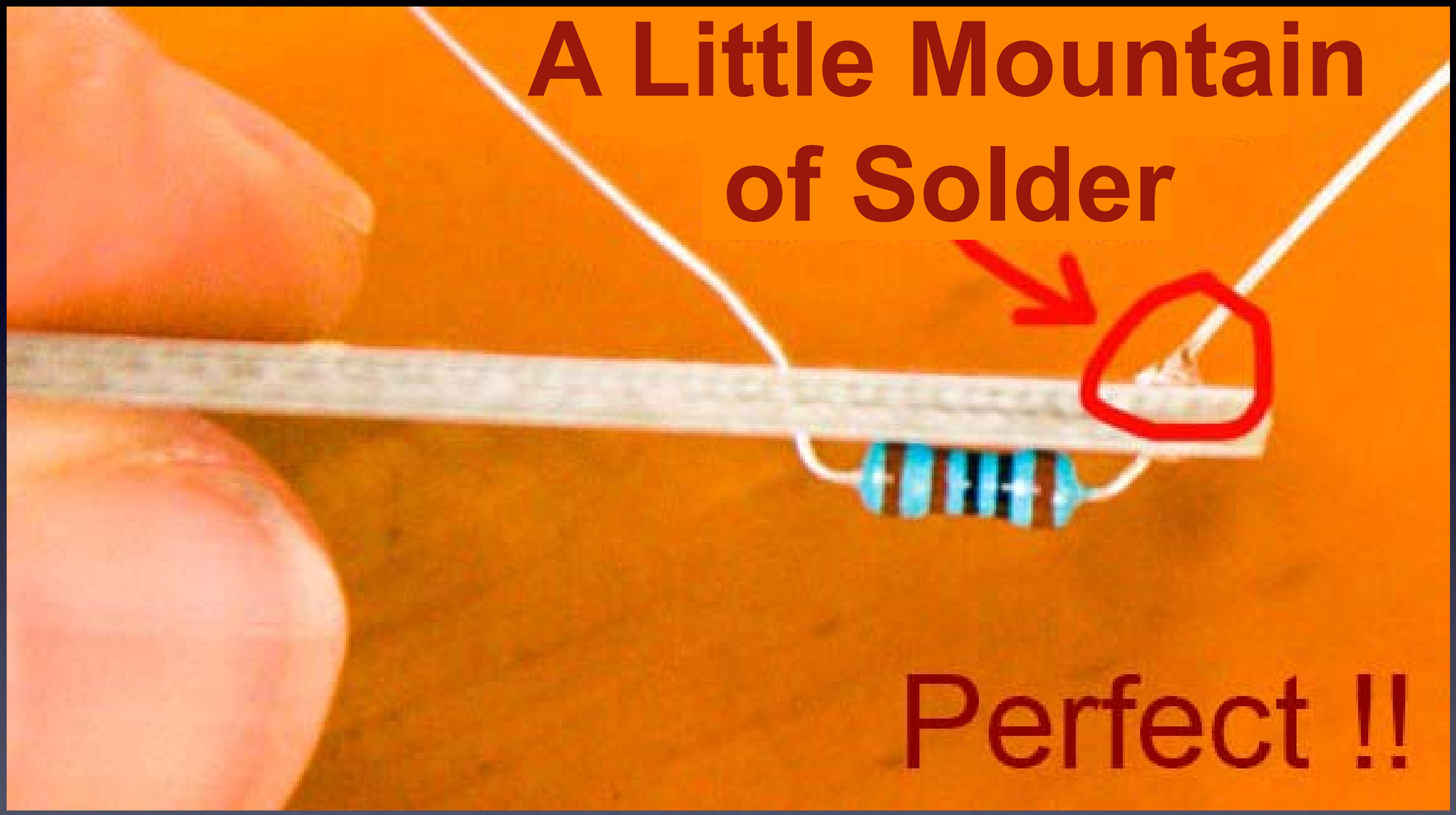

Pull solder away,
But keep holding soldering iron down
for 1 more second !!

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 !

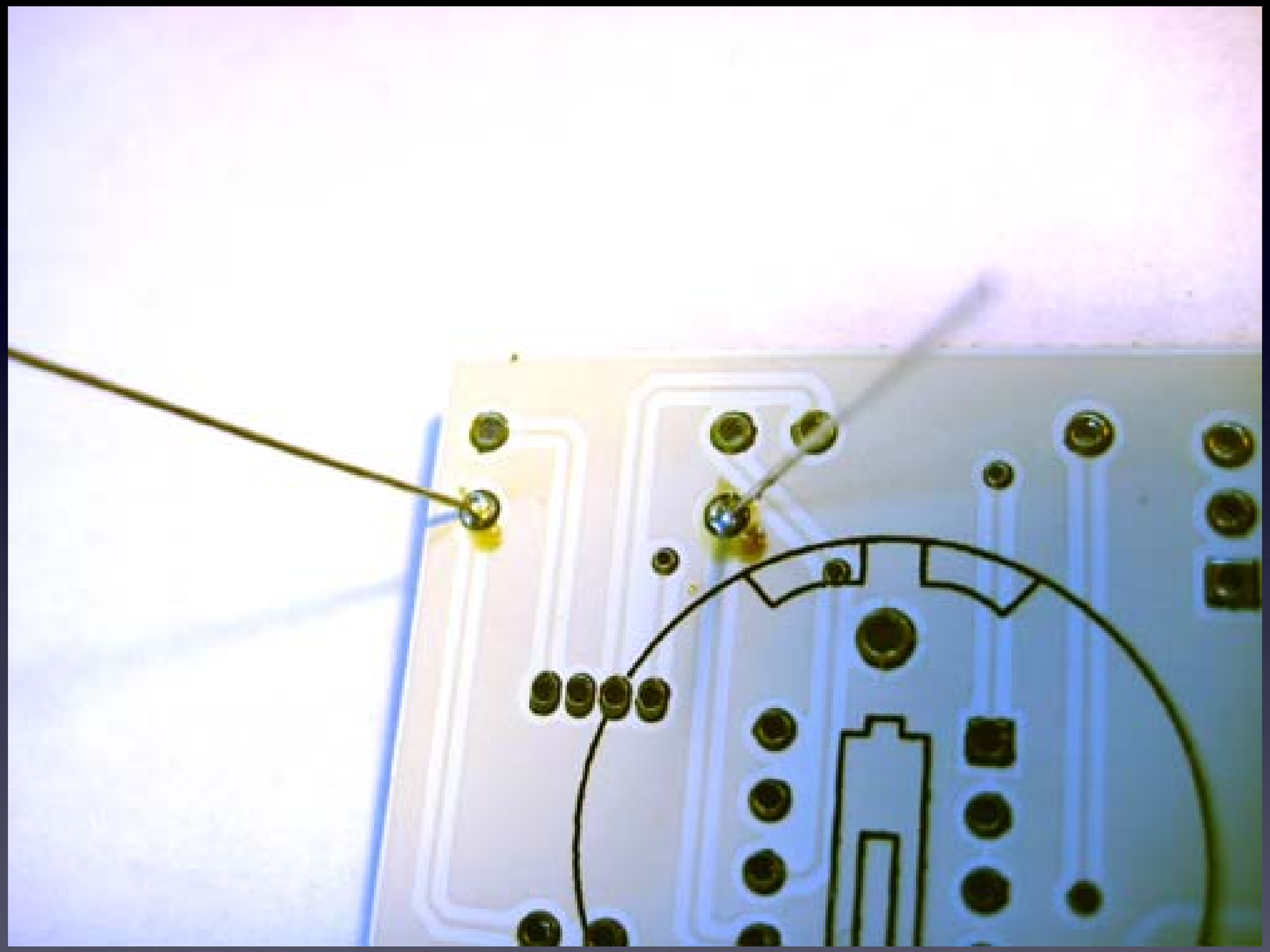
The Rhythm !

and speed (about 1 second per step)

Lift Tip

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

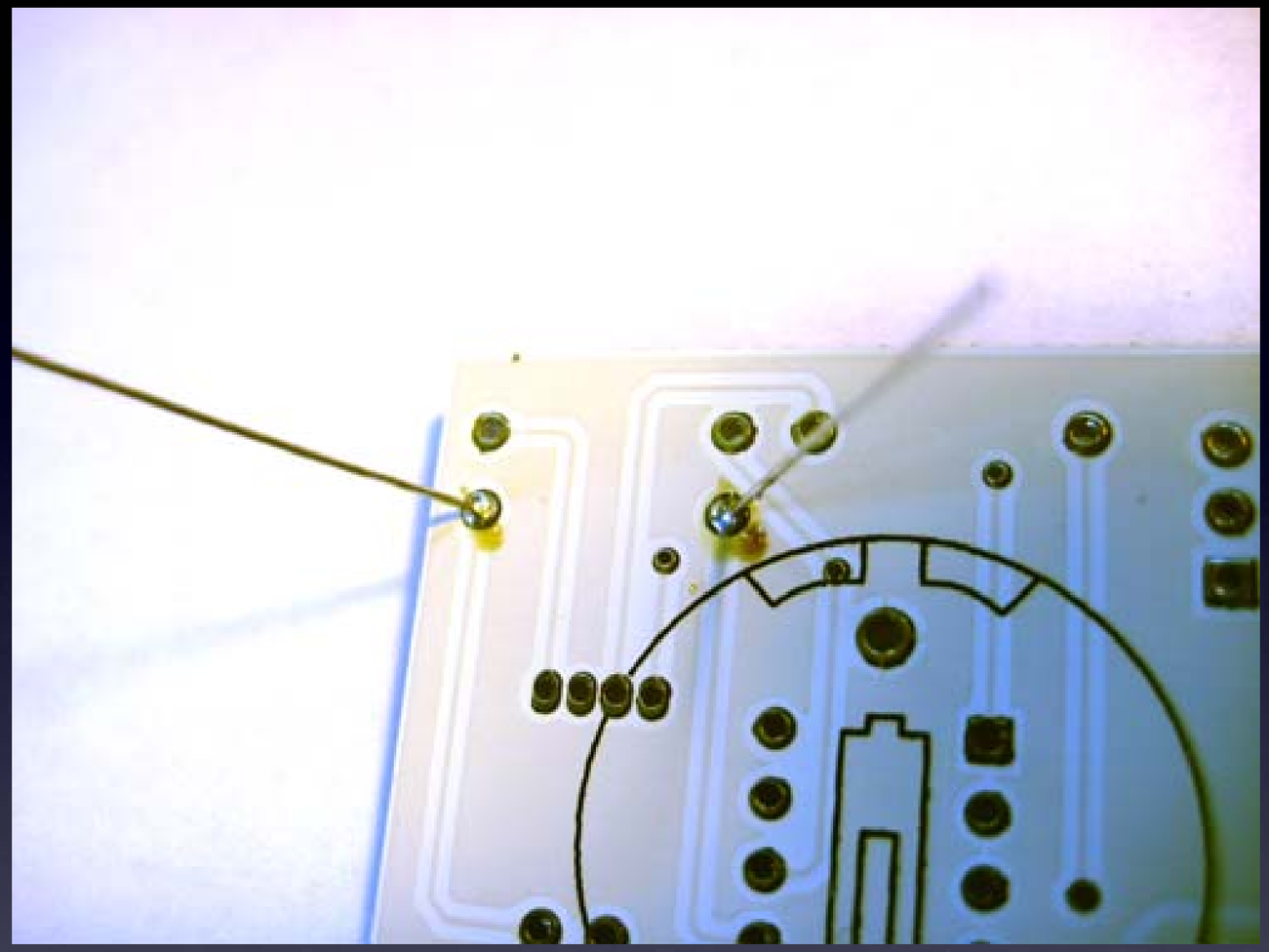
Solder all of the leads of the part to the board



For this part, there are two leads

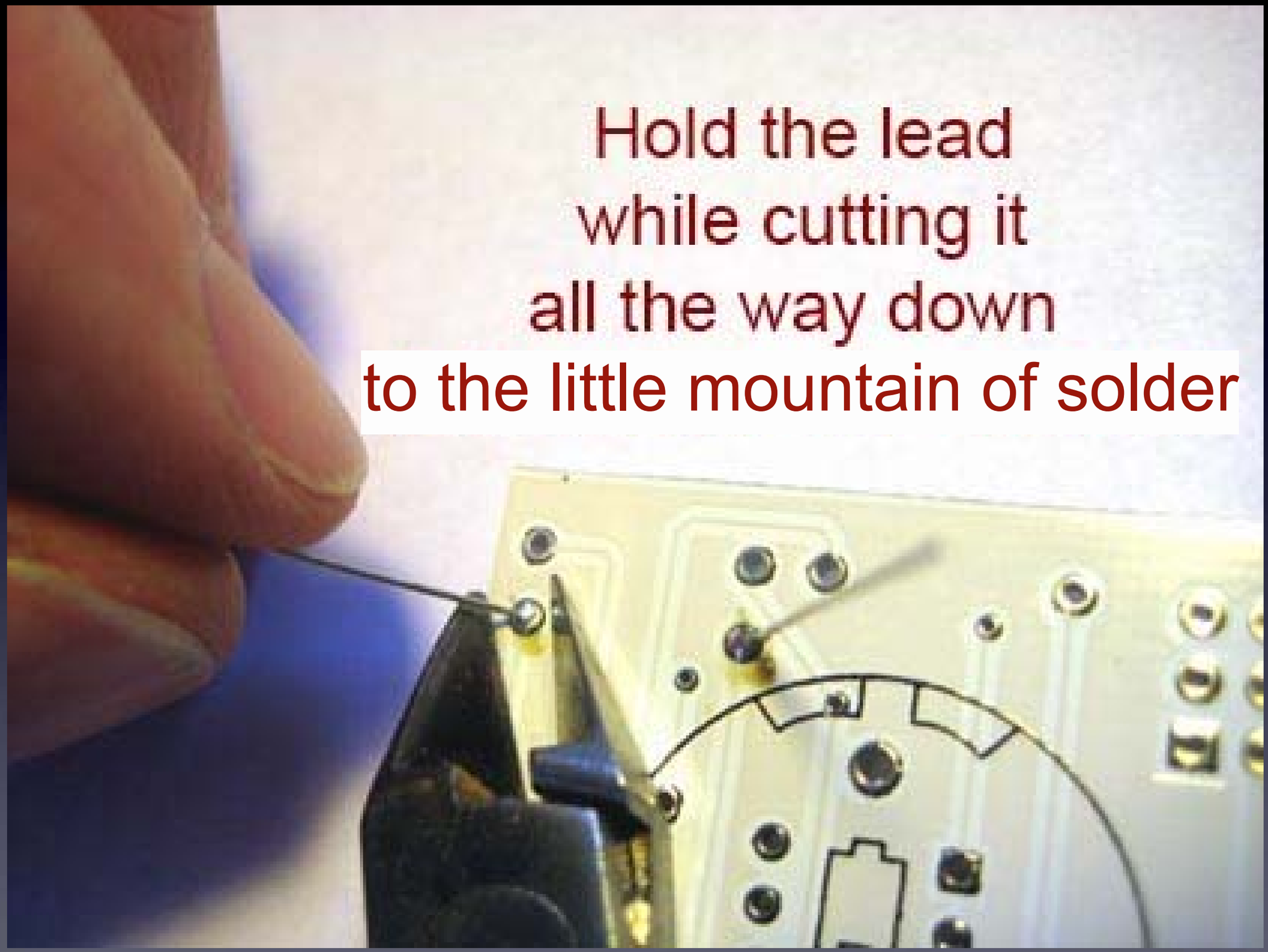
Here you can see two good solder connections

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



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

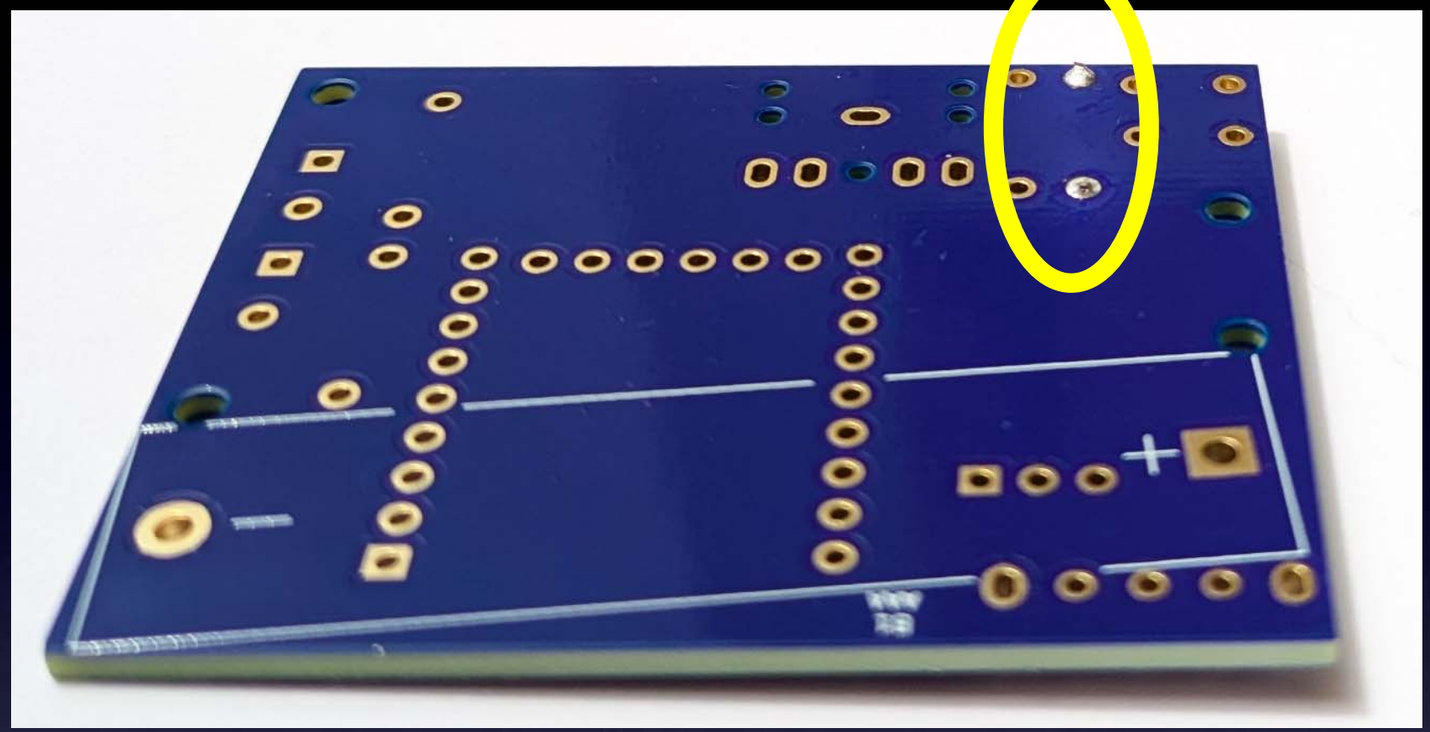
Safety Tip #3:

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.)

No wires sticking out



2 good solder connections

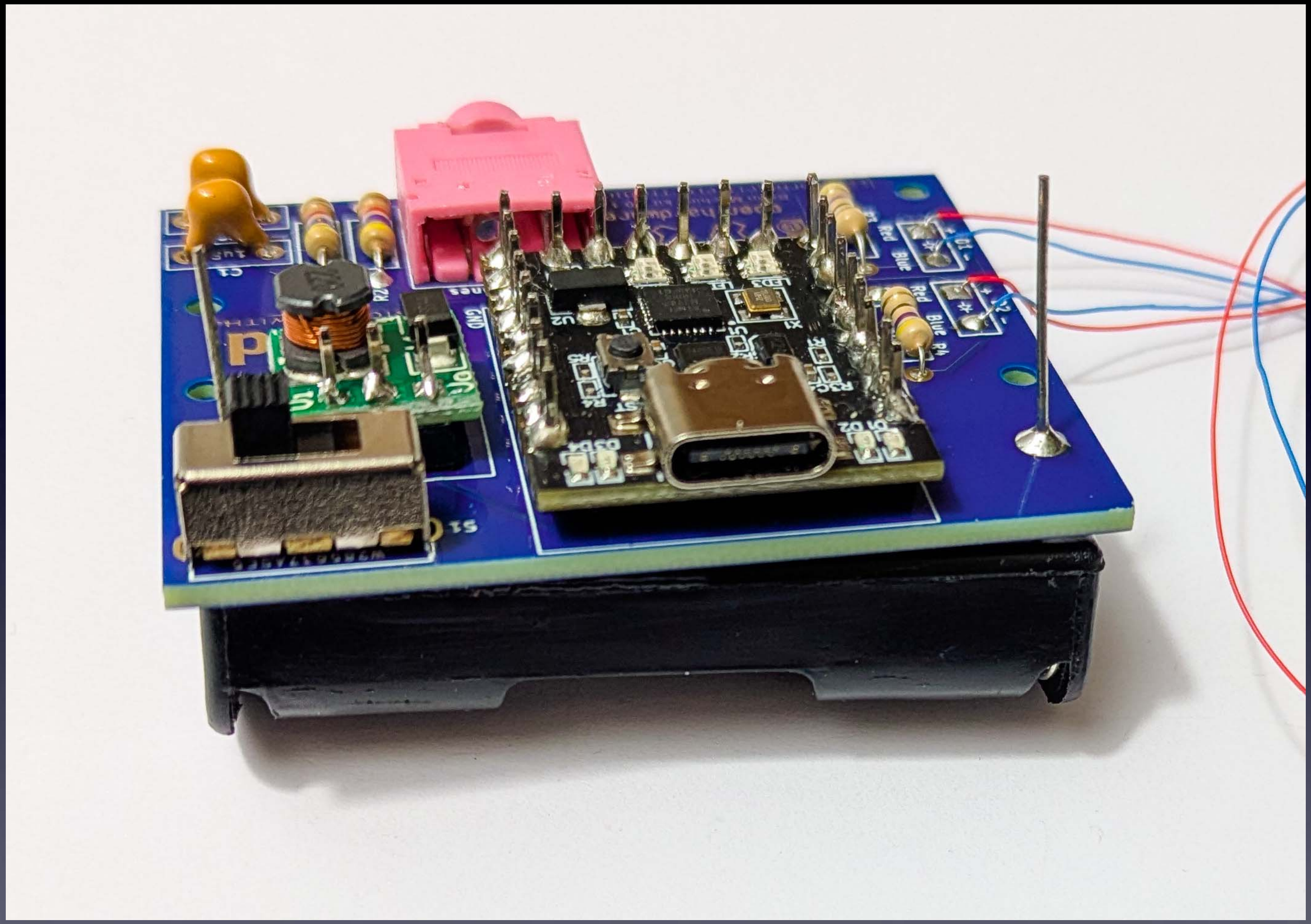
R1 soldered to the board

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

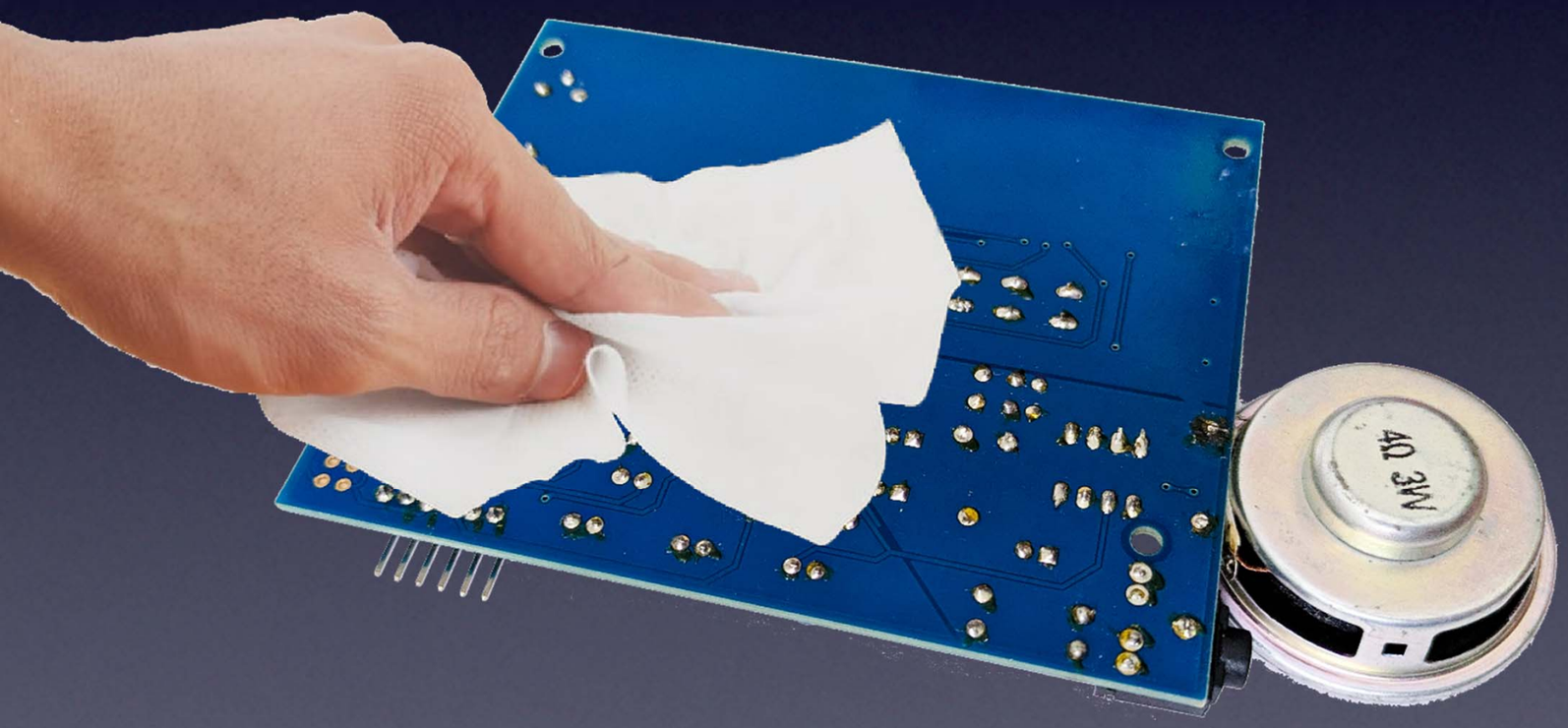
Till all the parts are soldered



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

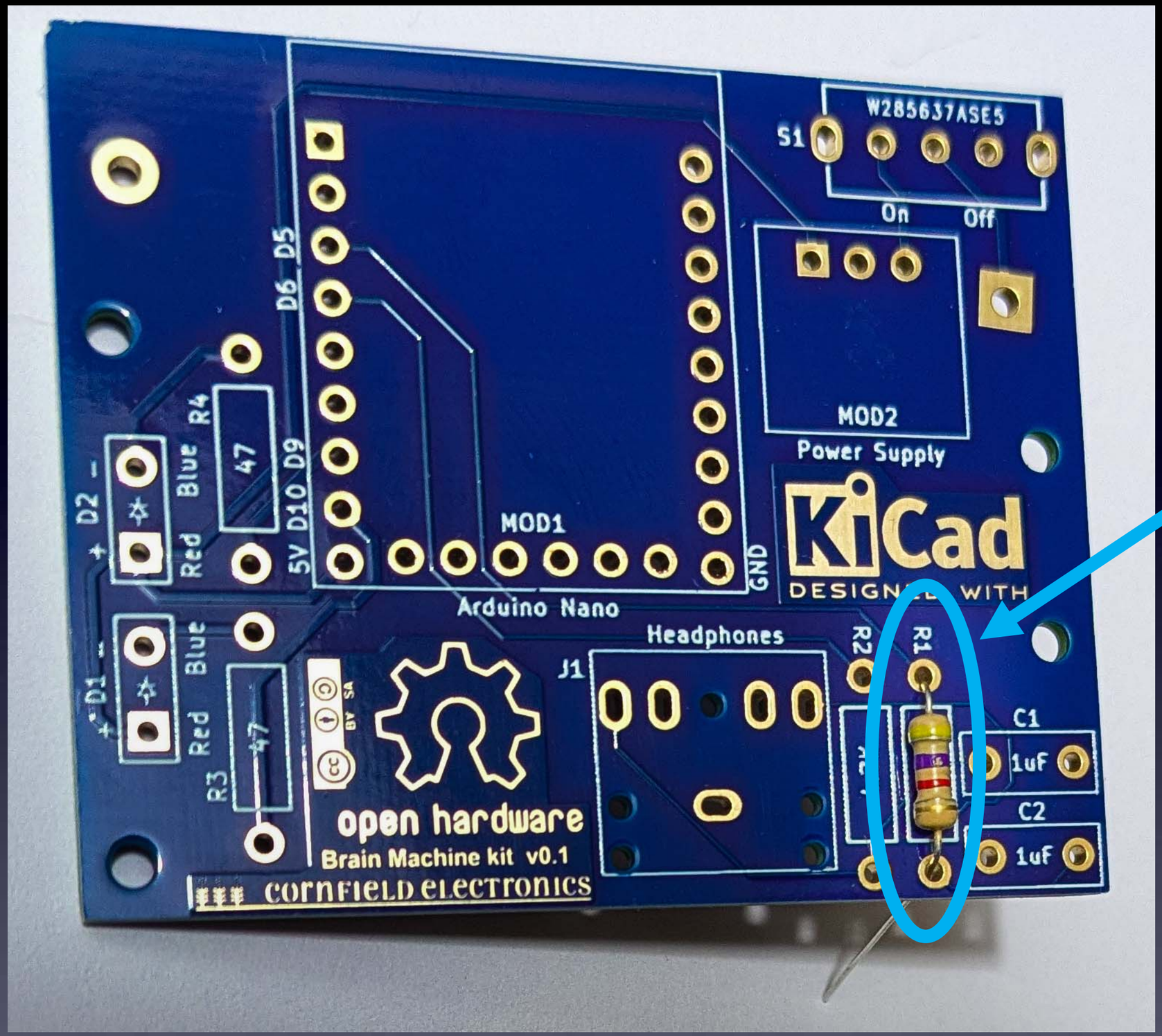
Then put in the battery,

Turn it on,

And it works!

(Or you start debugging.)

Let’s start!

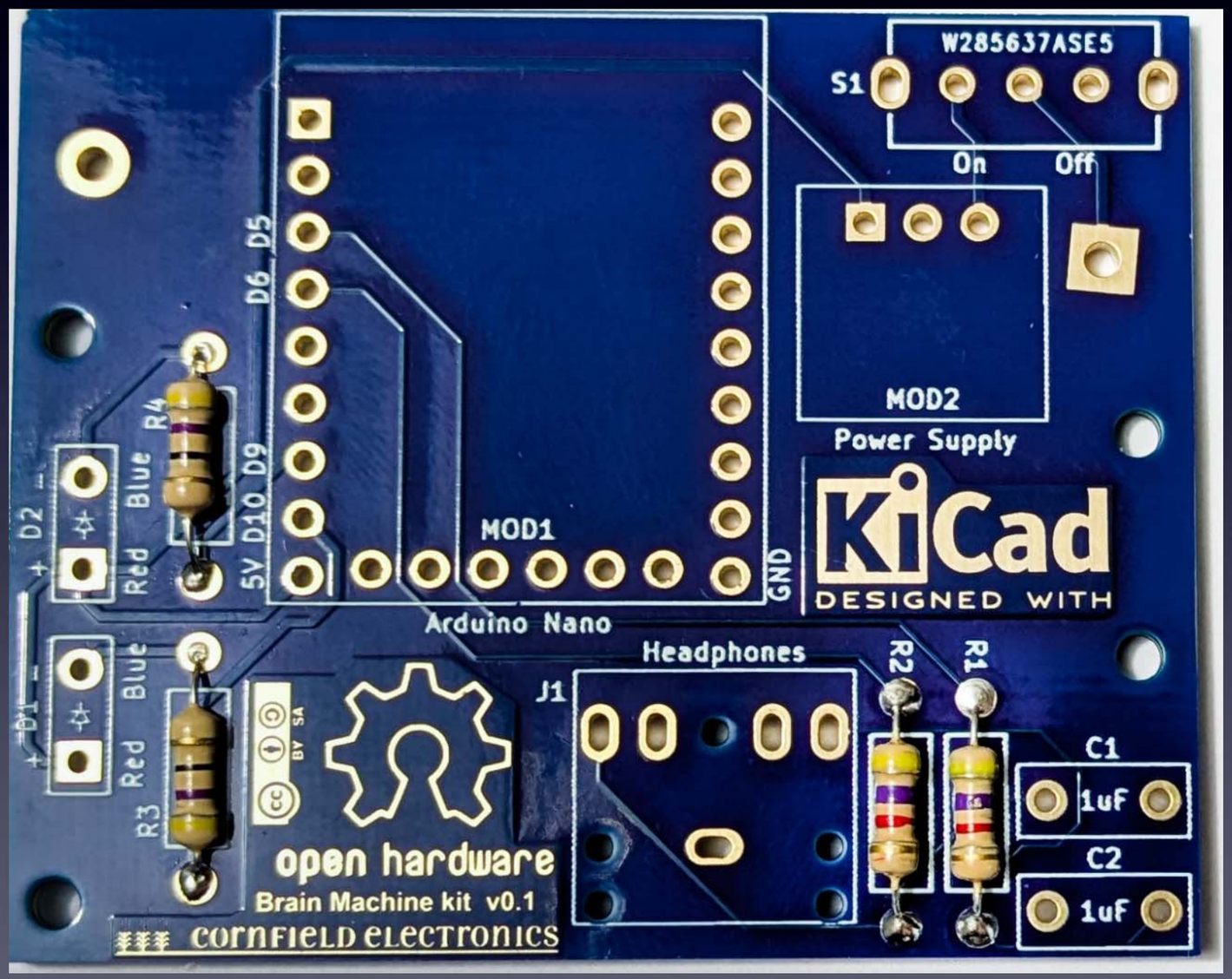


Direction does not matter

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

R1, R2:  4.7K: Yellow, Violet, Red

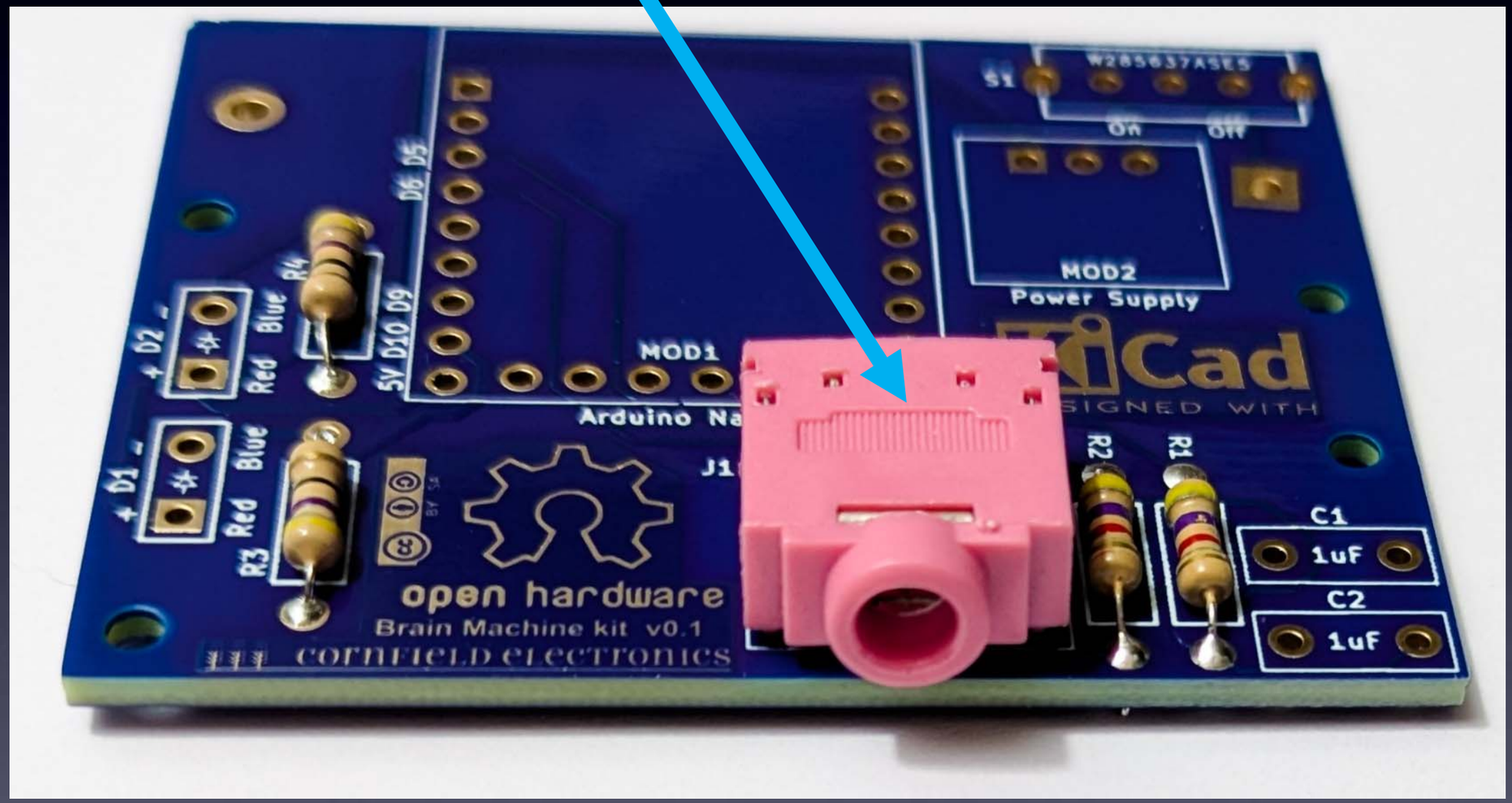
R3, R4:  47: Yellow, Violet, Black



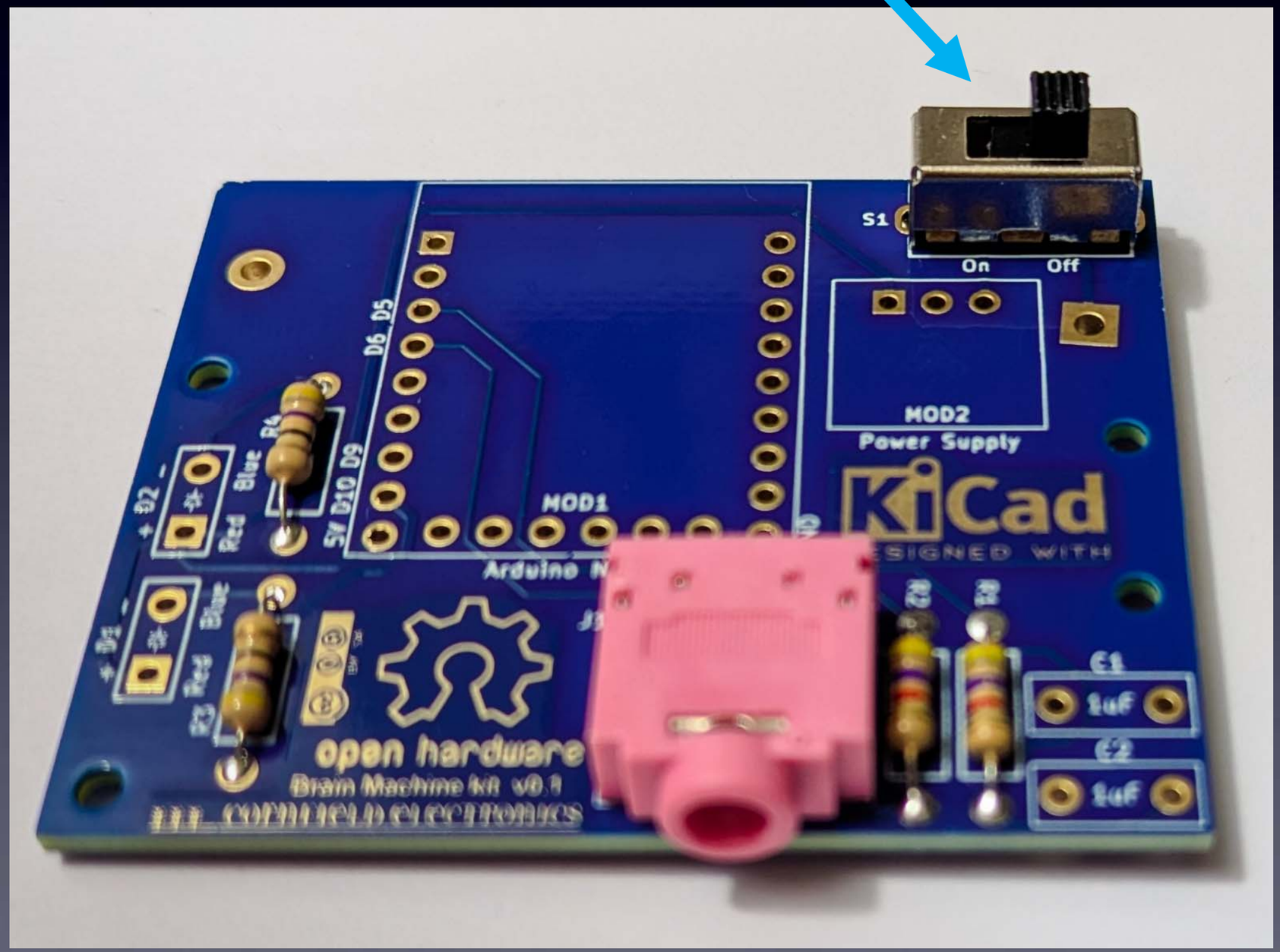
Direction does not matter

All 4 resistors

J1: Headphone Jack



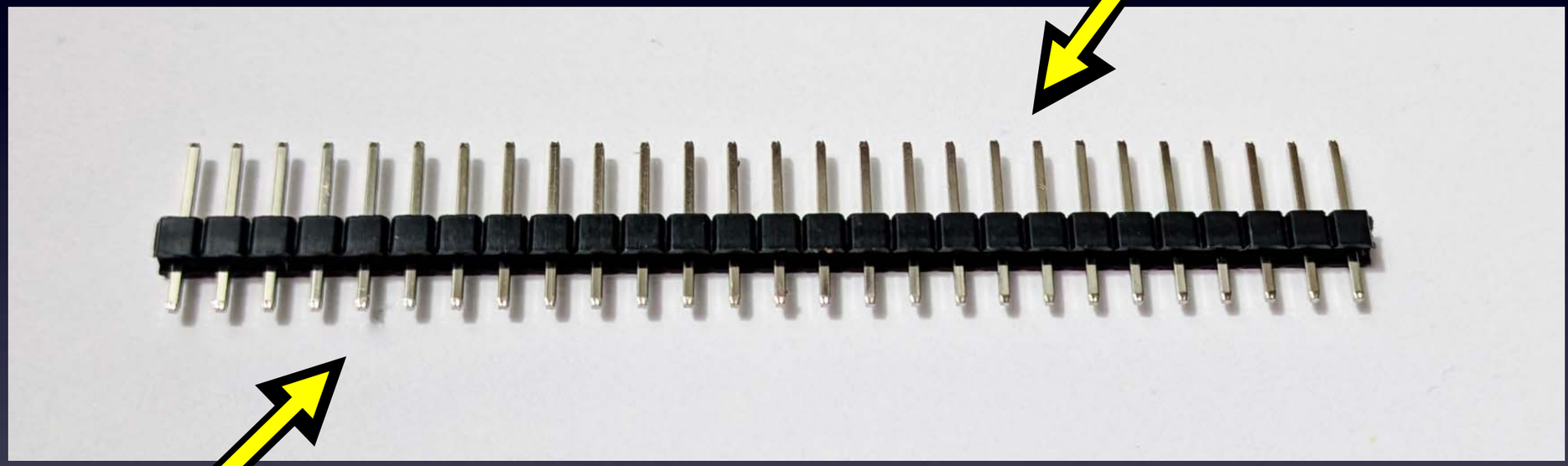
S1: On/Off switch



Direction does not matter

Pin Headers

long pins



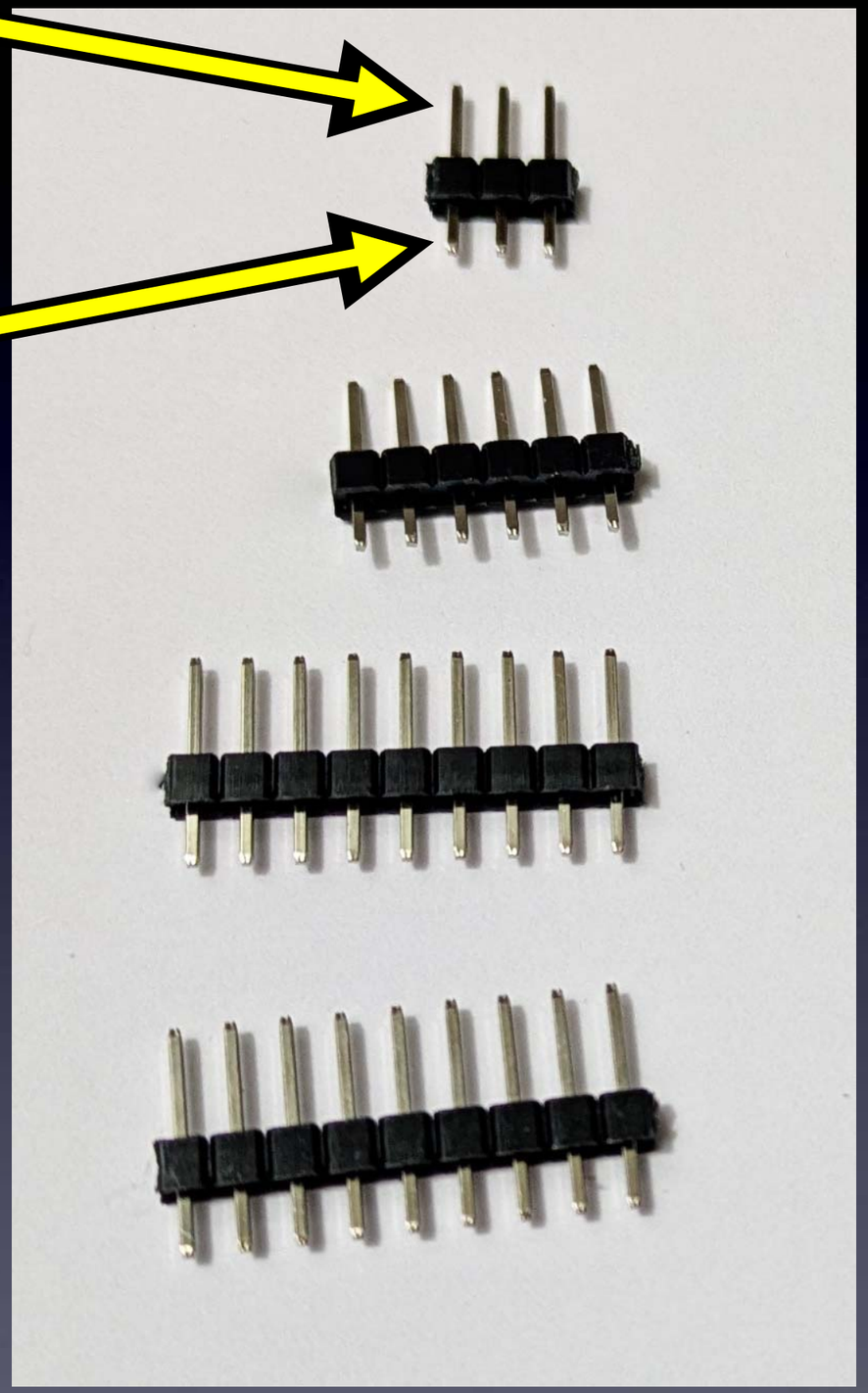
27 pins

short pins

Pin Headers

long pins

short pins



3 pins

6 pins

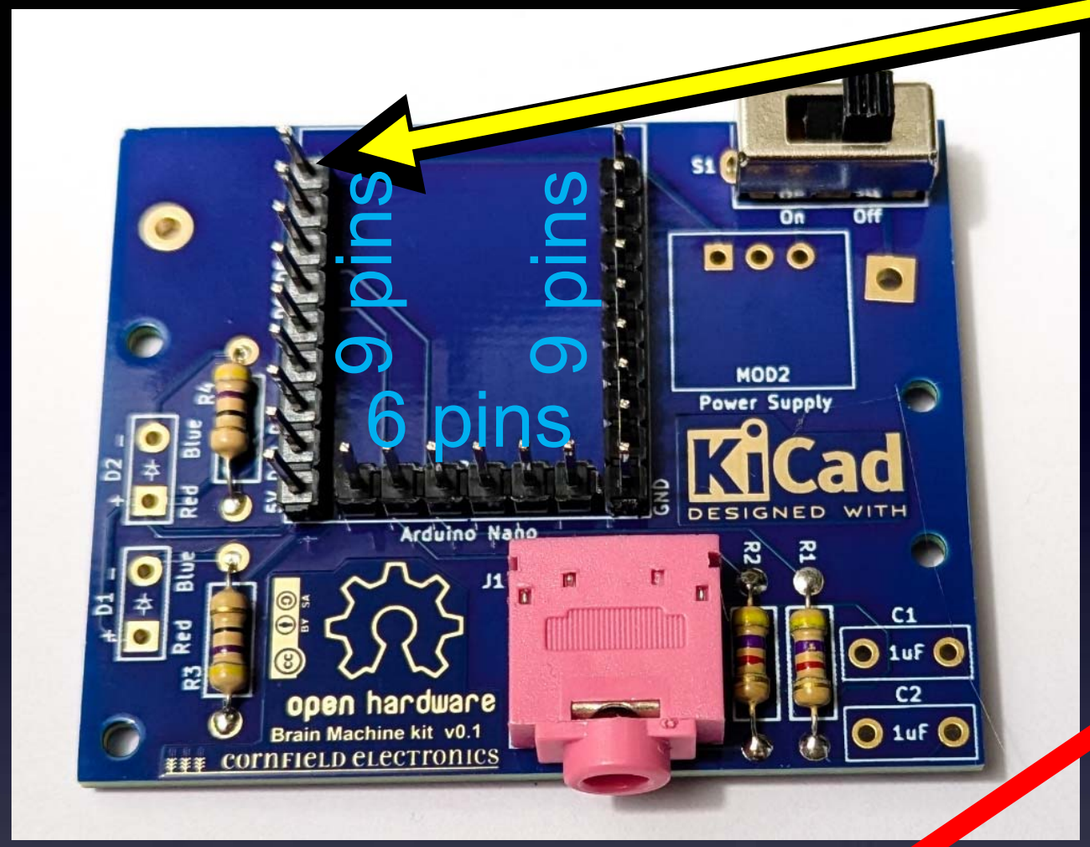
9 pins

9 pins

Use wire cutters

Pin Headers for Arduino Nano

long pins sticking up

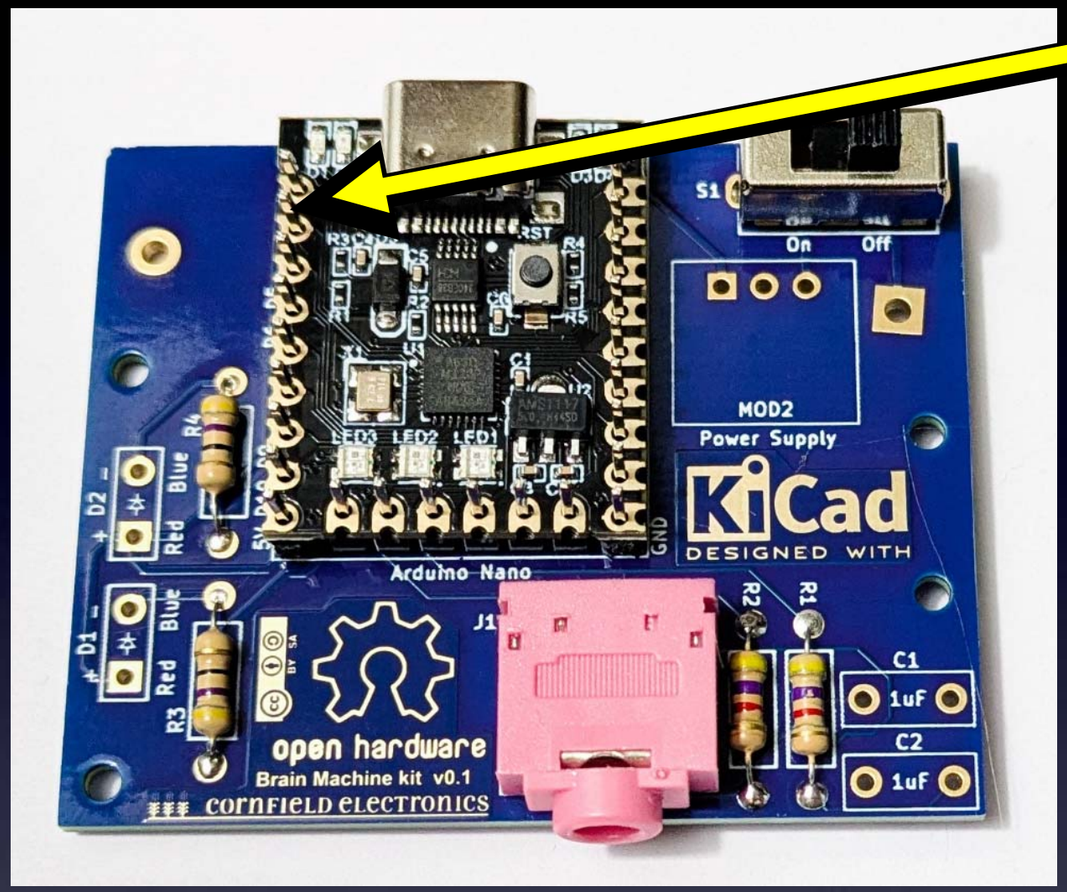


IMPORTANT !

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

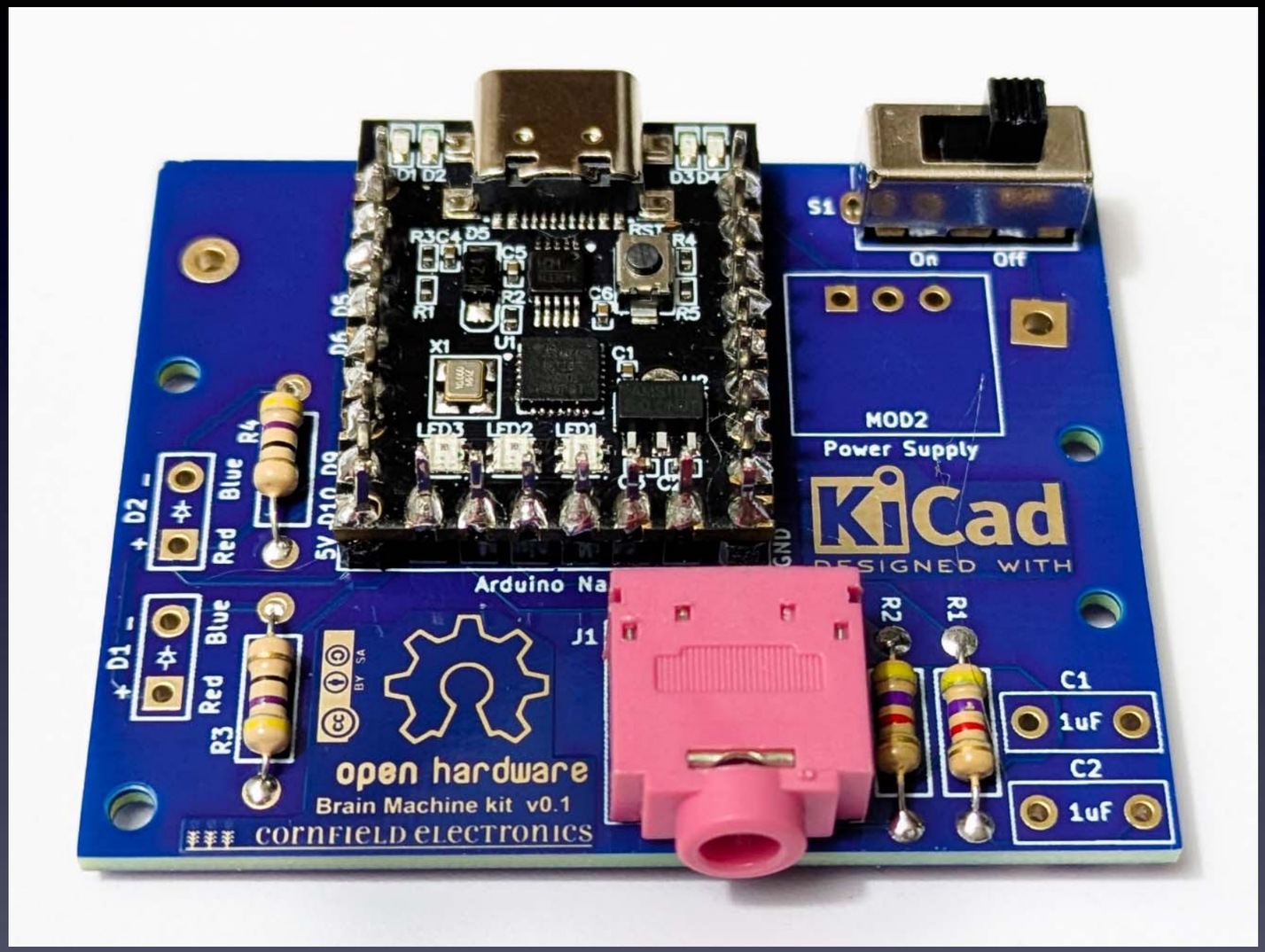
Arduino Nano placed on its pins



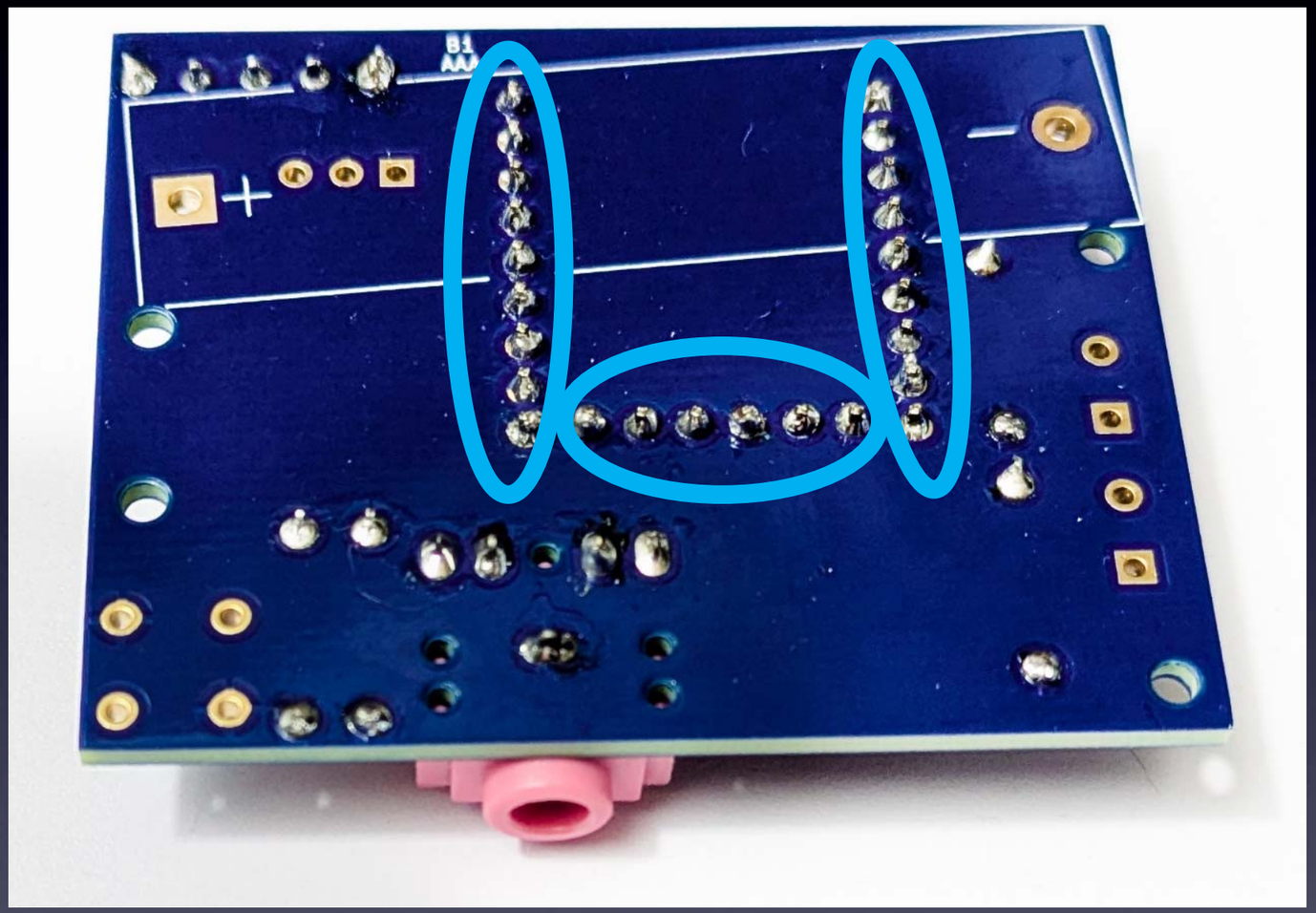
long pins sticking up

→ Short pins go into the board ! ←

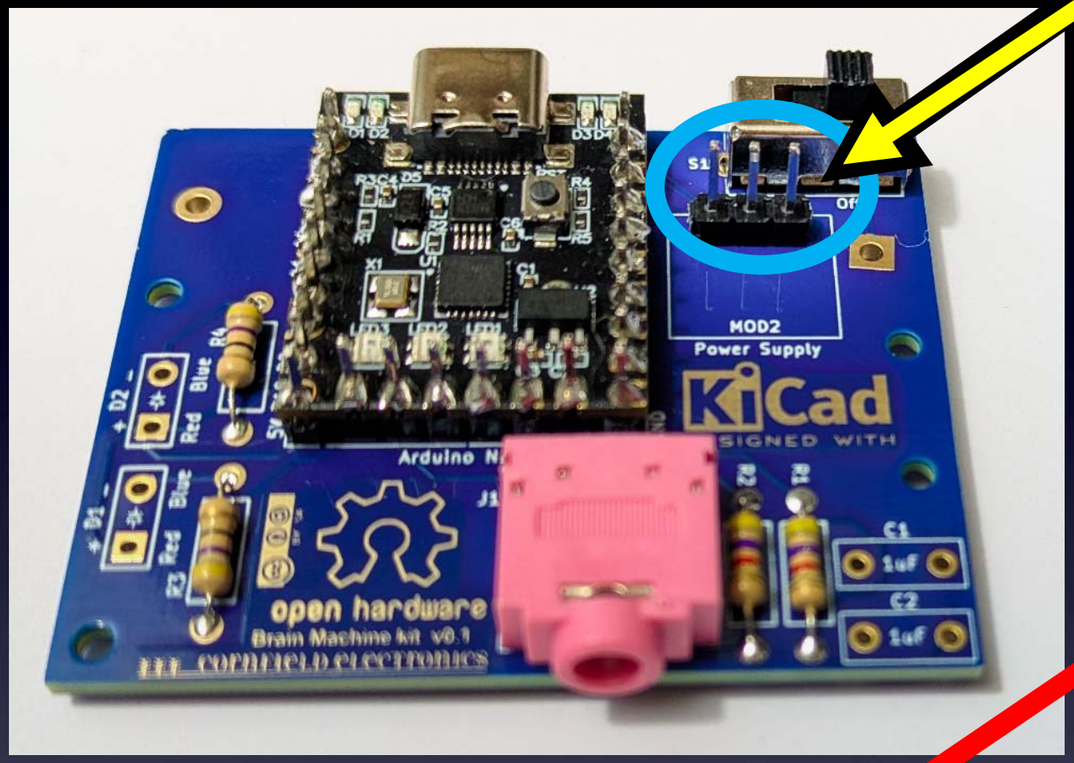
Arduino Nano soldered to its pins



Arduino Nano soldered to board



Pin Headers for Power Supply



long pins sticking up

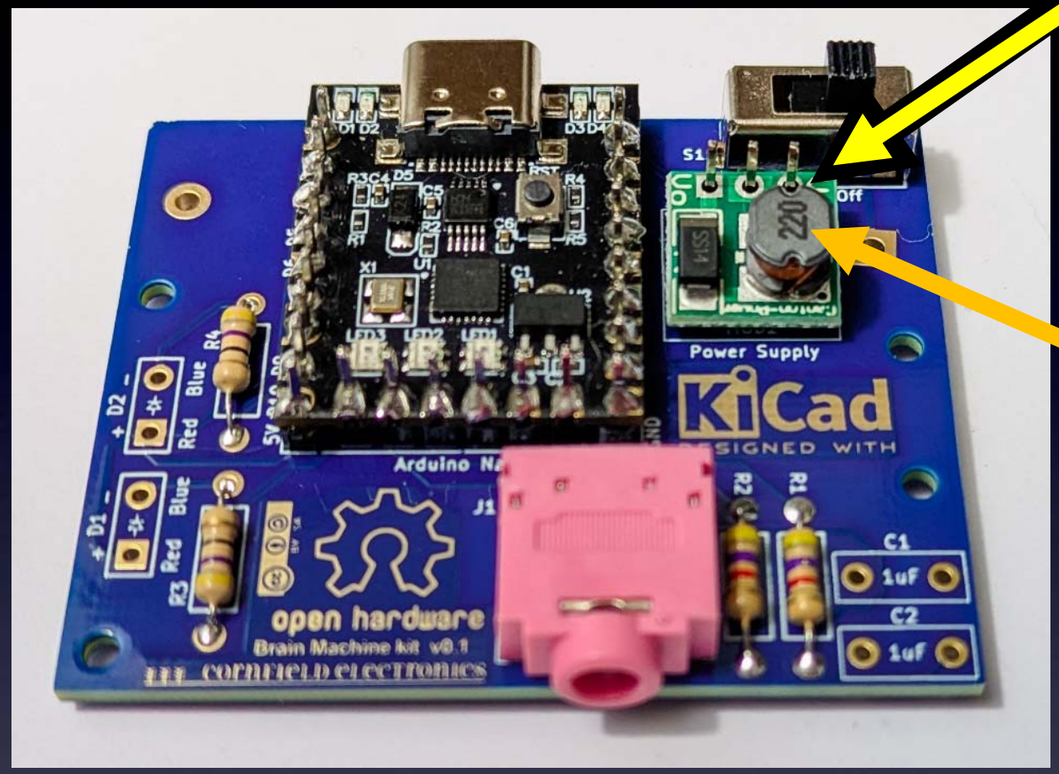
3 pins

IMPORTANT !

→ Short pins go into the board ! ←

→ Do Not solder, yet ←

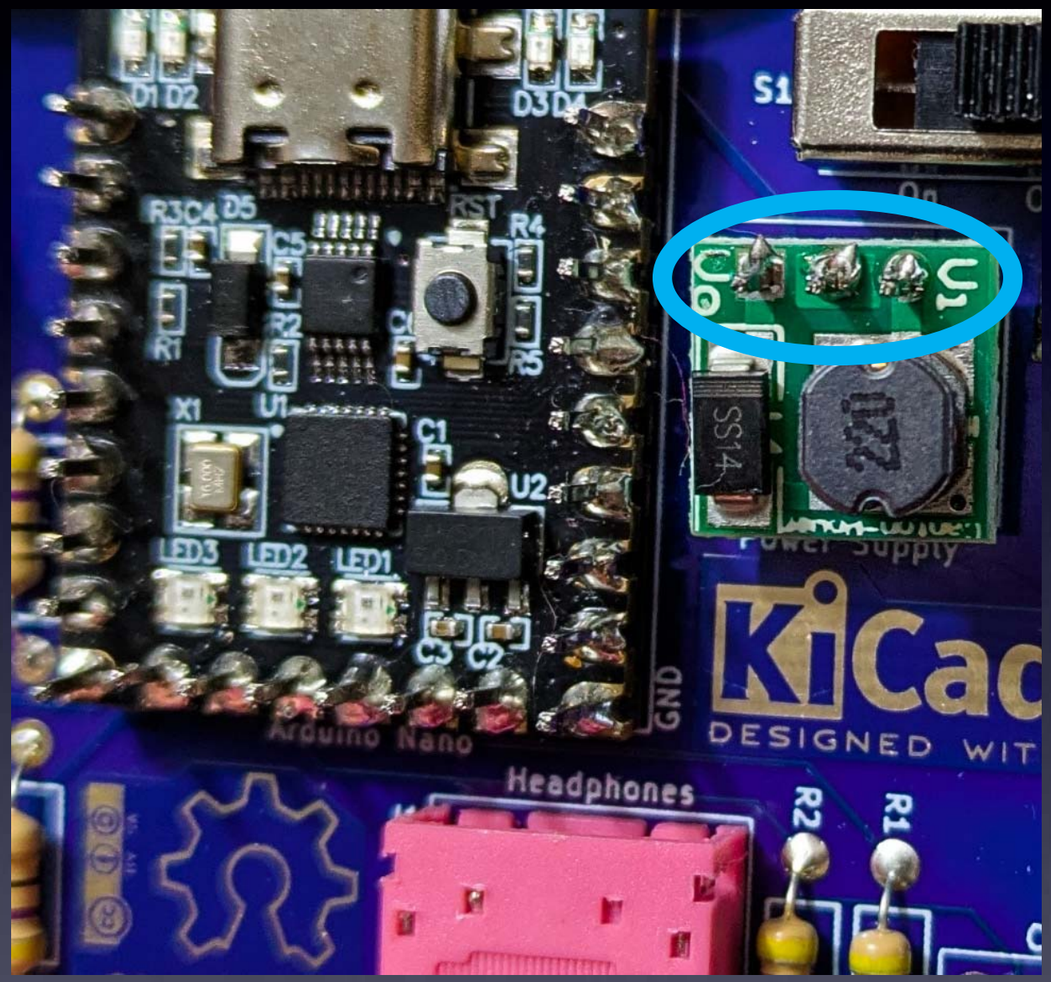
Power Supply placed on its pins



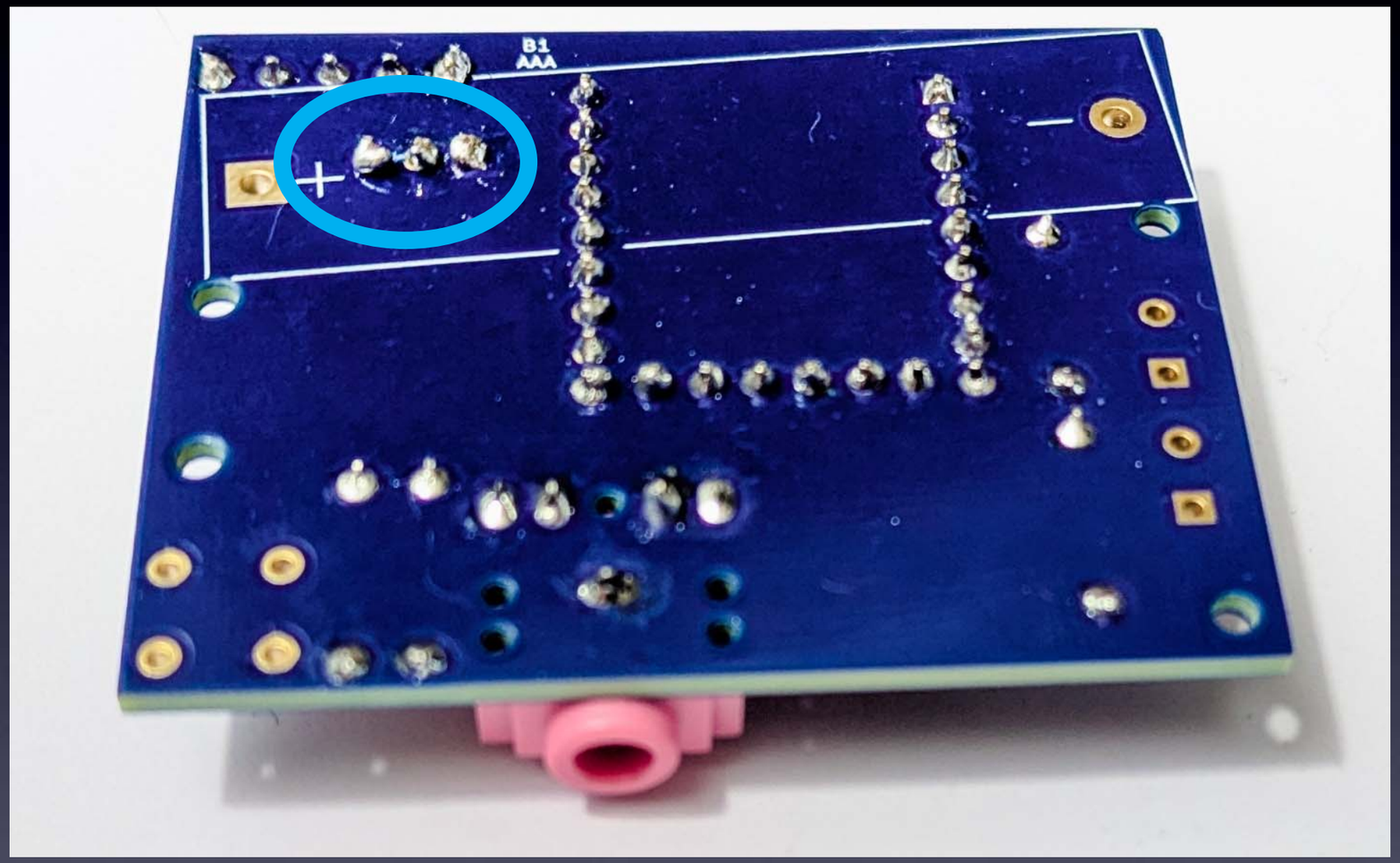
→ IMPORTANT: Power Supply ***must*** go in this way ! ←

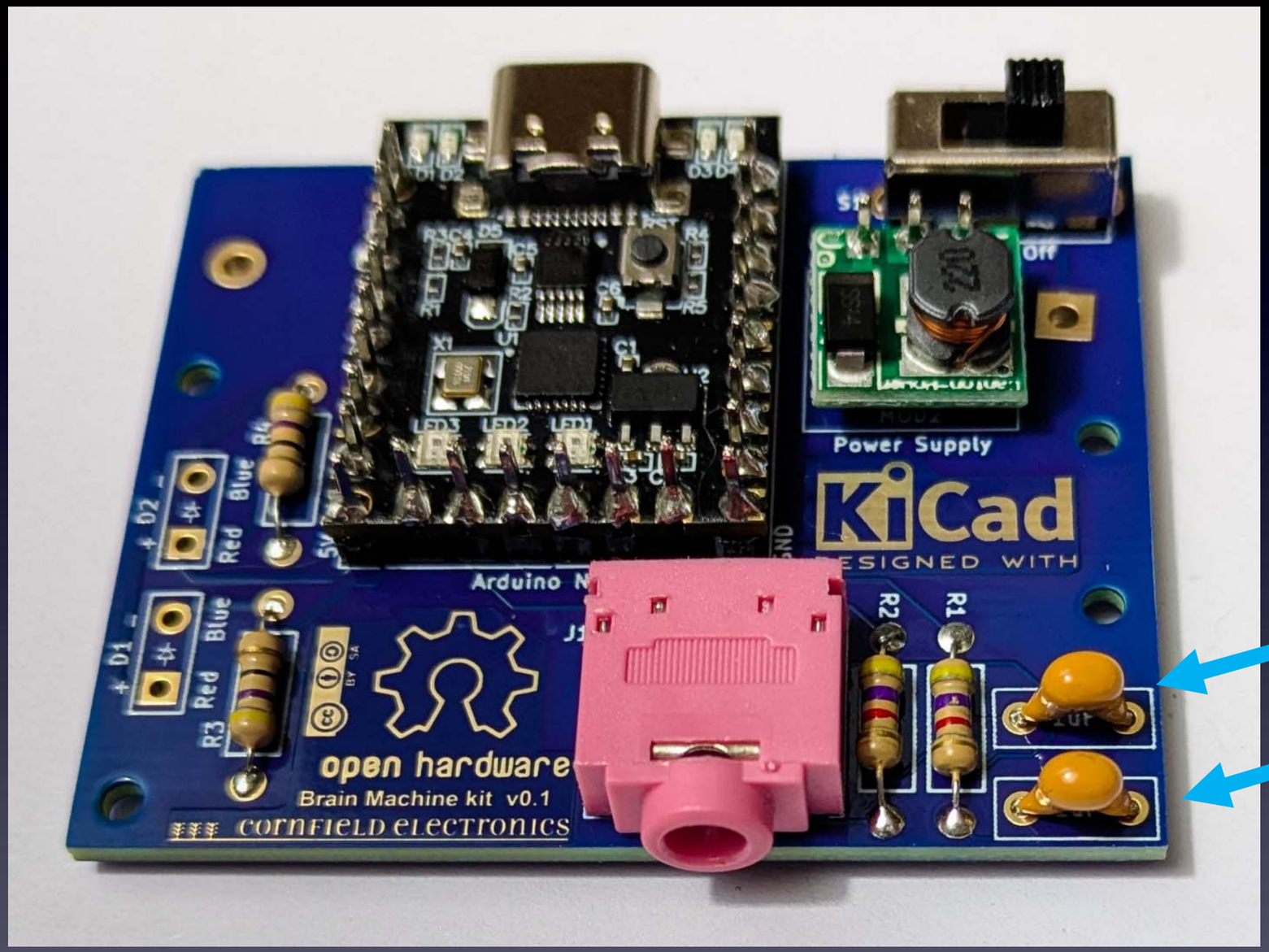
(coil is facing up)

Power Supply soldered to its pins



Power Supply soldered to board

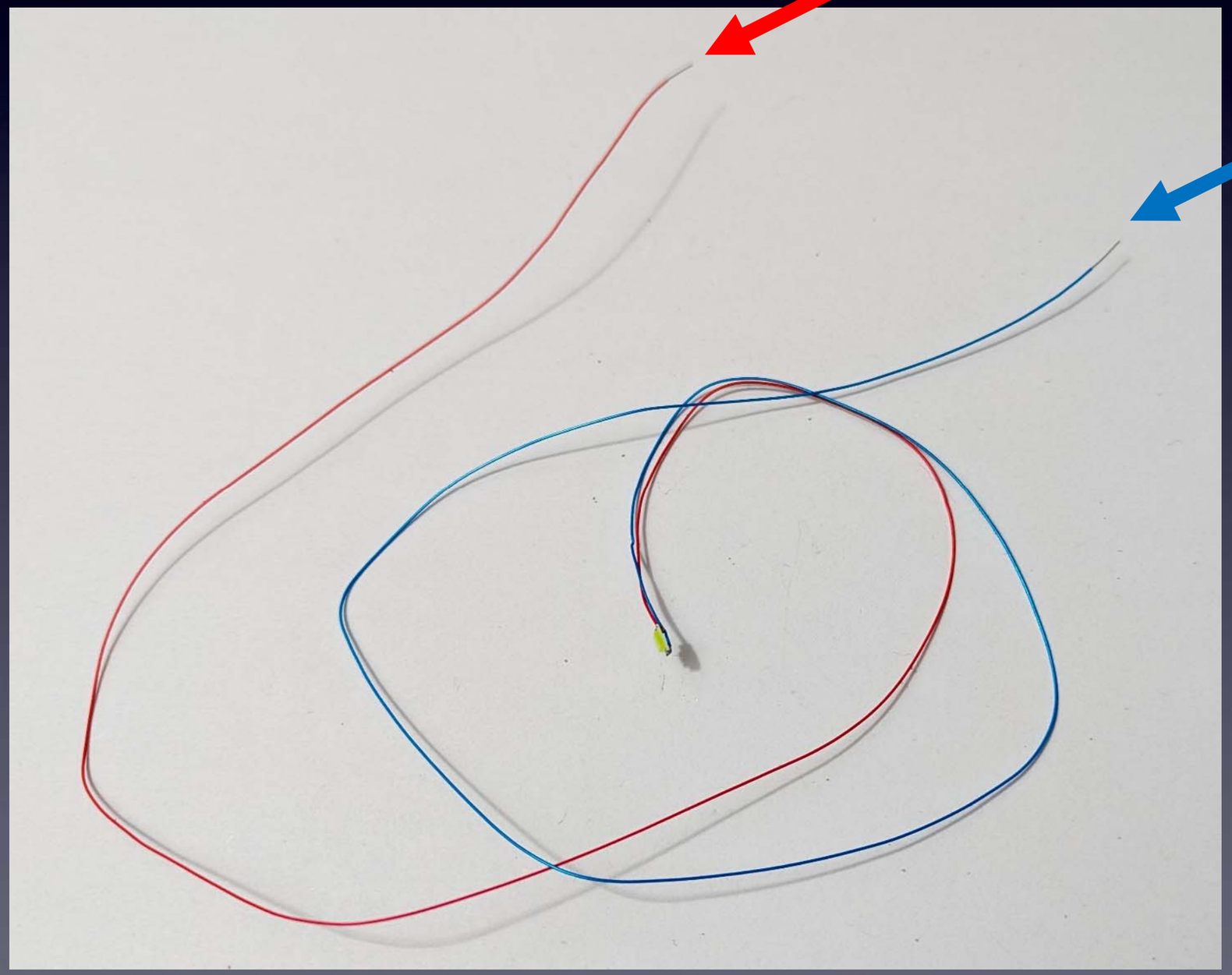




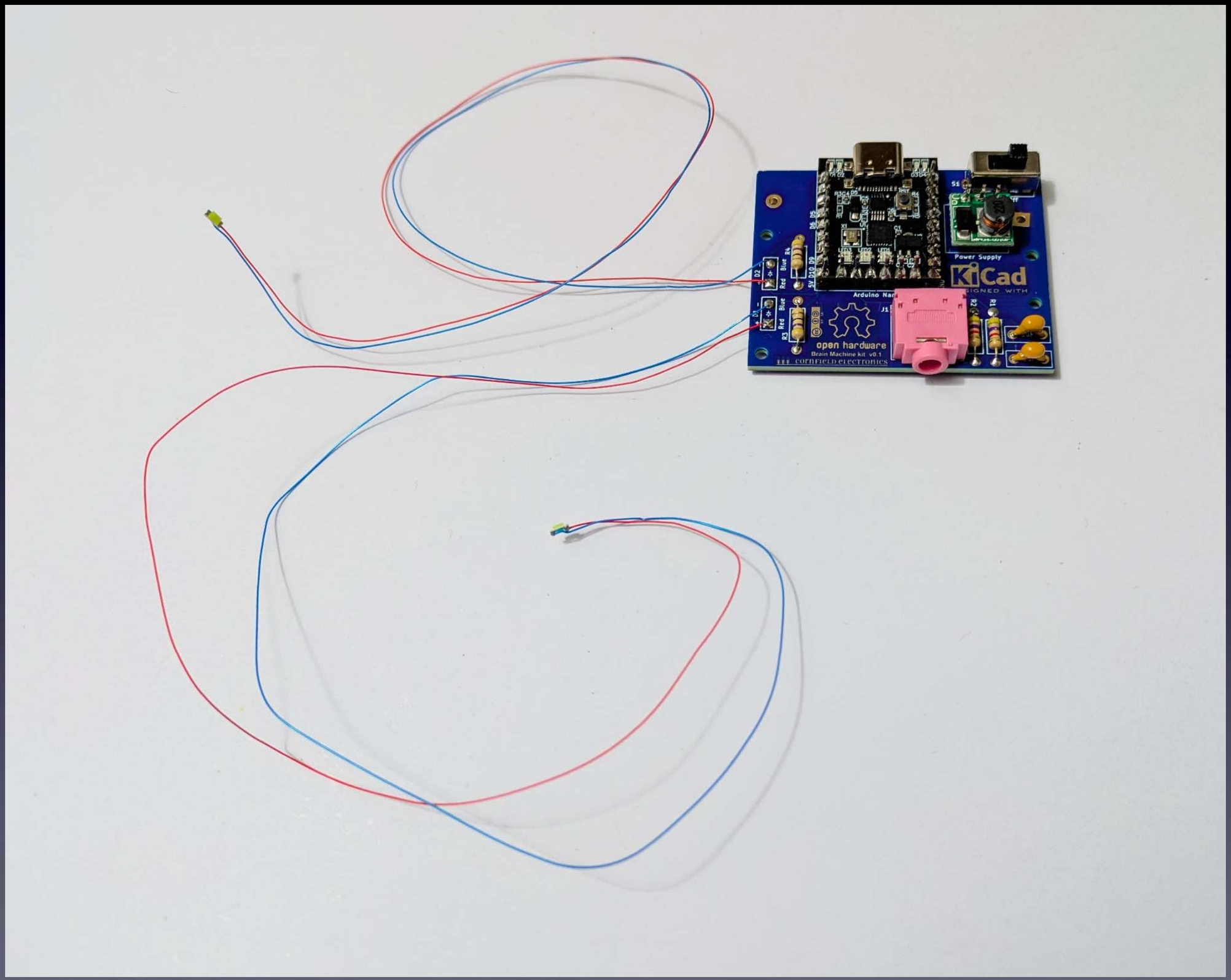
Direction does not matter

C1, C2

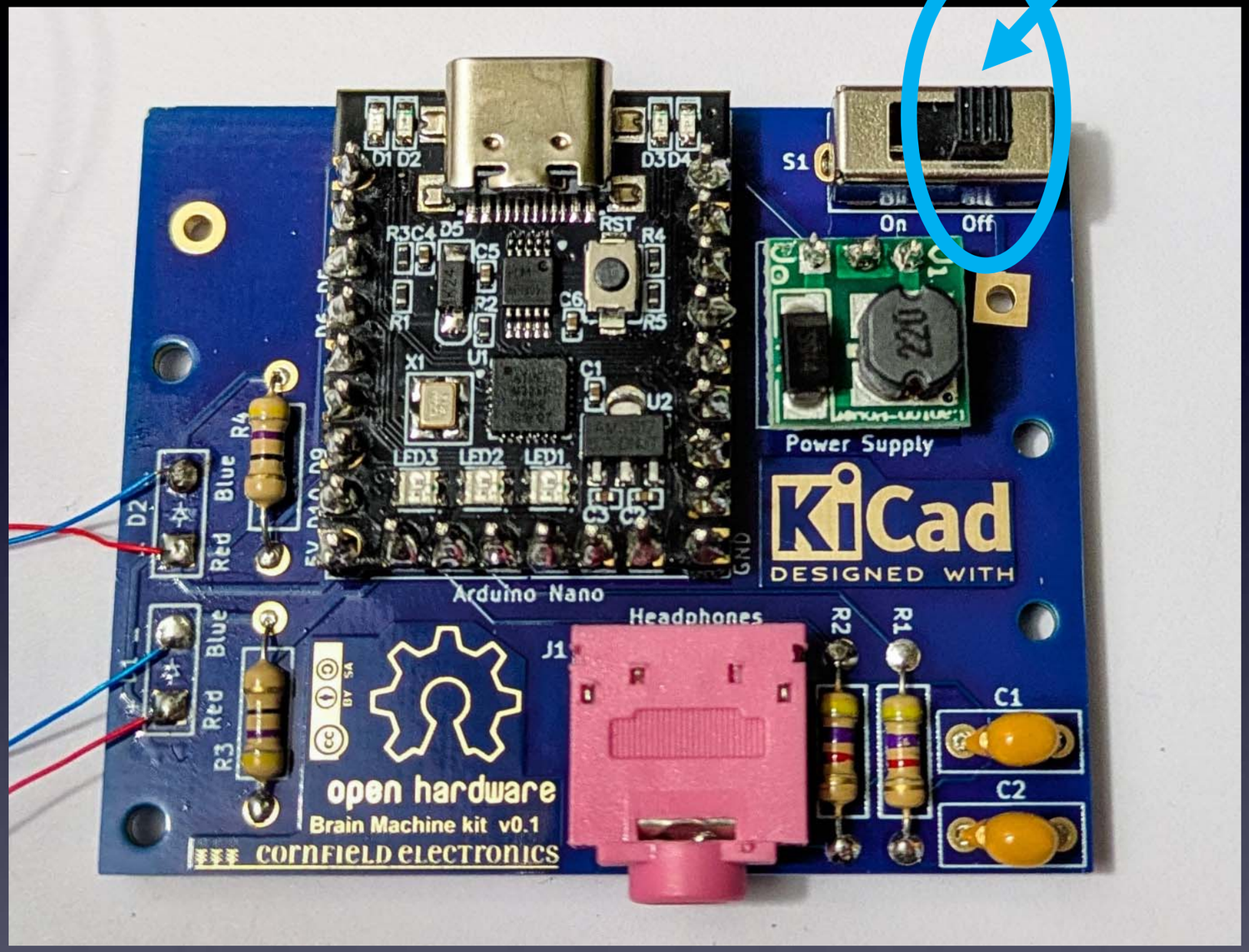
LED1 and LED2:
Red wire
and
Blue wire



LED1, LED2 soldered to board



Let’s Test !



S1 in OFF position

Let's Test !

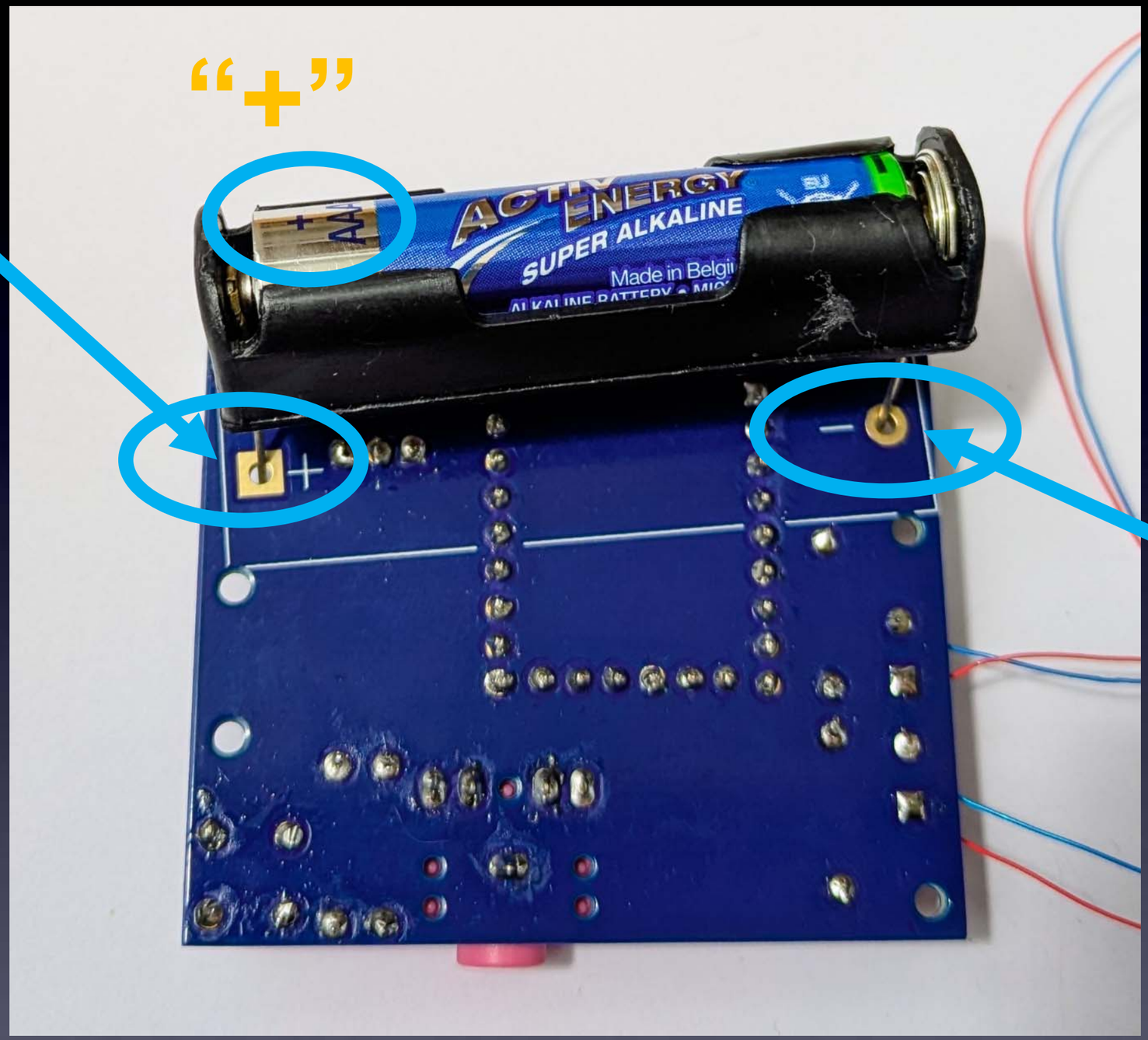
"+"

"-"

(spring)

AAA Battery in its holder

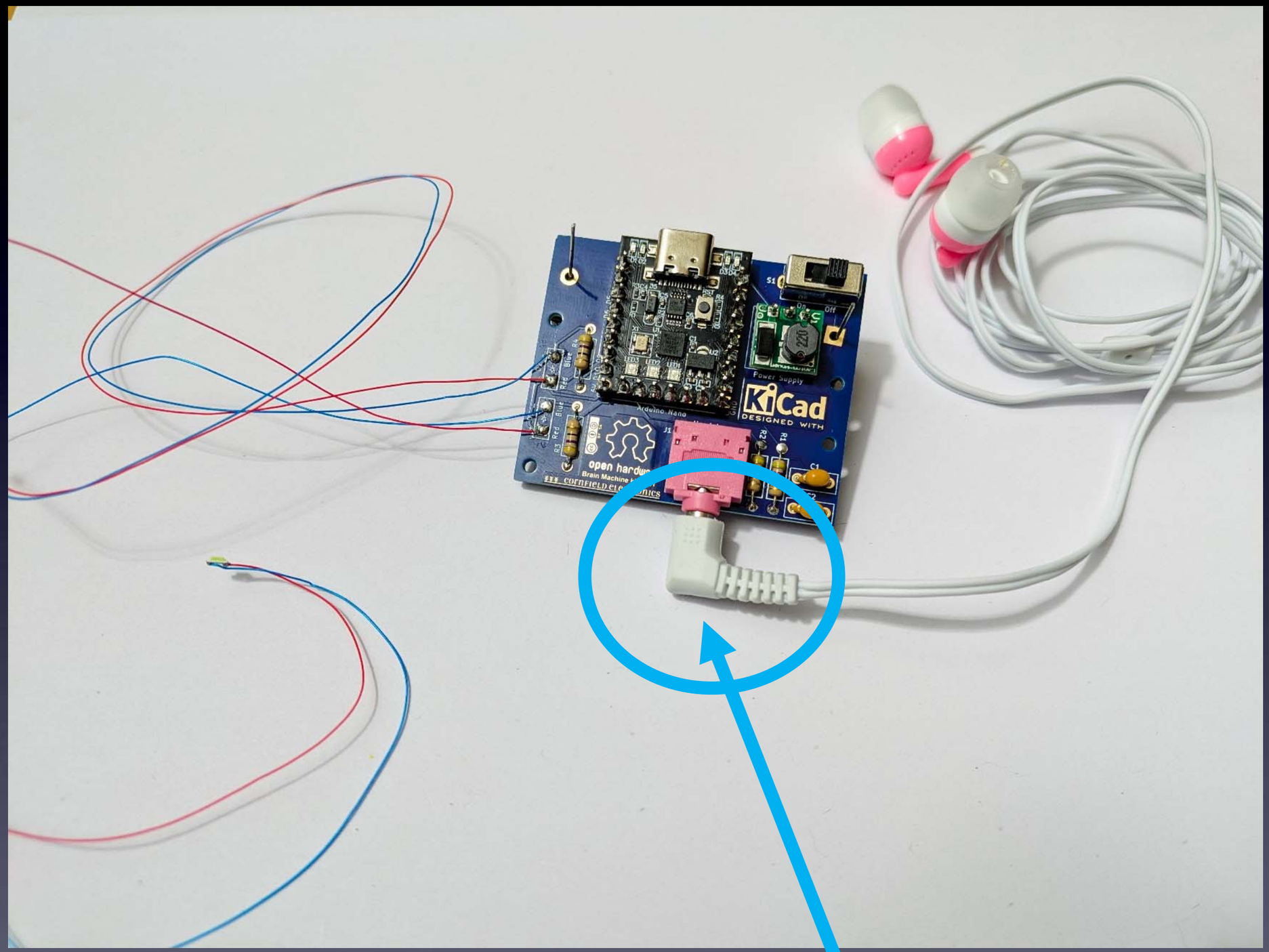
Let’s Test !



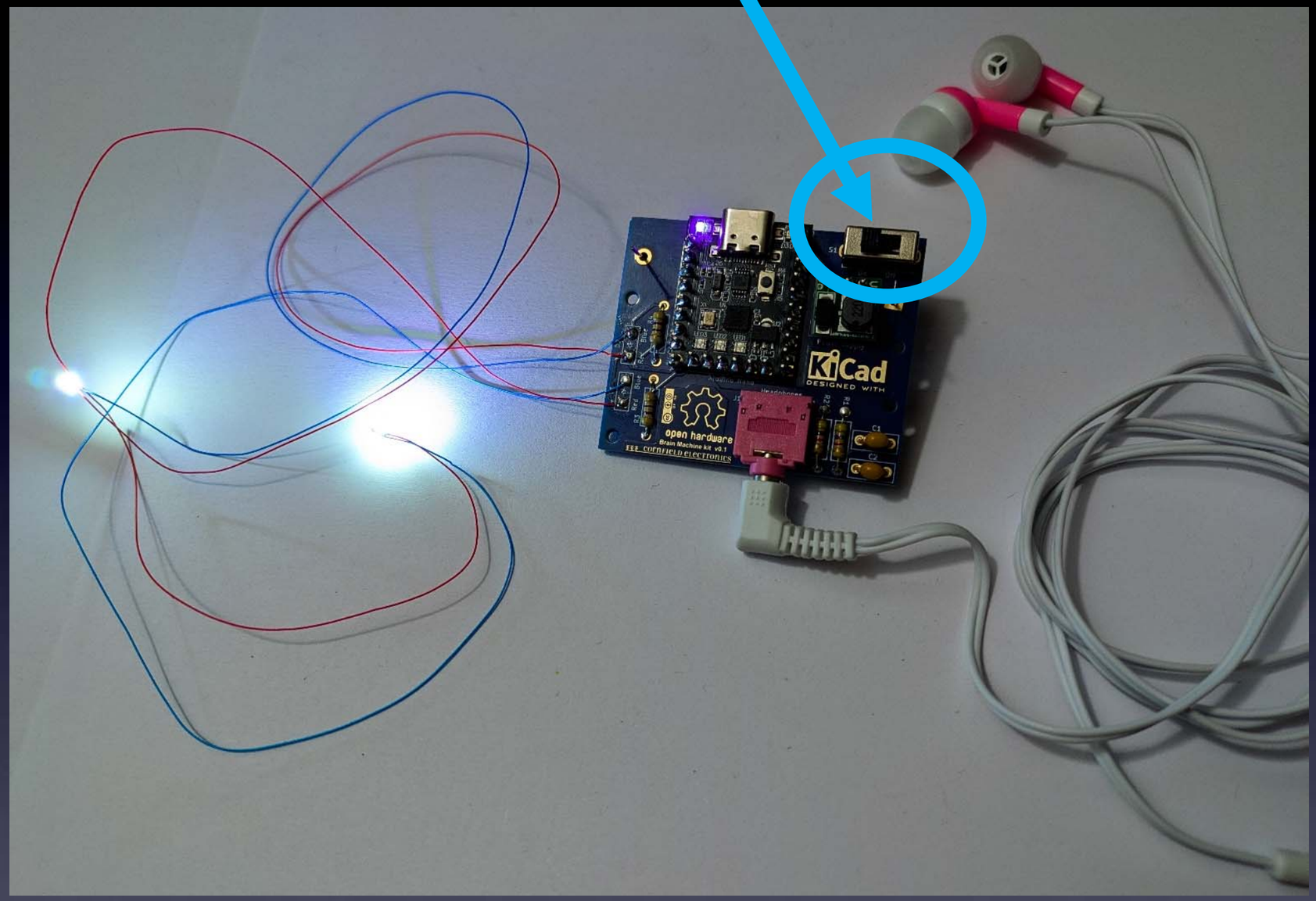
Place AAA Battery holder in place

→ Do Not solder, yet ←

Let’s Test !



Let’s Test !

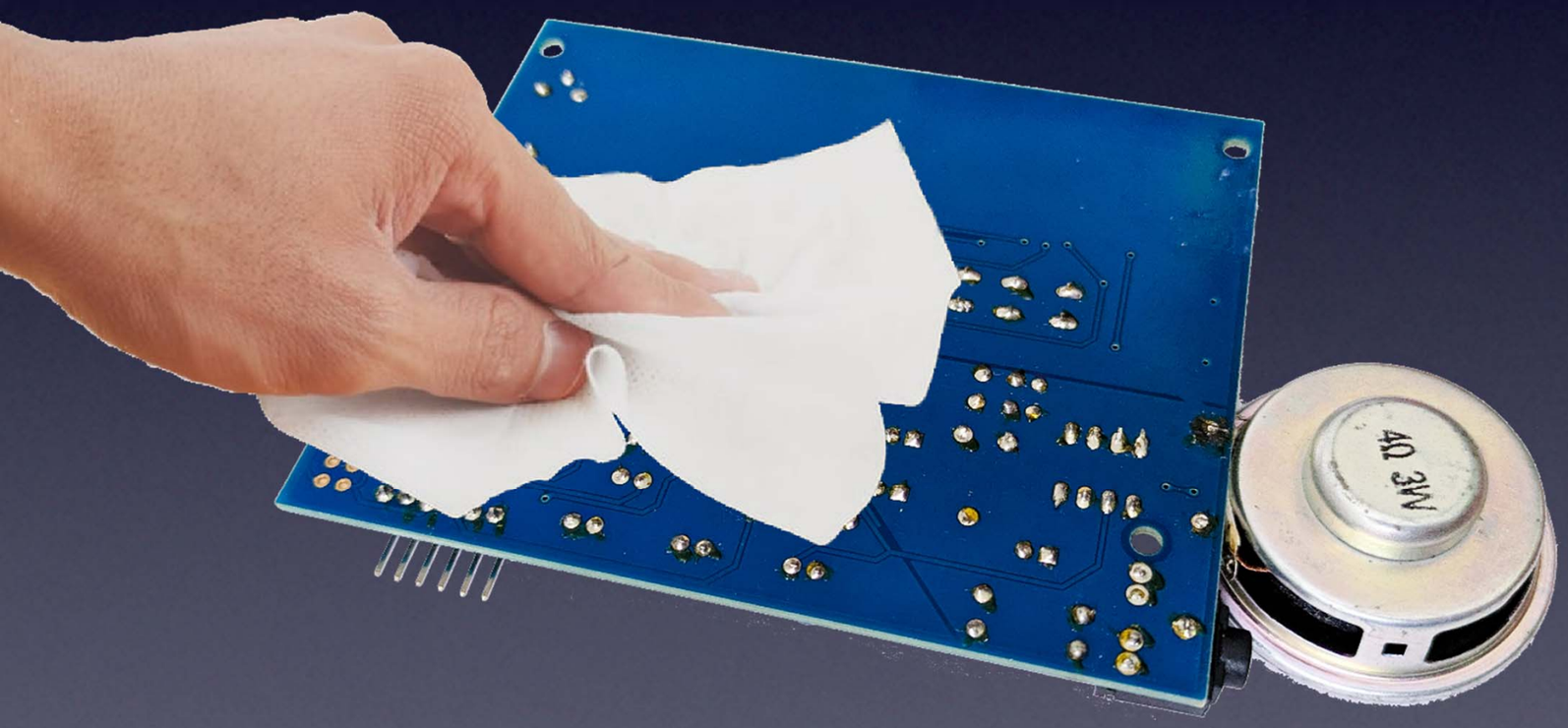


Turn ON

- LEDs flicker
- Each ear has a different pitch

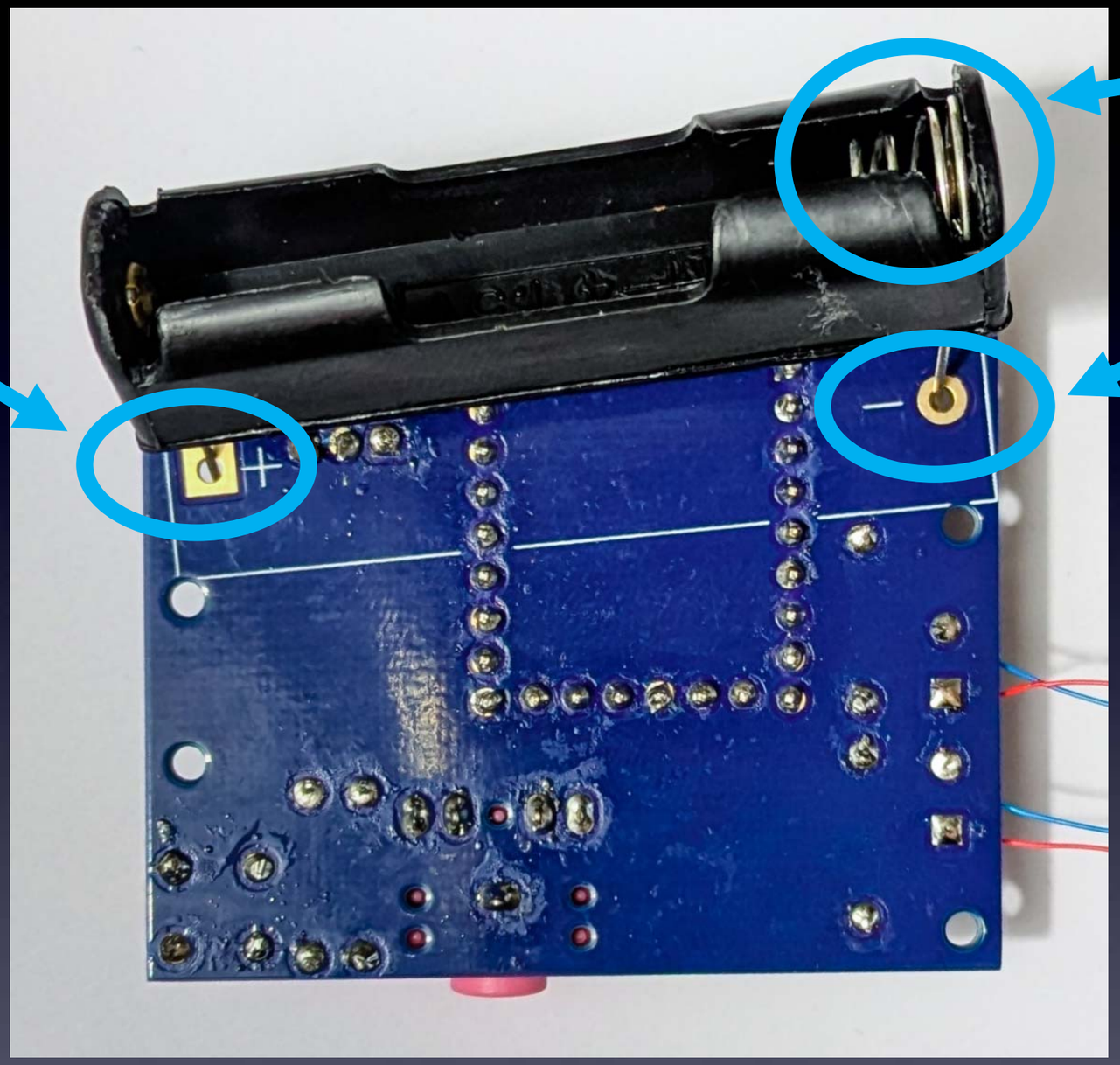
If you used any *flux paste for re-working problems*

The bottom of the PCB will be sticky from the flux

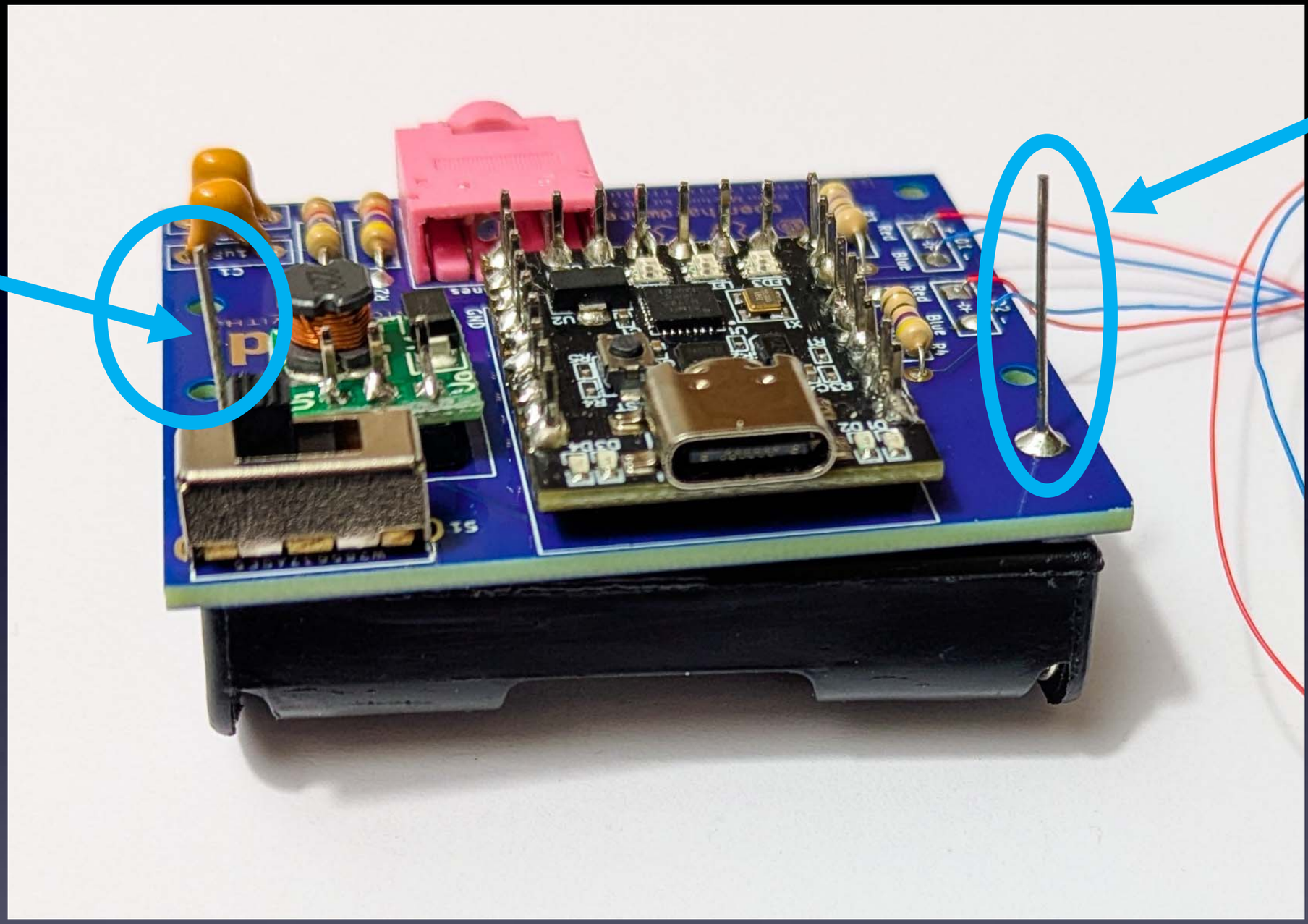


You can clean it with a cloth wet with Isopropyl Alcohol

Insert Battery Holder



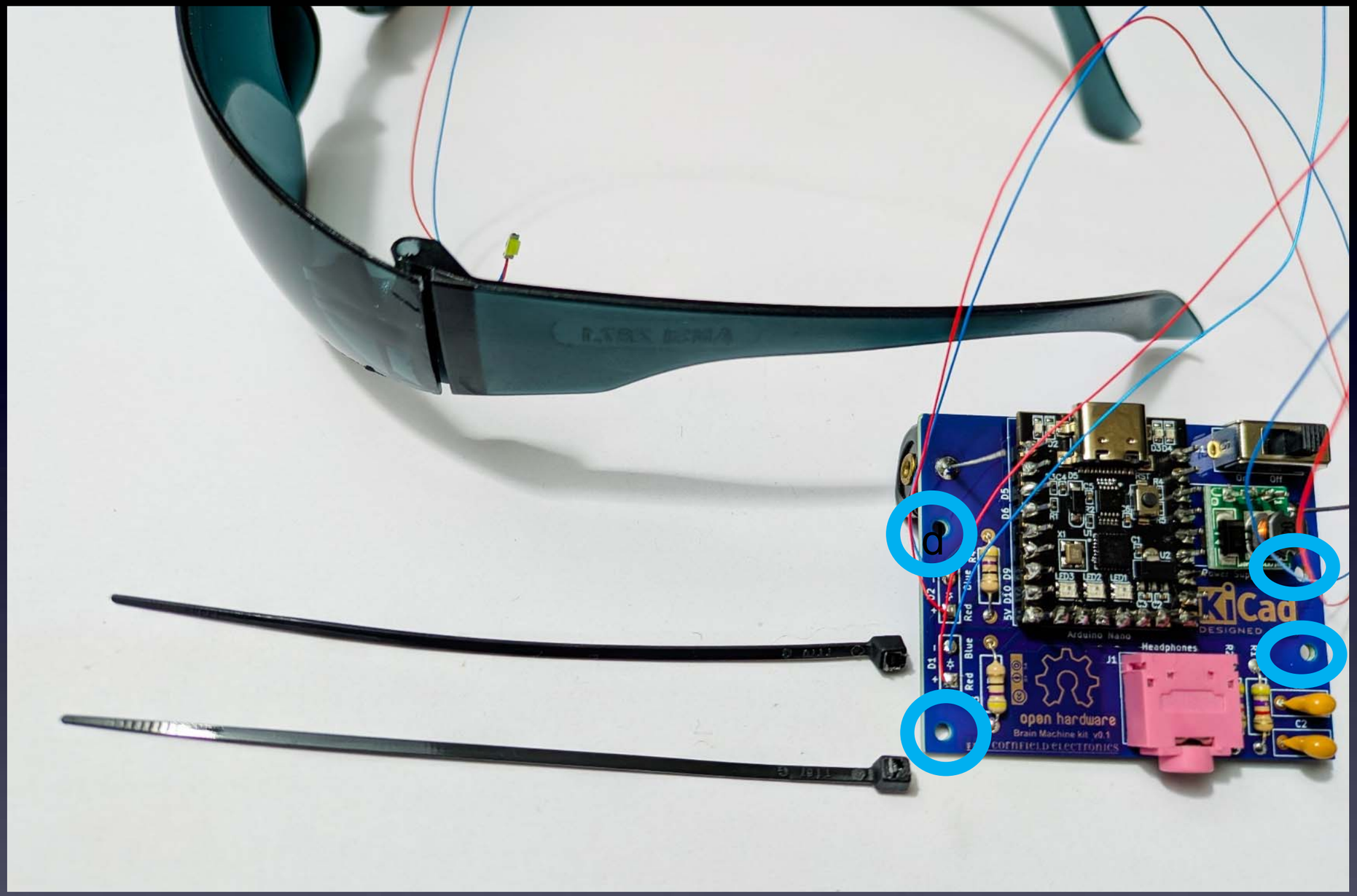
Battery Holder Soldered



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

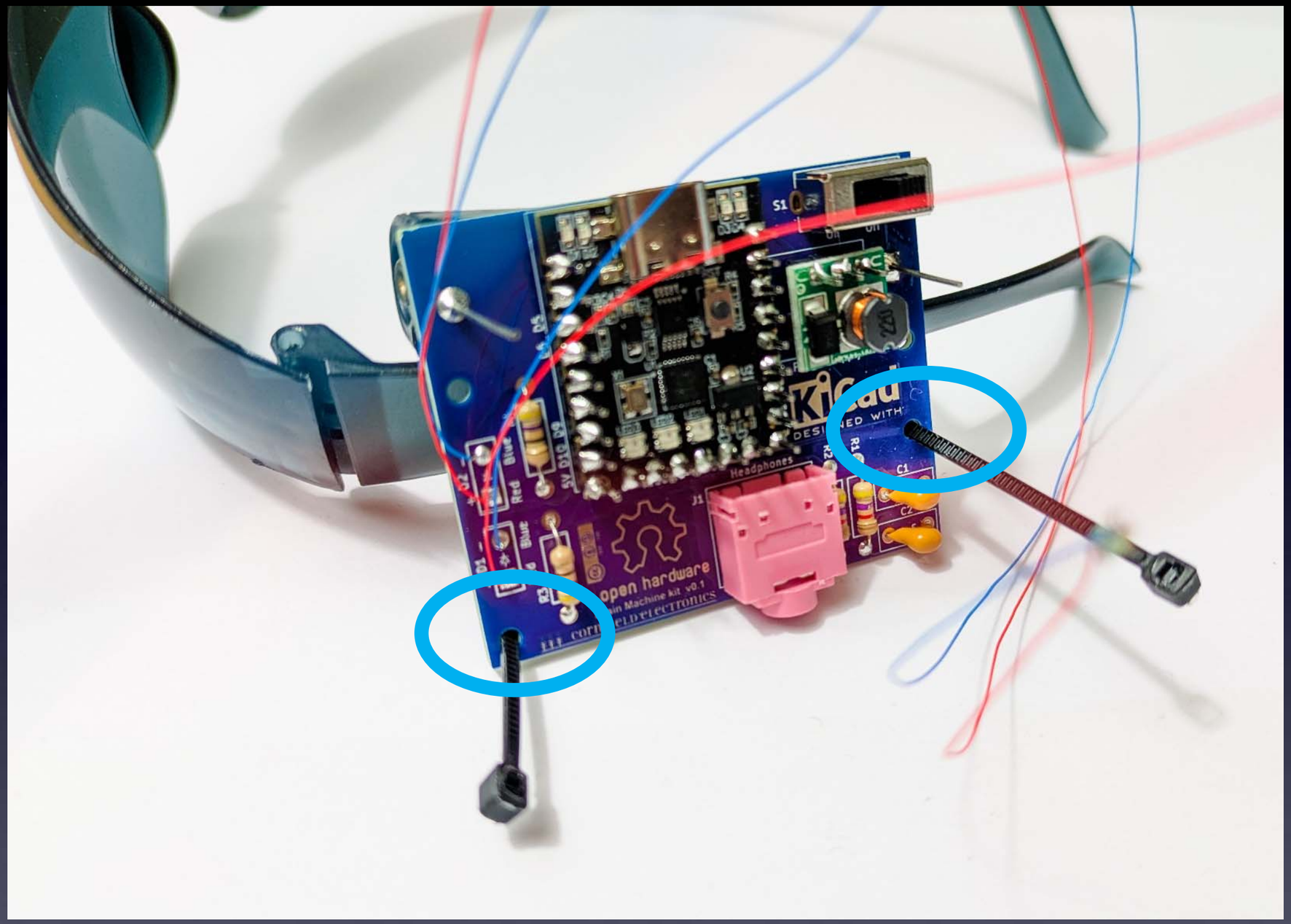
(That will destroy the wire cutters)

Attach Board to Glasses



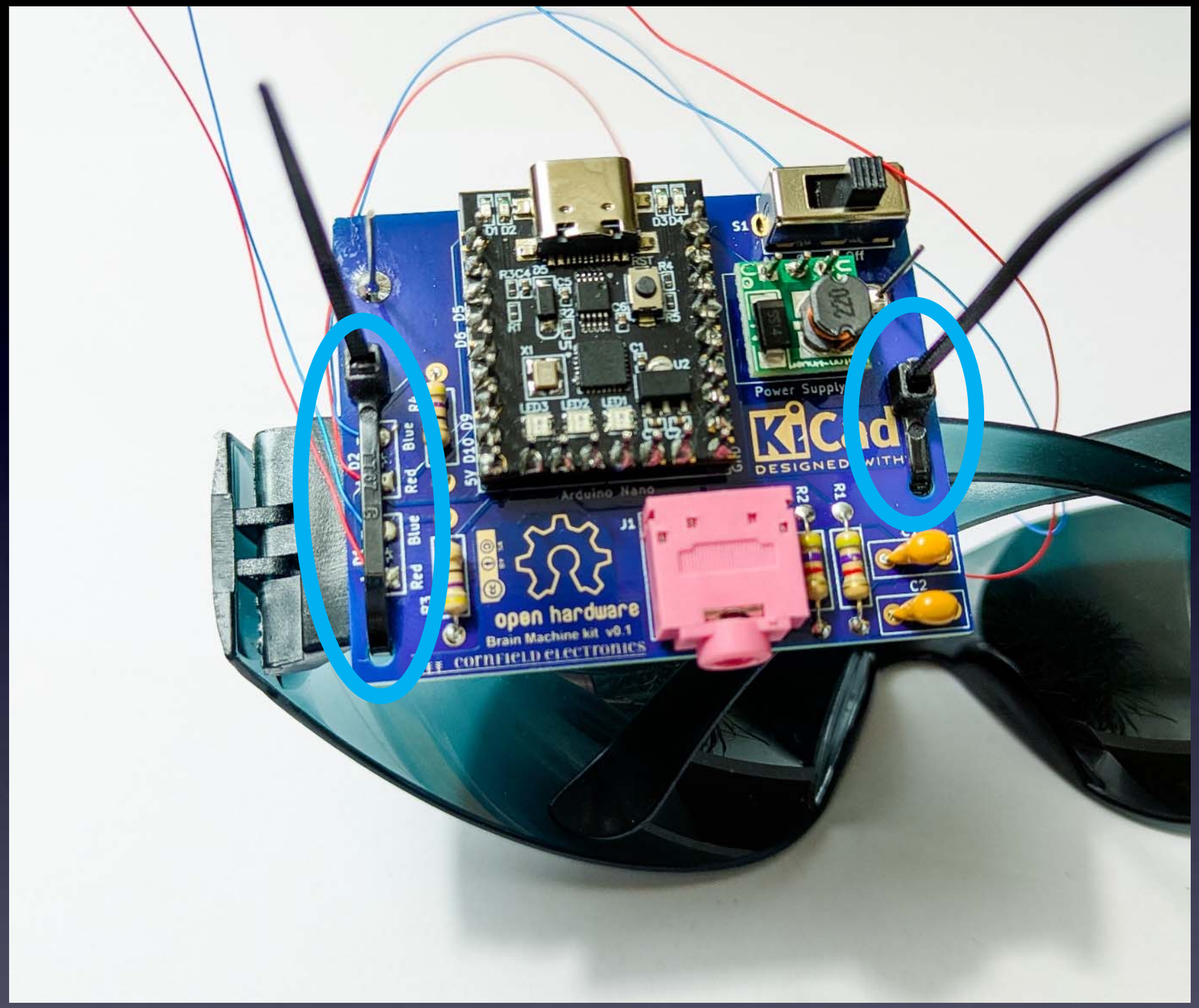
→ Use left side of glasses ←

Attach Board to Glasses



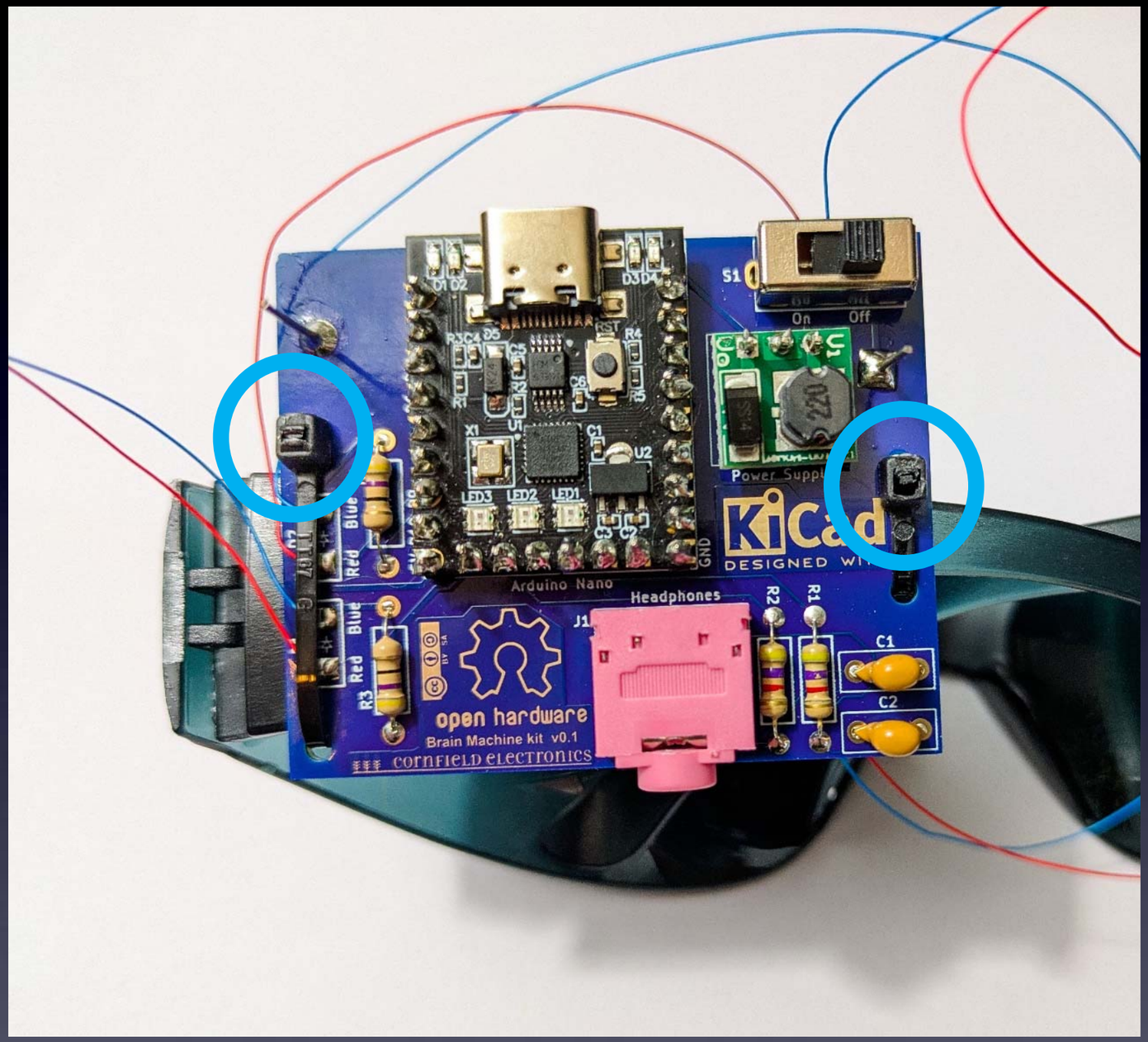
Insert zip-ties into lower mounting holes

Attach Board to Glasses



Wrap zip-ties around, and secure

Attach Board to Glasses



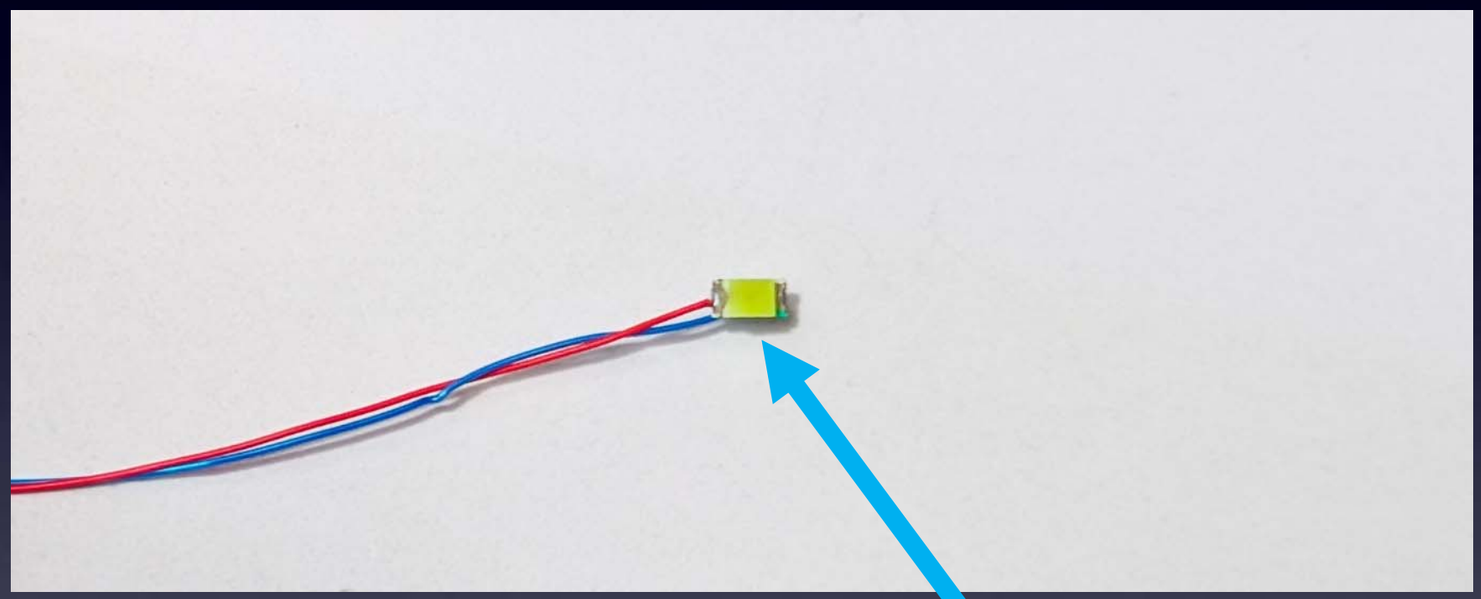
Cut zip-ties short

Mark where LEDs will go

<u>For each eye</u>:

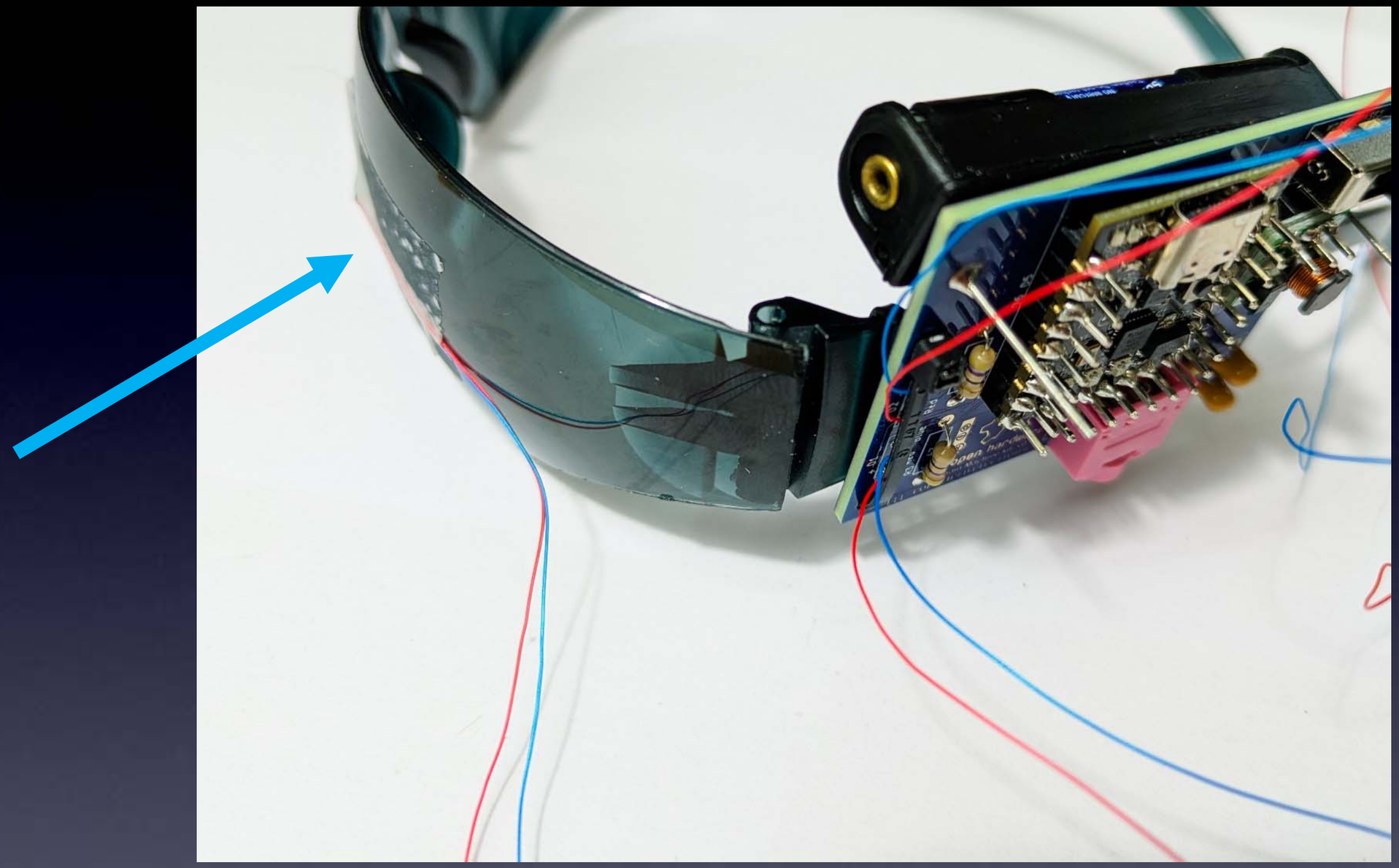
Slowly move the marker toward your eye
to make a mark directly in front of your eye.

LEDs light up on one side



The LEDs light up on the flat white side

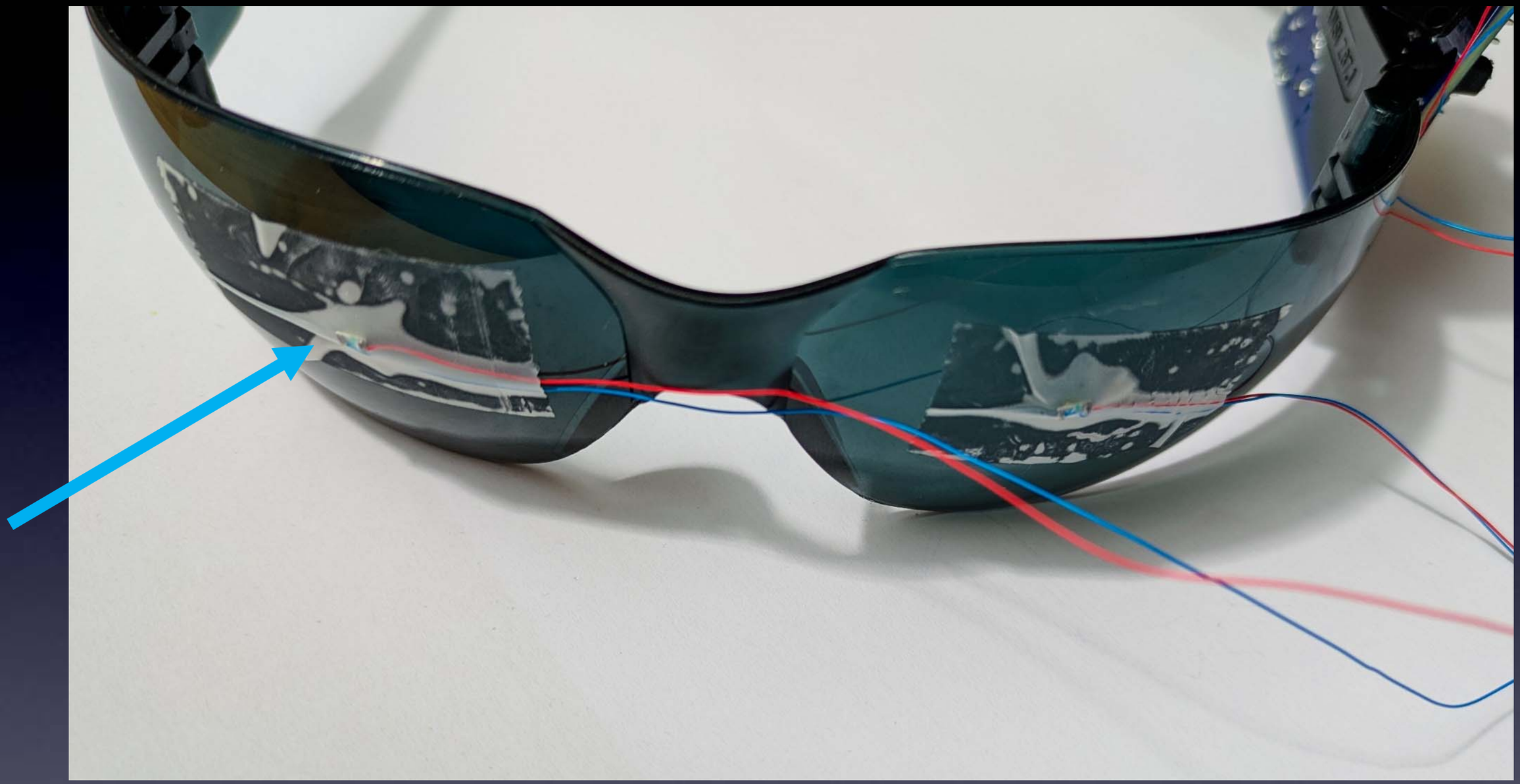
Tape Left LED to Glasses



Tape the flat white side of D1 over the left mark

(so the light will shine on your eye)

Tape Right LED to Glasses



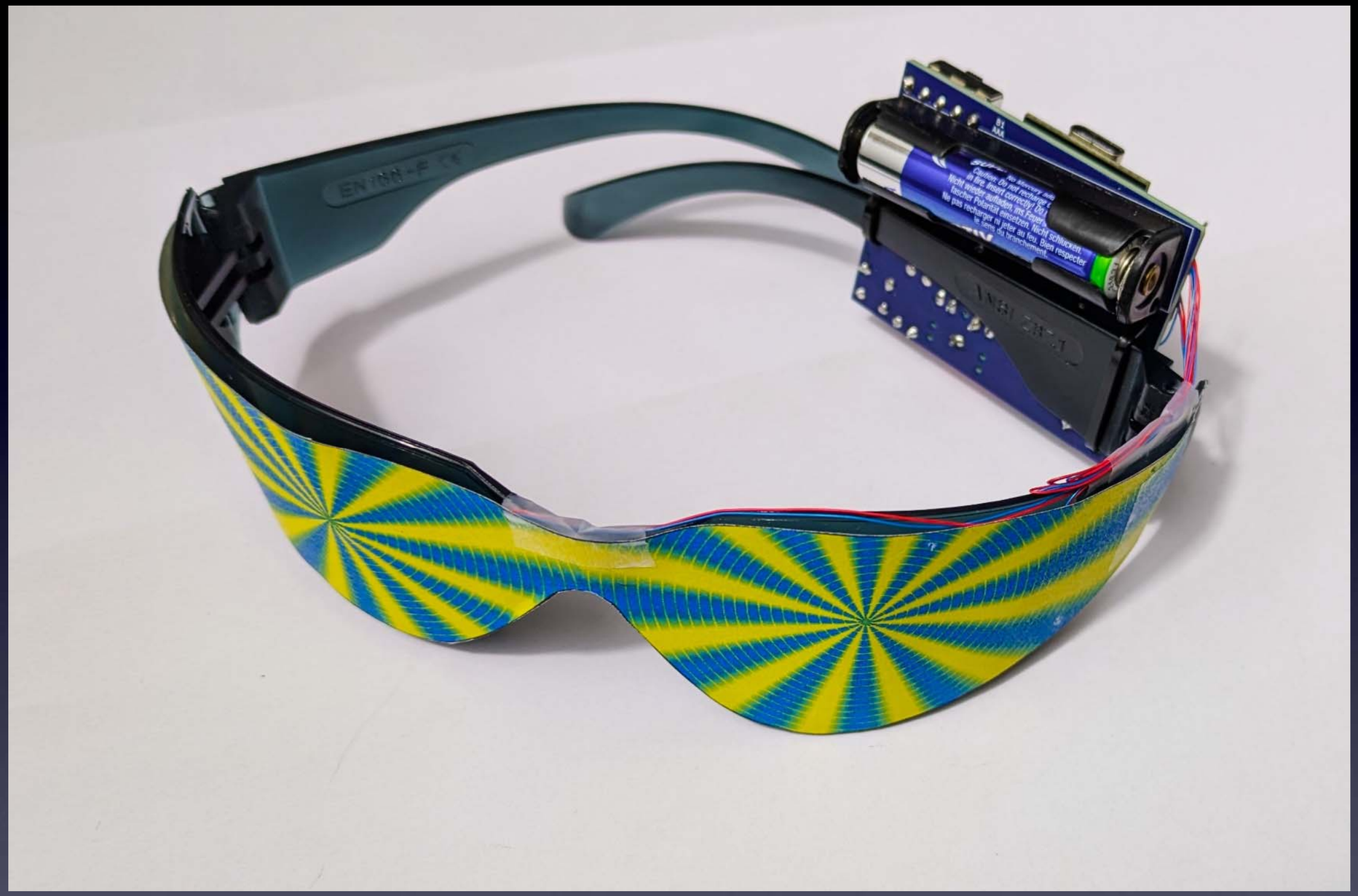
Tape the flat white side of D2 over the right mark

(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.

<u>To program in a new sequence into your Brain Machine, you will need</u>:

- 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:

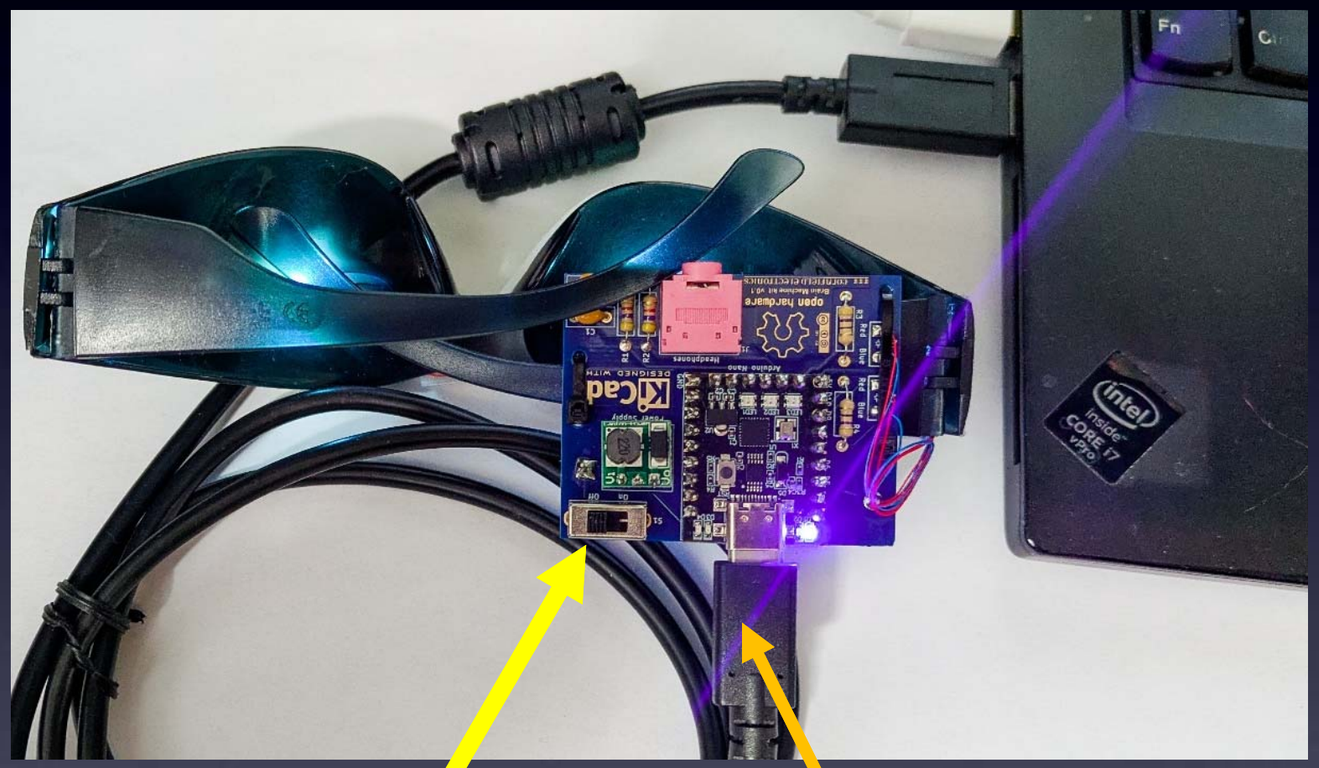
Download the Brain Machine brainwave sequence sketch
<http://cornfieldelectronics.com/cfe/projects.php#brainmachine>

Store it on your computer anywhere you like.

(details on this soon)

Connecting your Brain Machine to your computer

USB-C cable

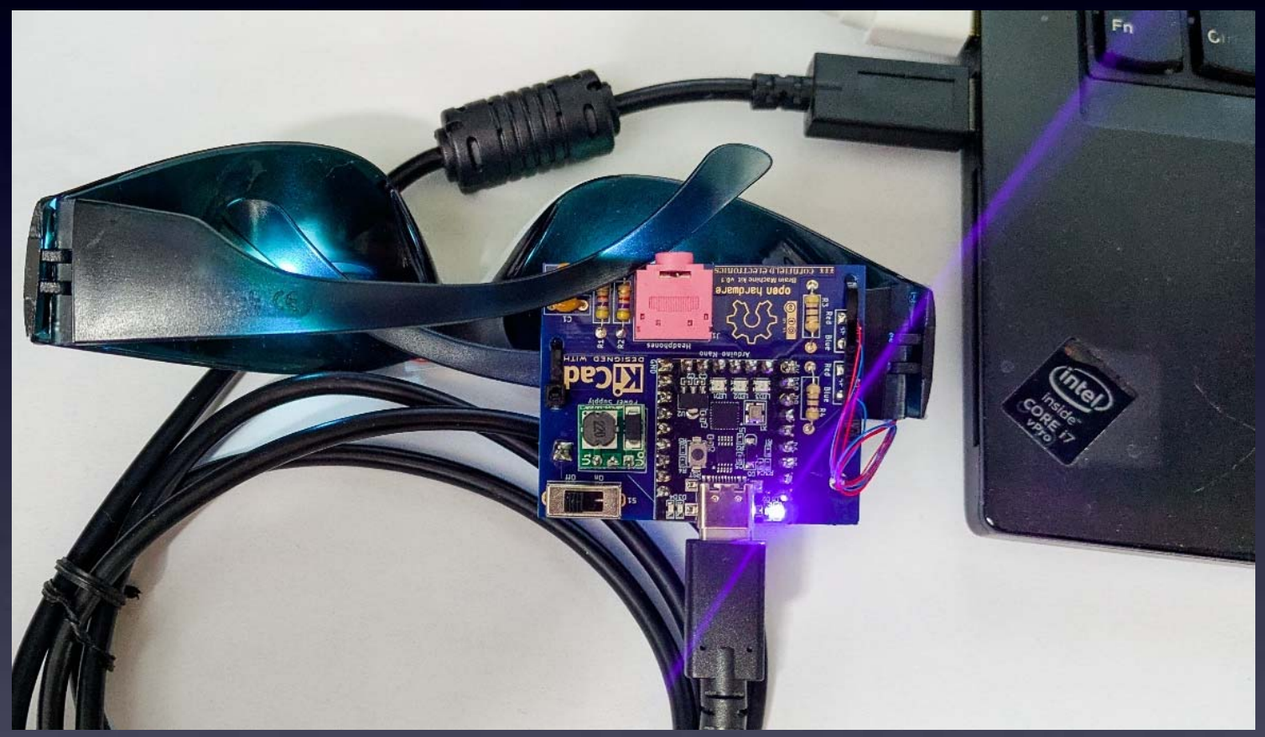


<u>IMPORTANT</u>:
Make sure the Switch on your Brain Machine is *OFF*

to computer's USB

Connecting your Brain Machine to your computer

USB-C cable



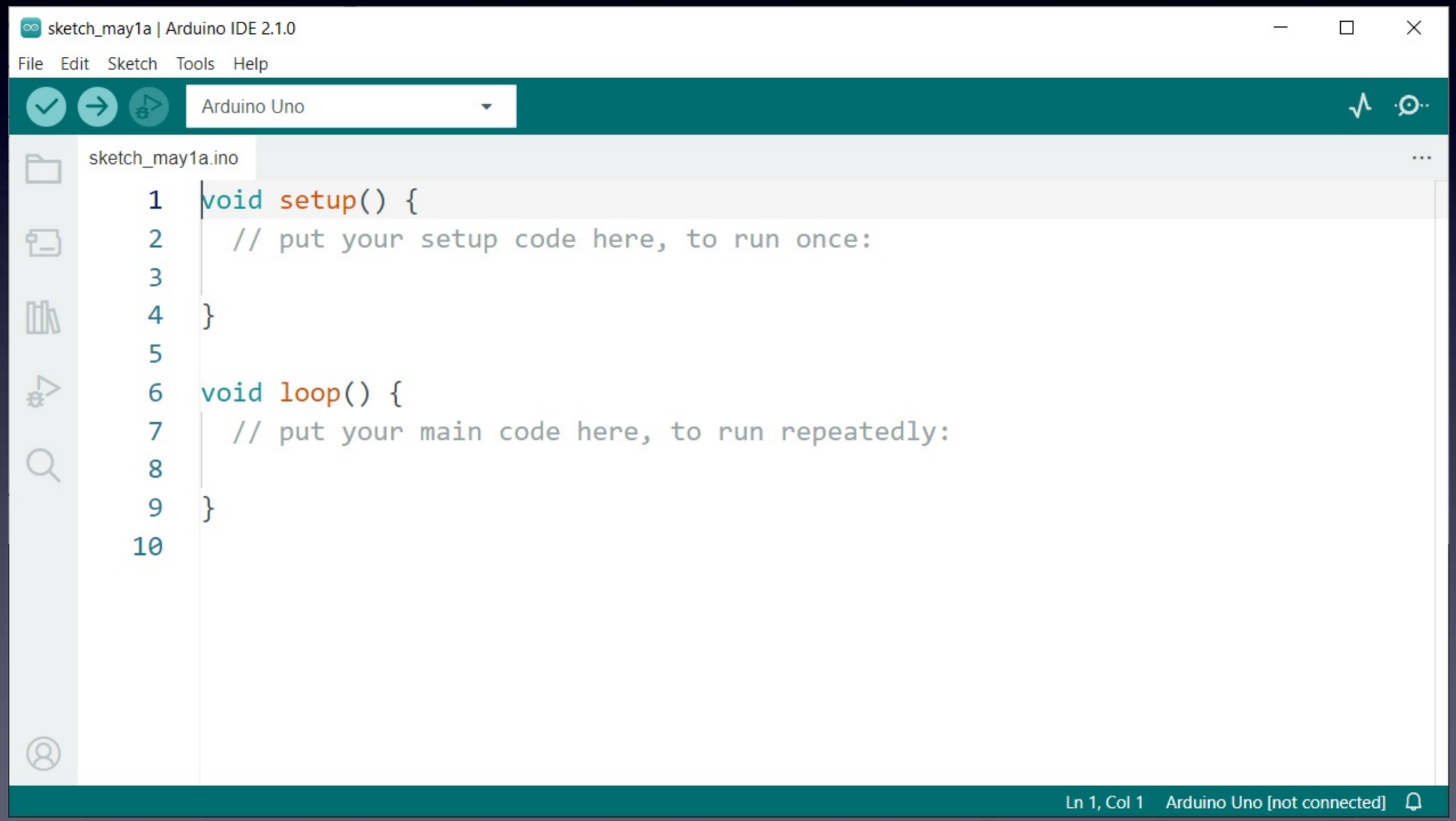
You may need to download and install a driver for your Operating System (Windows, MacOS, or Linux):

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

Or search for: "CH340 driver"

Arduino

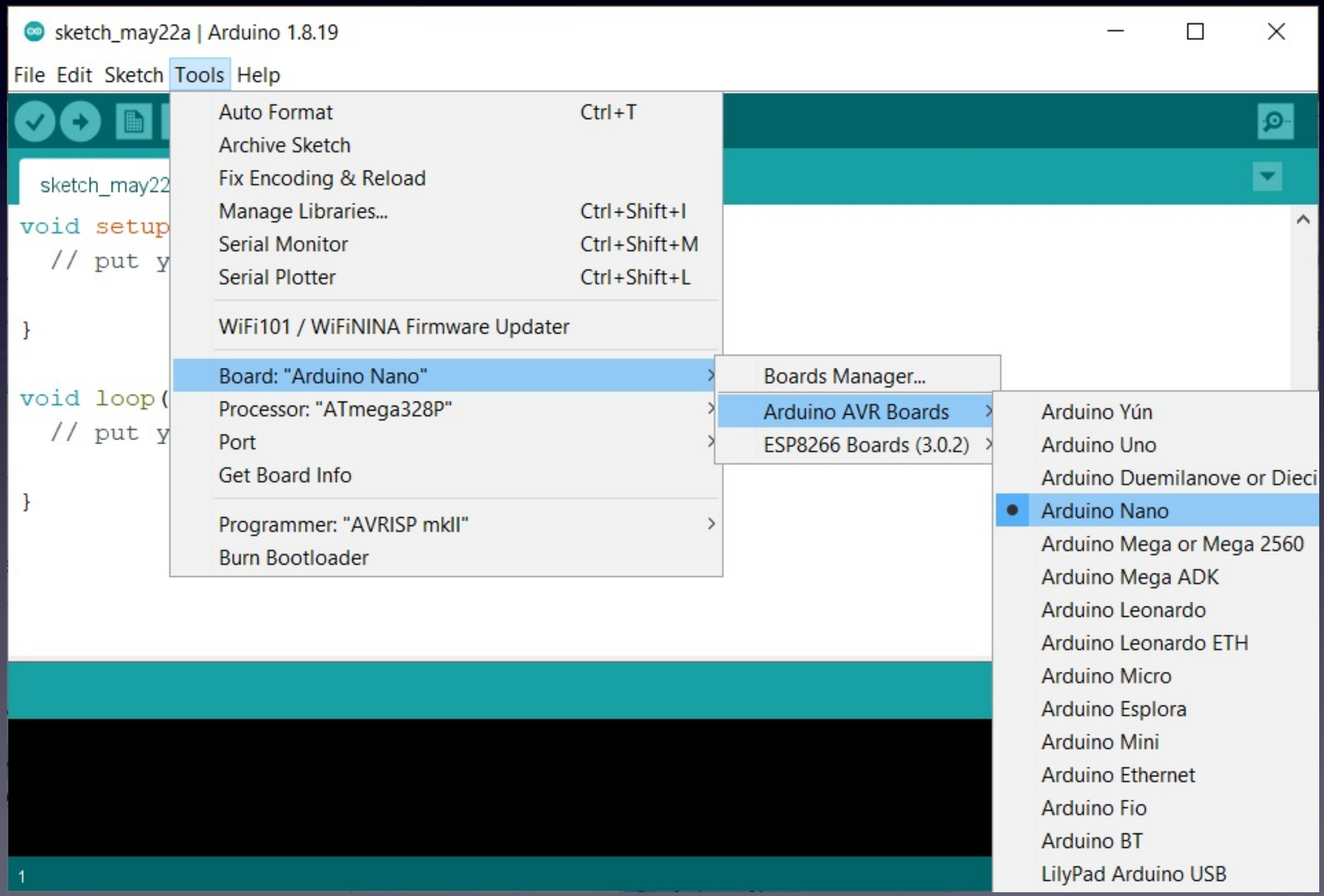
After you download and install the Arduino software start it, and you will see a screen that looks like this:



Arduino

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

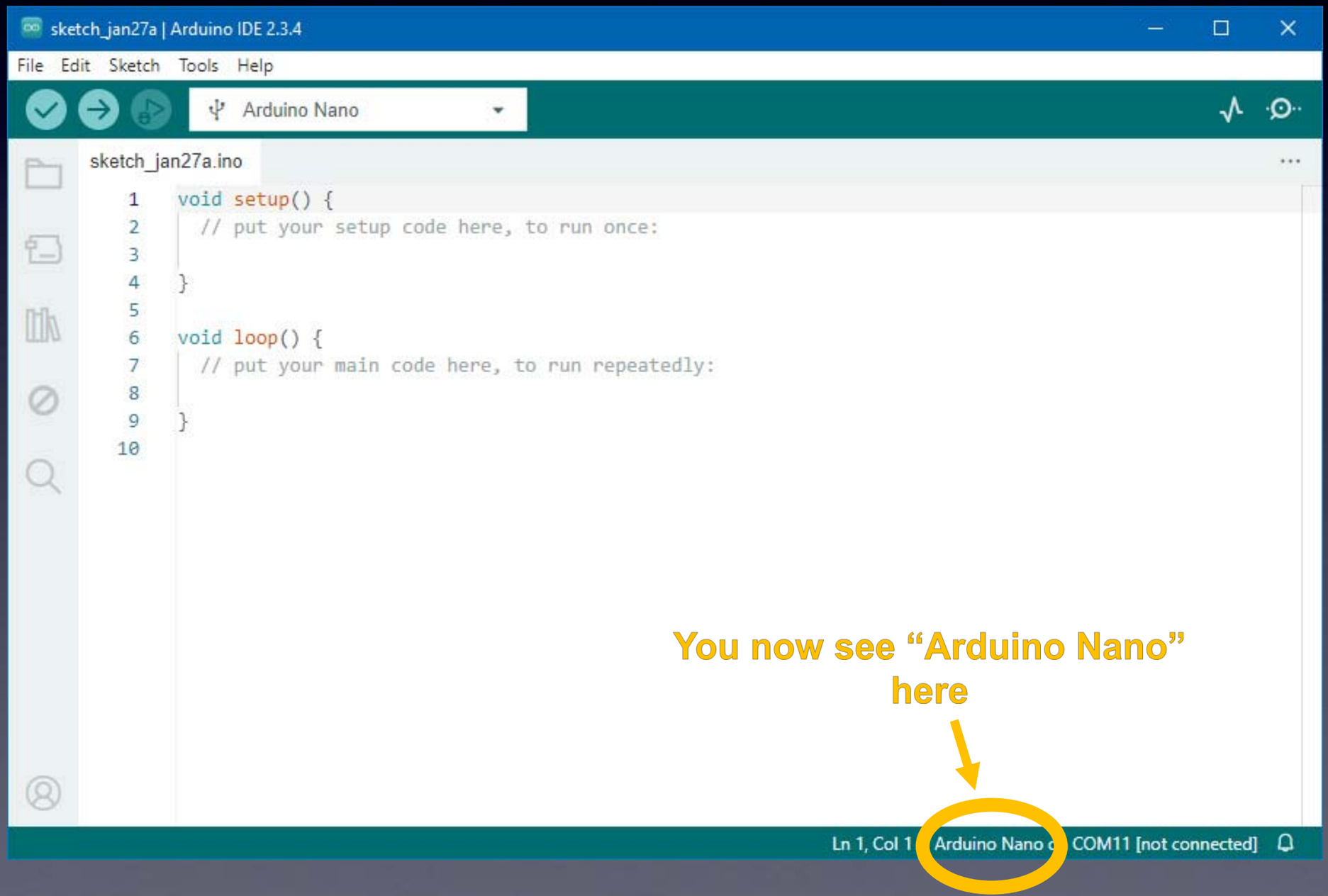
(1) Choose “Arduino Nano” as the Board



Arduino

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

(1)
Choose “Arduino Nano” as the Board

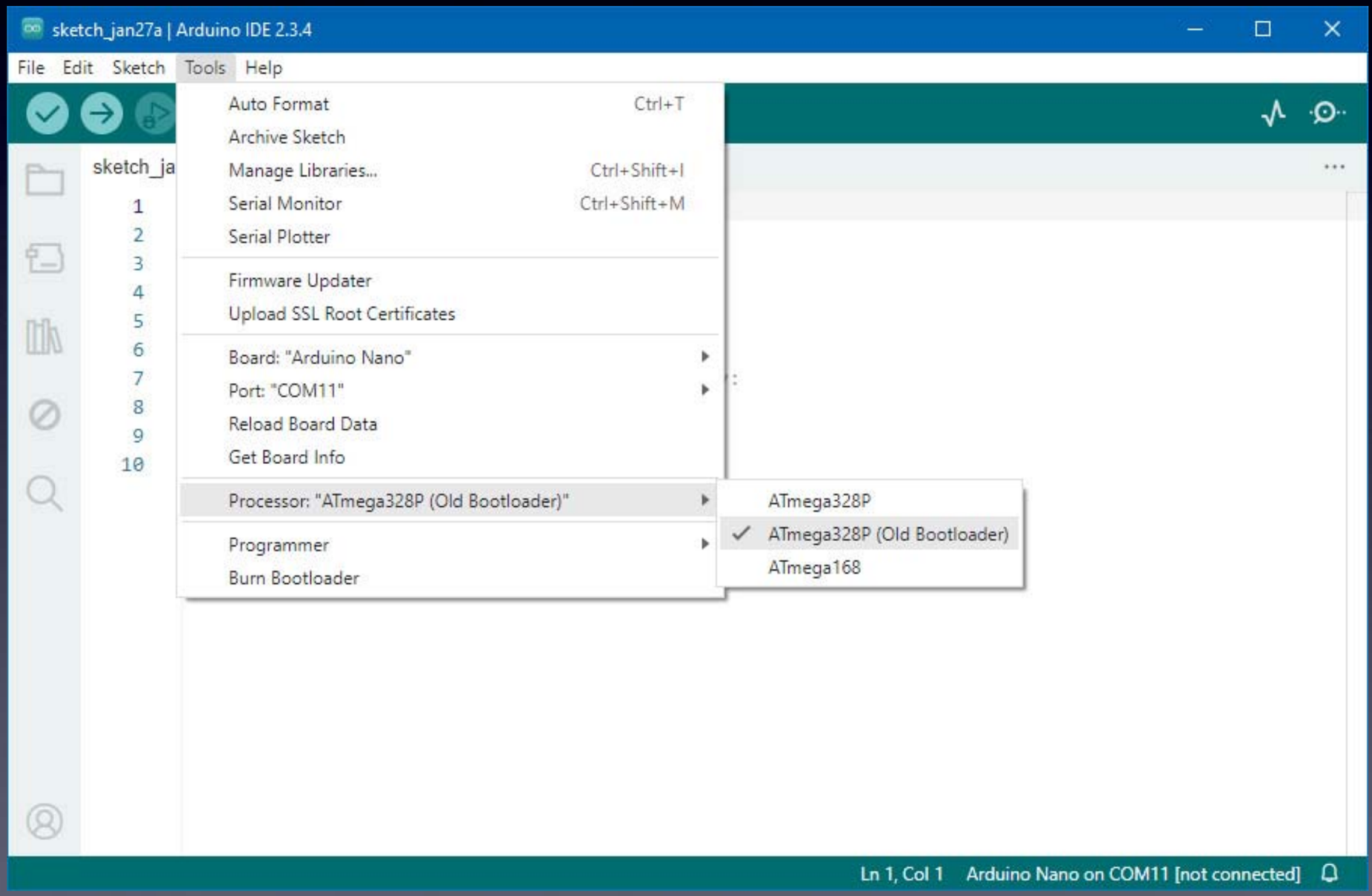


Arduino

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

(2)
Choose your Processor

“ATmega328P (Old Bootloader)”

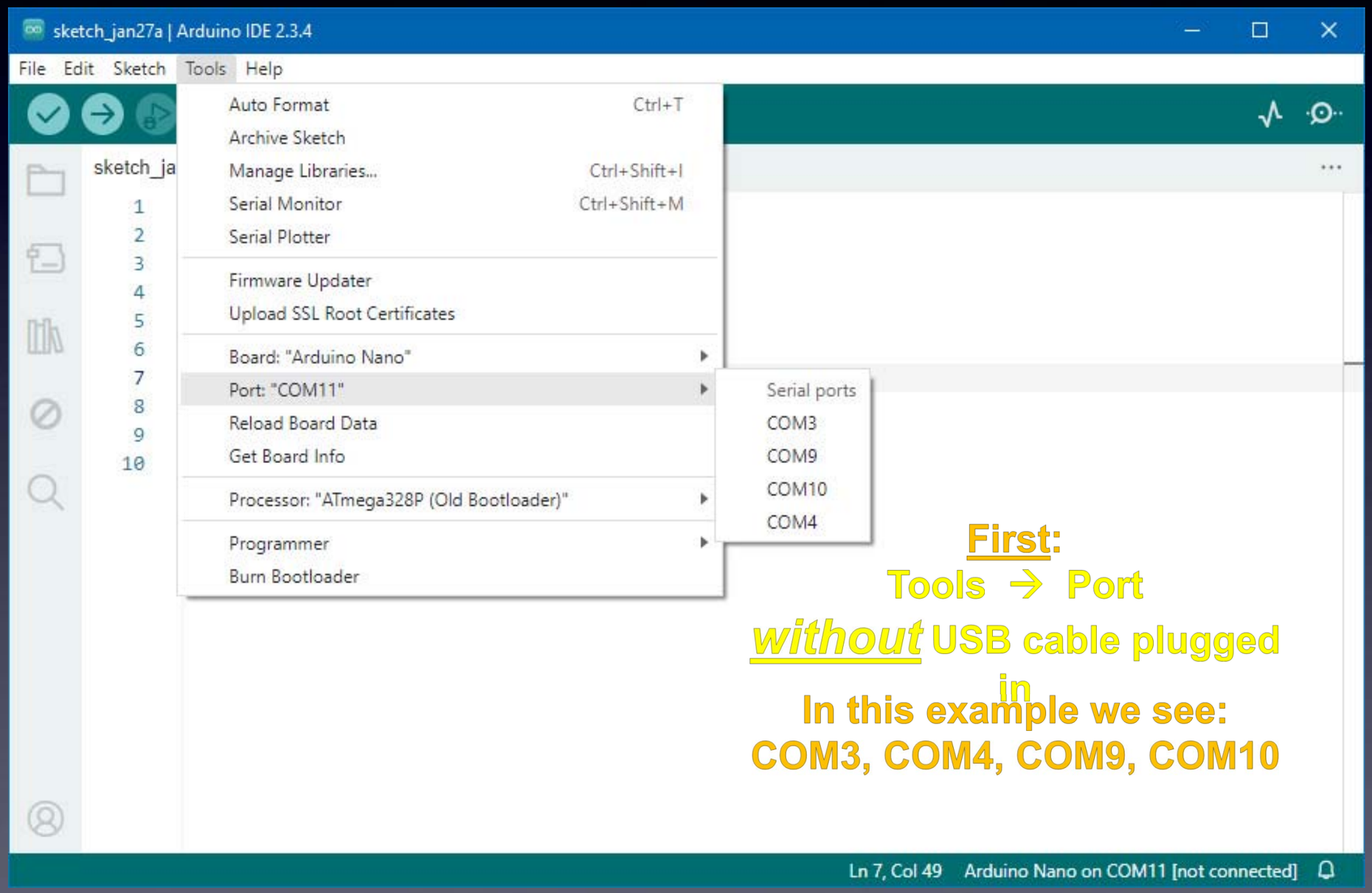


If this one doesn’t work, then choose “ATmega328P”

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)

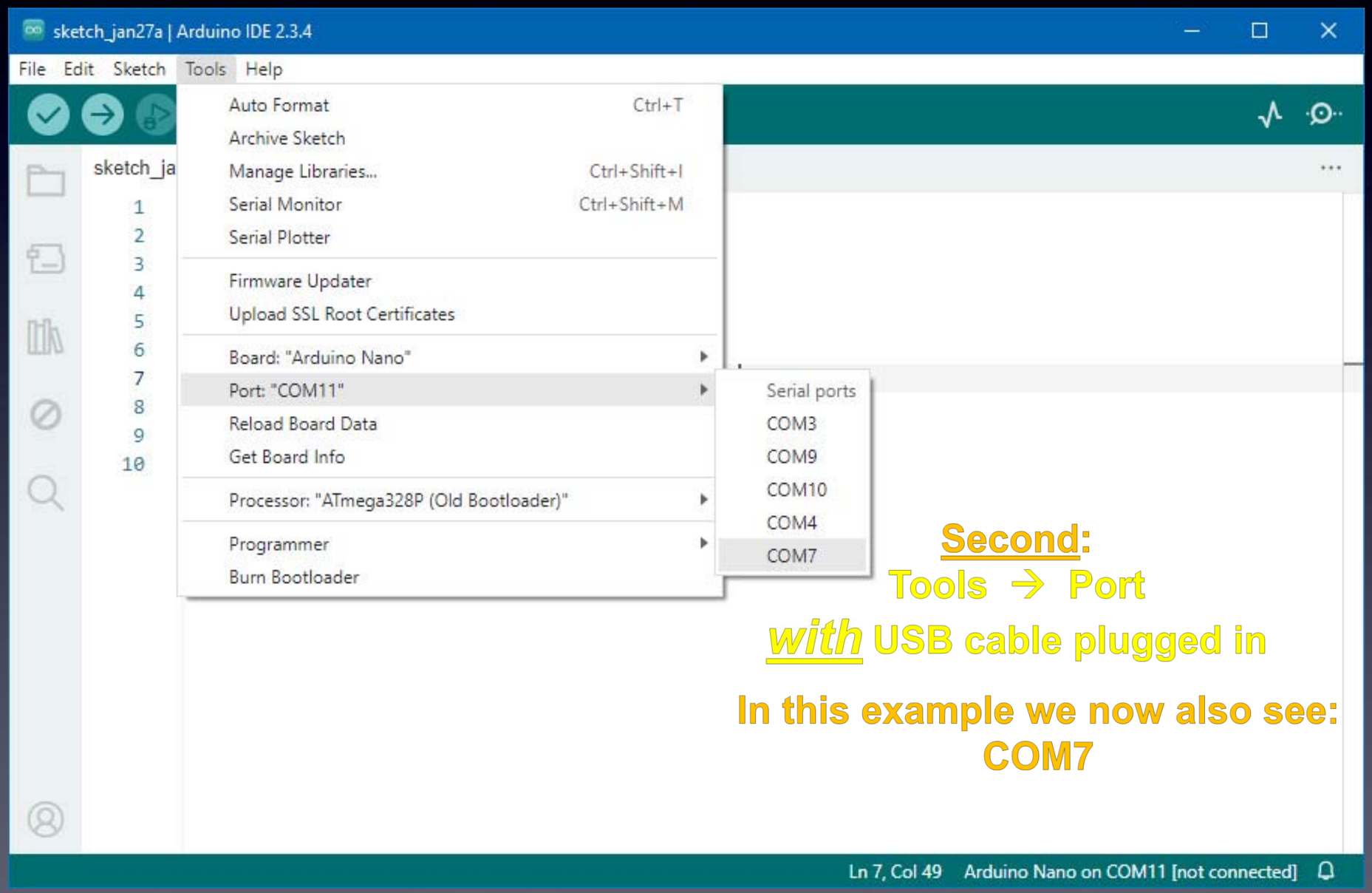


Arduino

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**

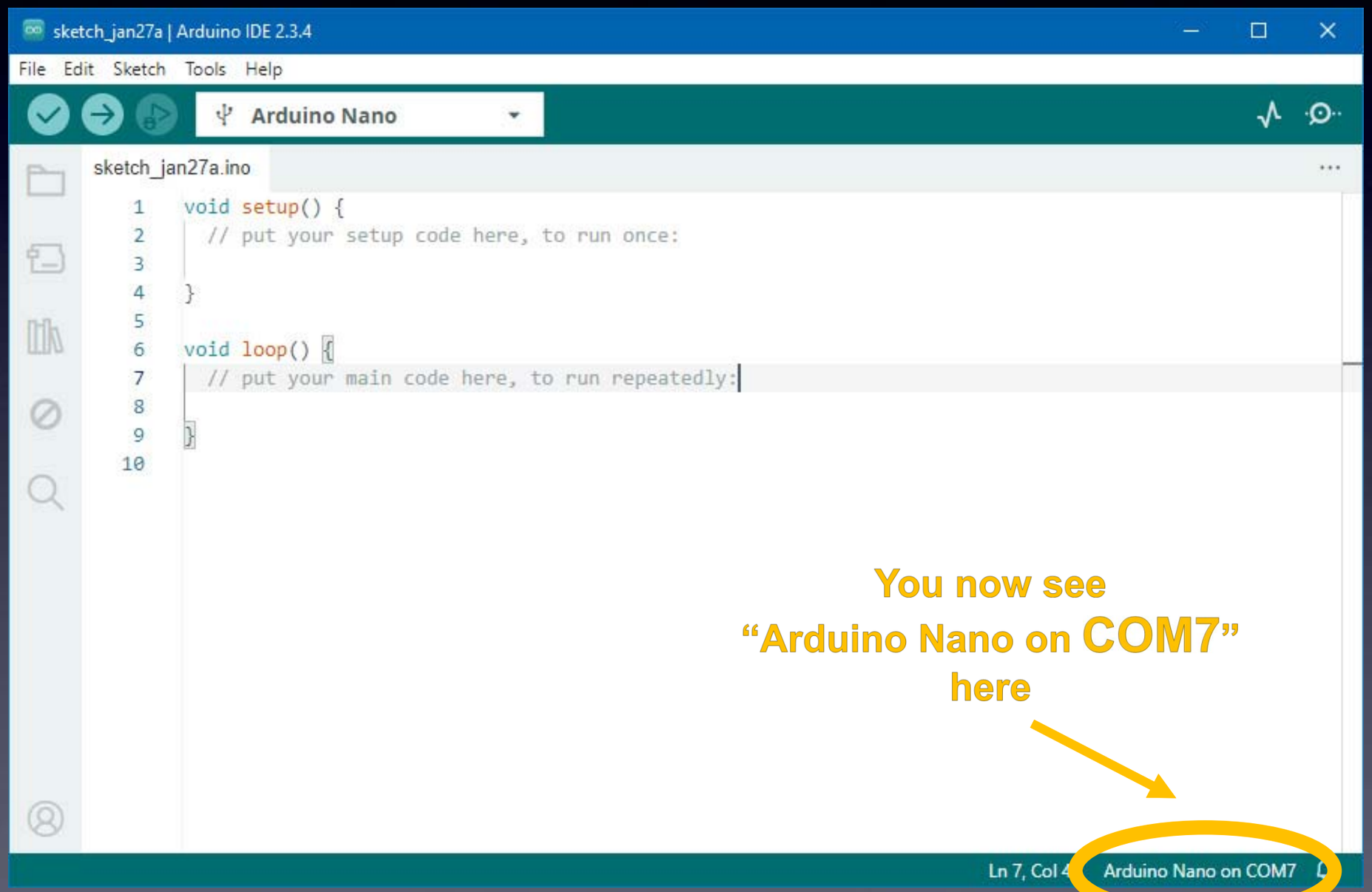
In this example we now also see: COM7

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.)

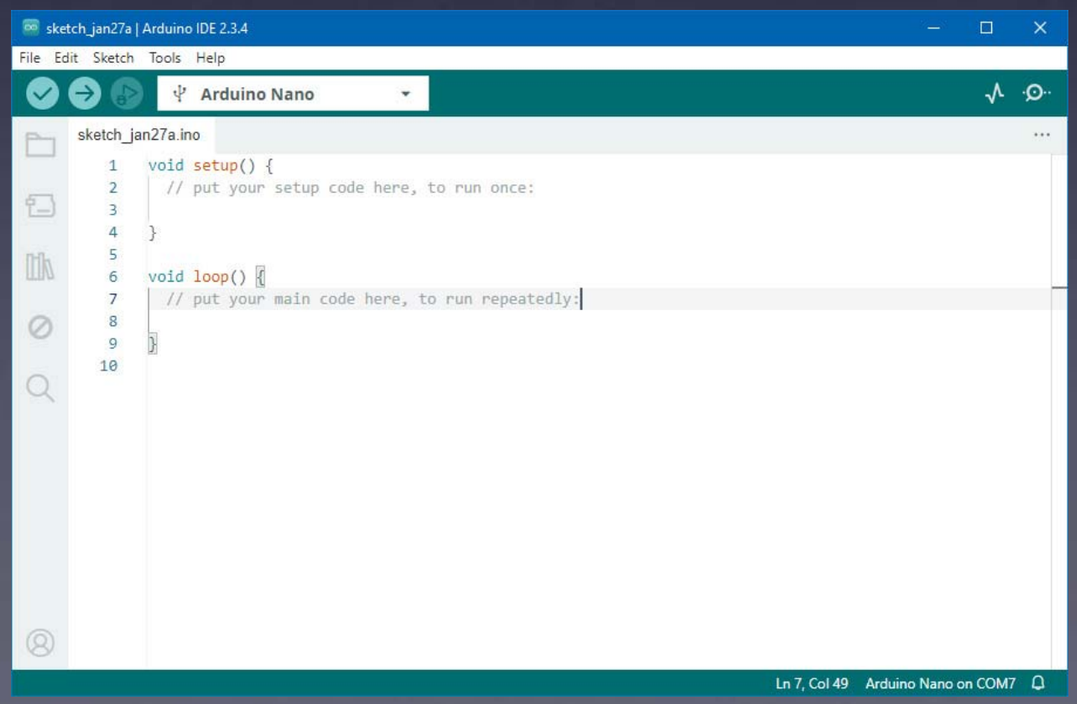


Arduino

Your Arduino software is now ready

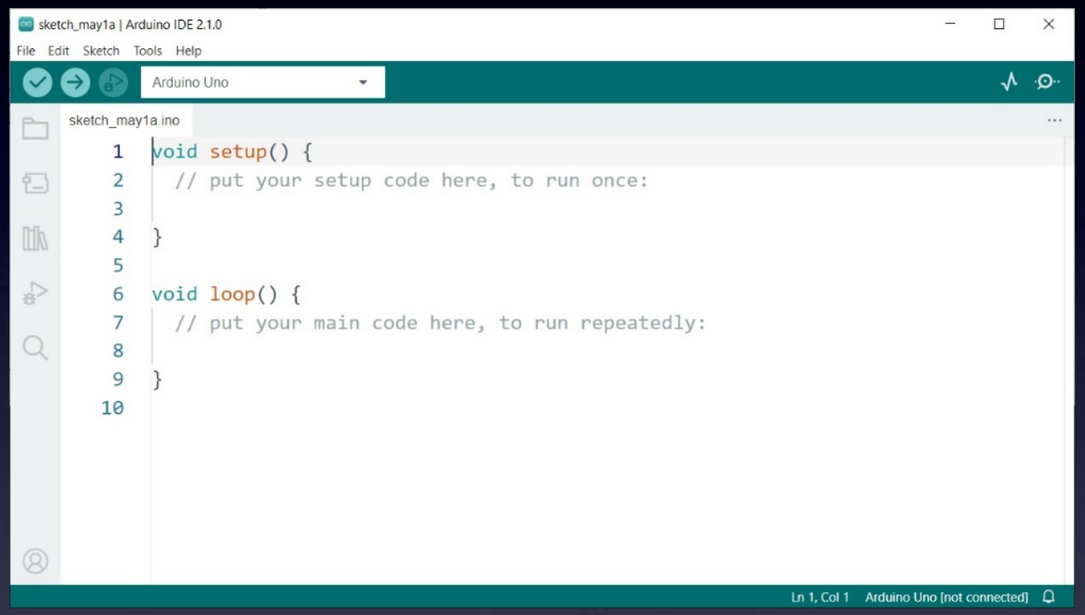
to program a new brainwave sequence sketch

into your Brain Machine !



Arduino

Designed for non-geeky artists



Definition of

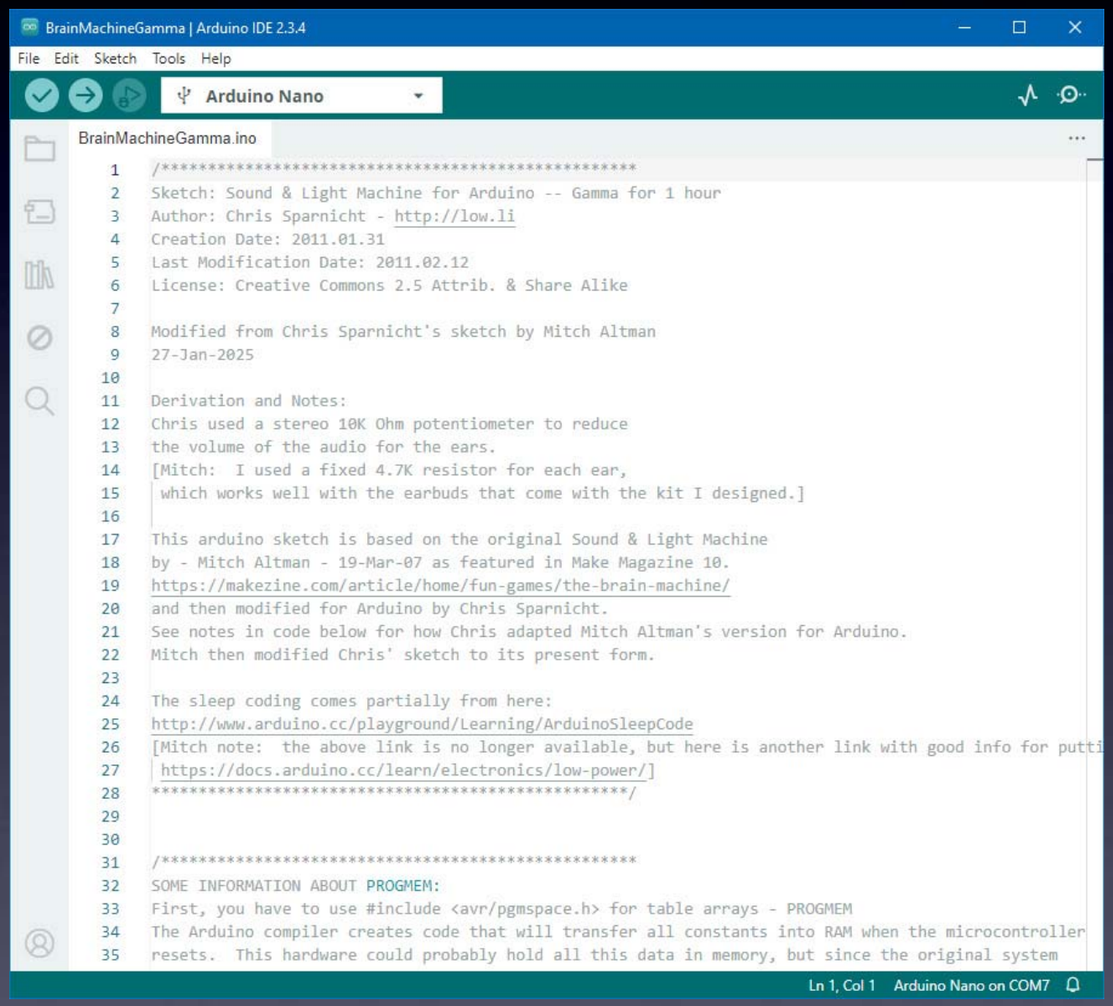
“Sketch” :

an Arduino program

Arduino

Designed for non-geeky artists

Download the new Gamma “sketch”



“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

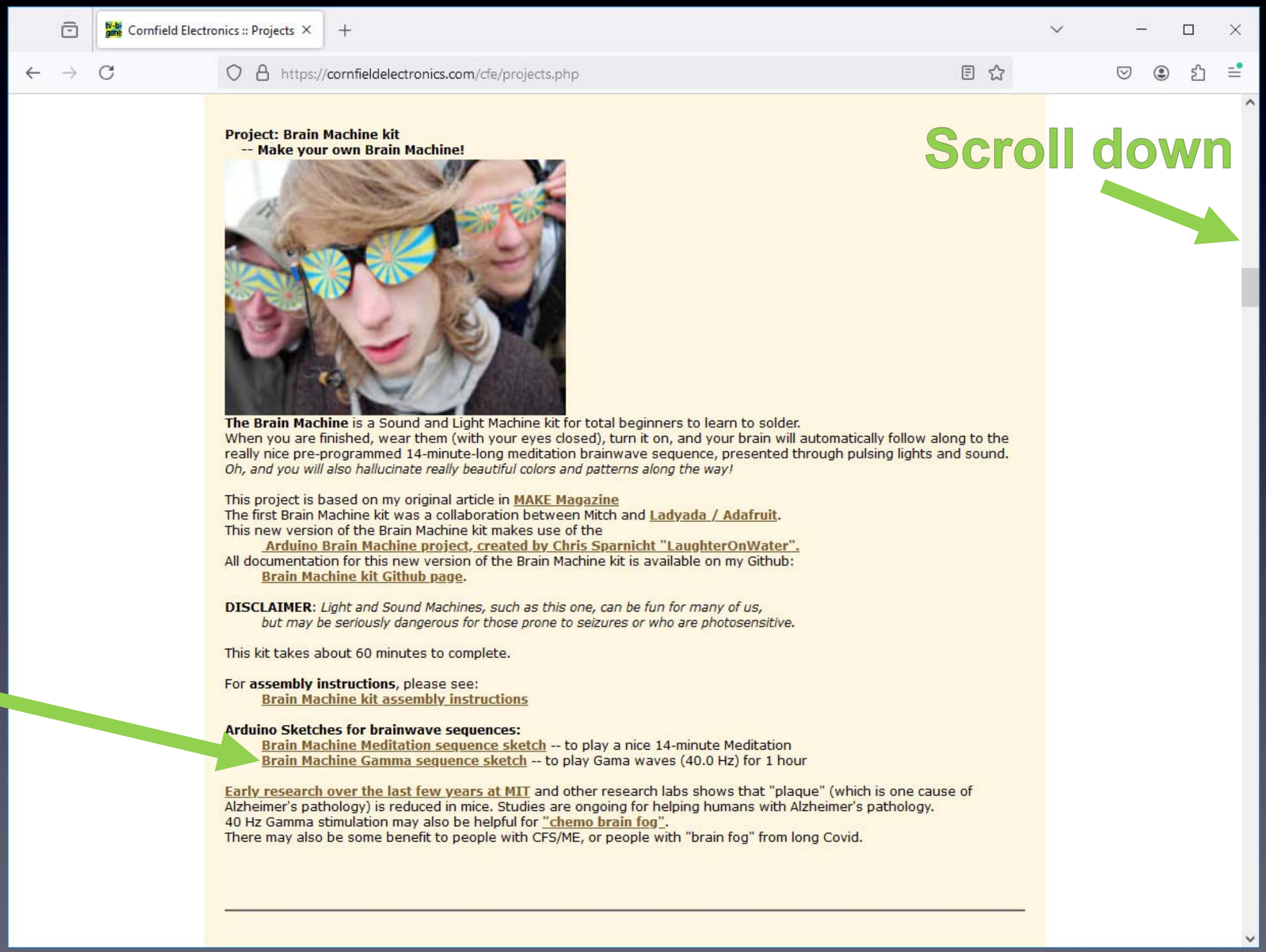
Download a new brainwave sequence “sketch”

“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.

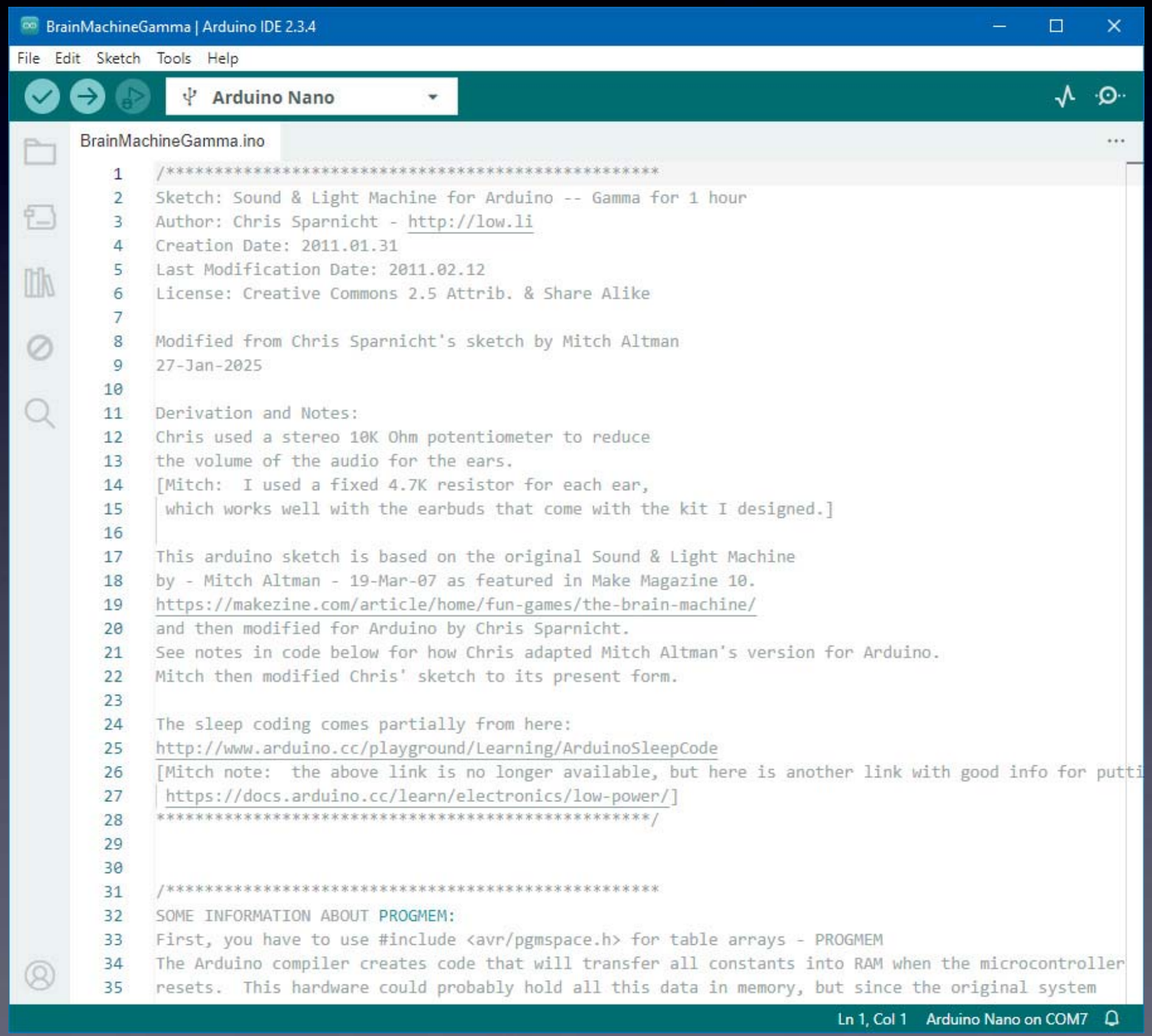
For **assembly instructions**, please see:
Brain Machine kit assembly instructions

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.

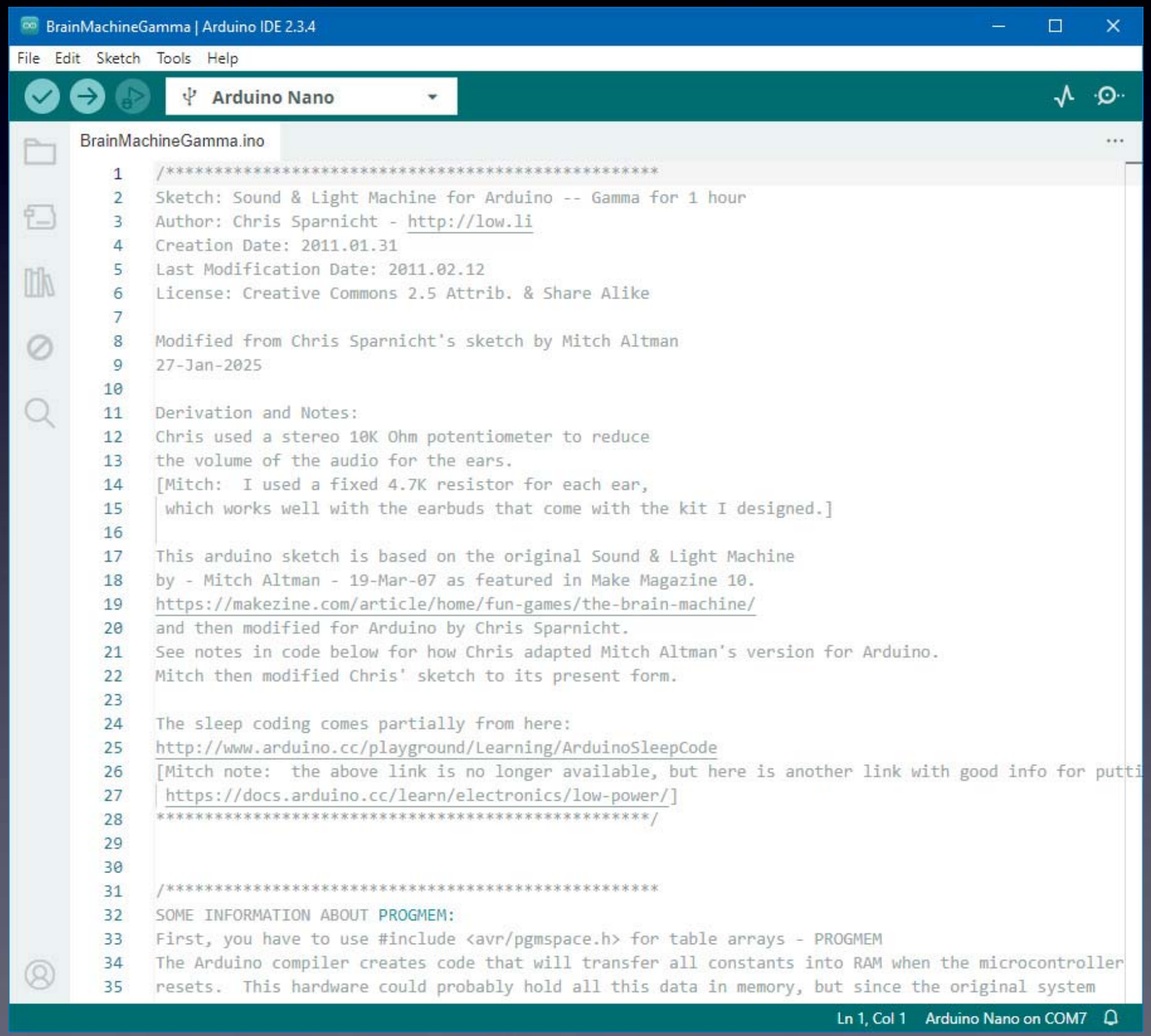
Arduino

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



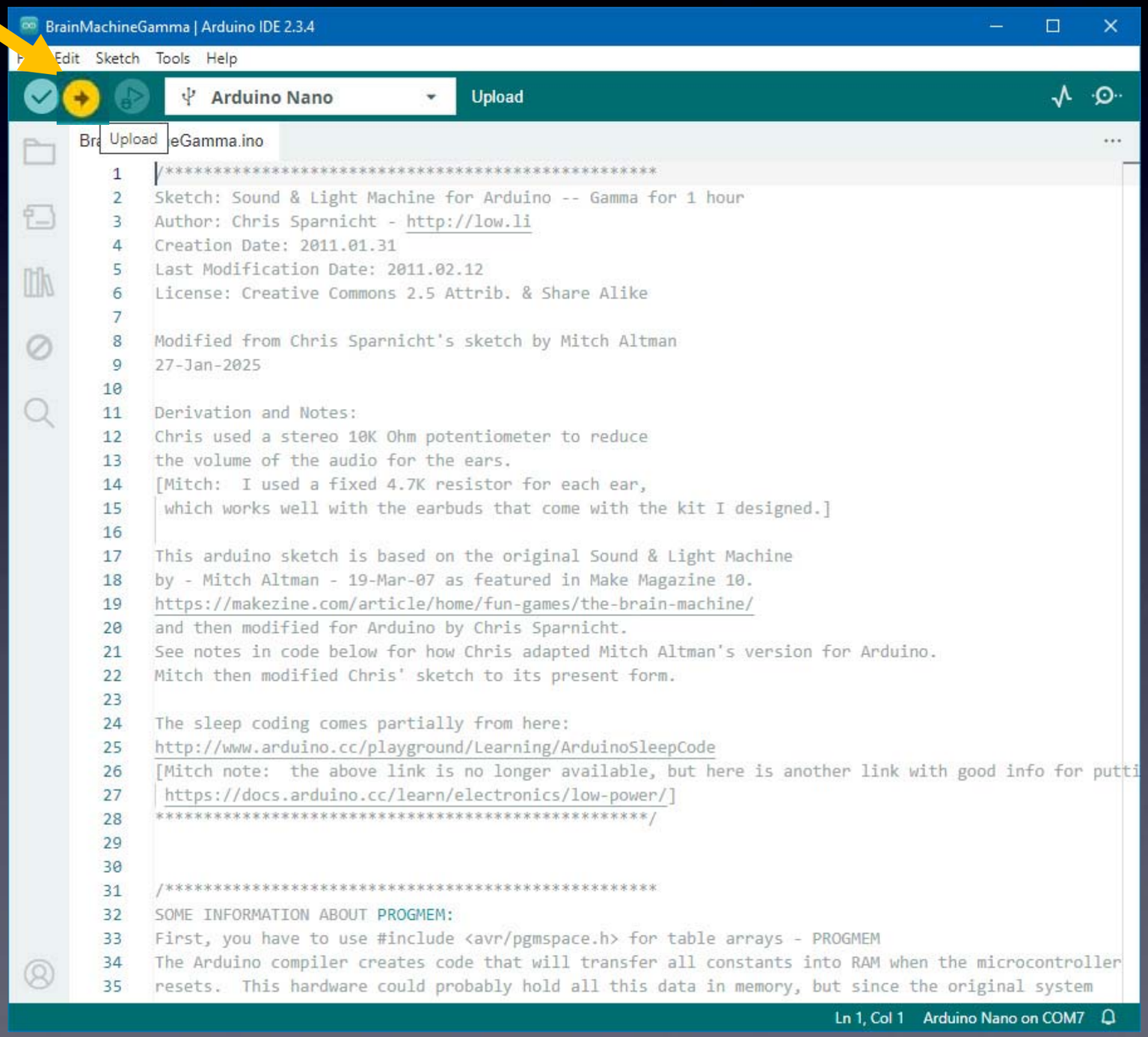
Arduino

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



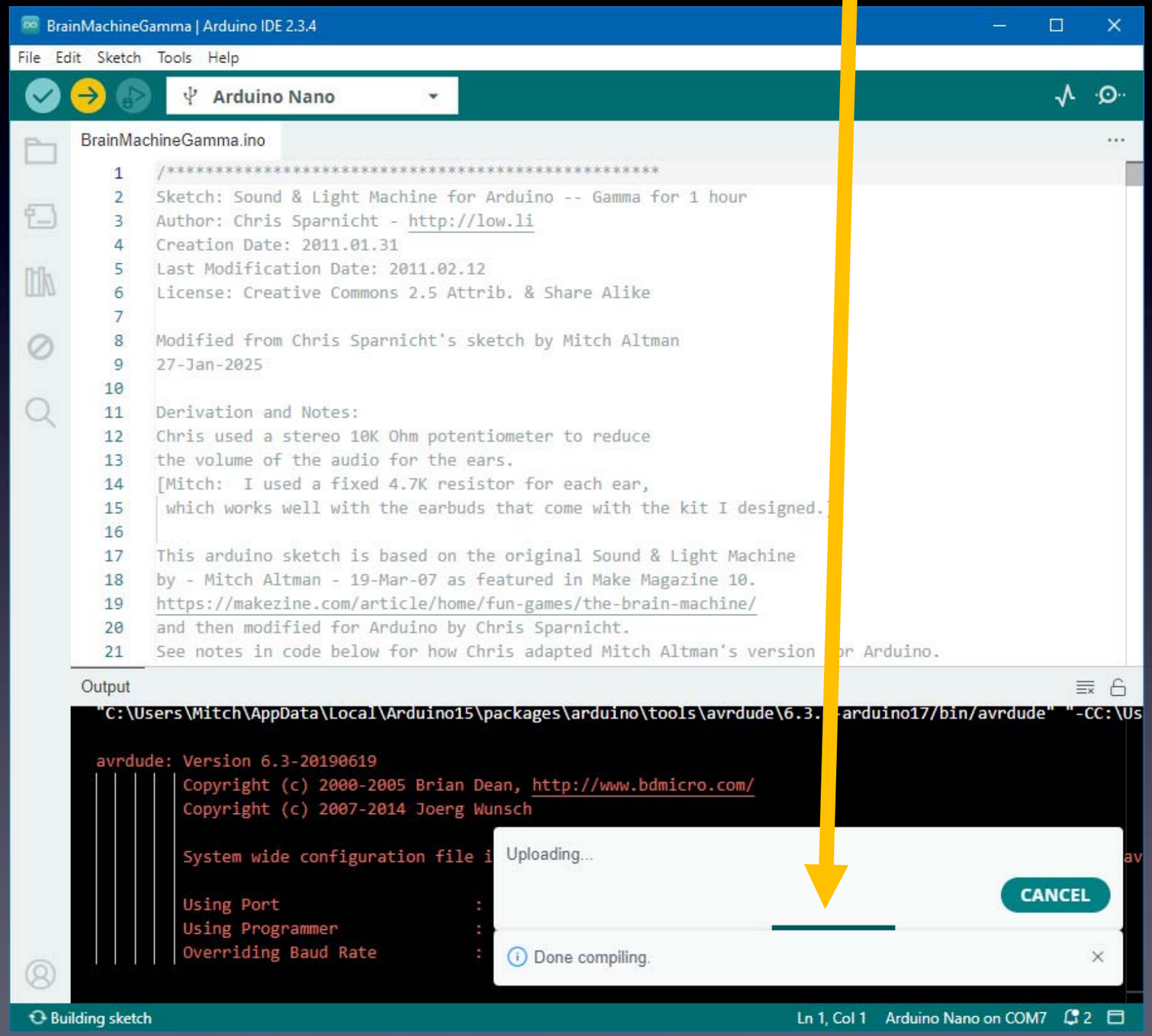
Arduino

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

21-Apr-2025

Brain Machine kit

Assembly Instructions

& Programming Instructions

open source hardware

CORNFIELD ELECTRONICS