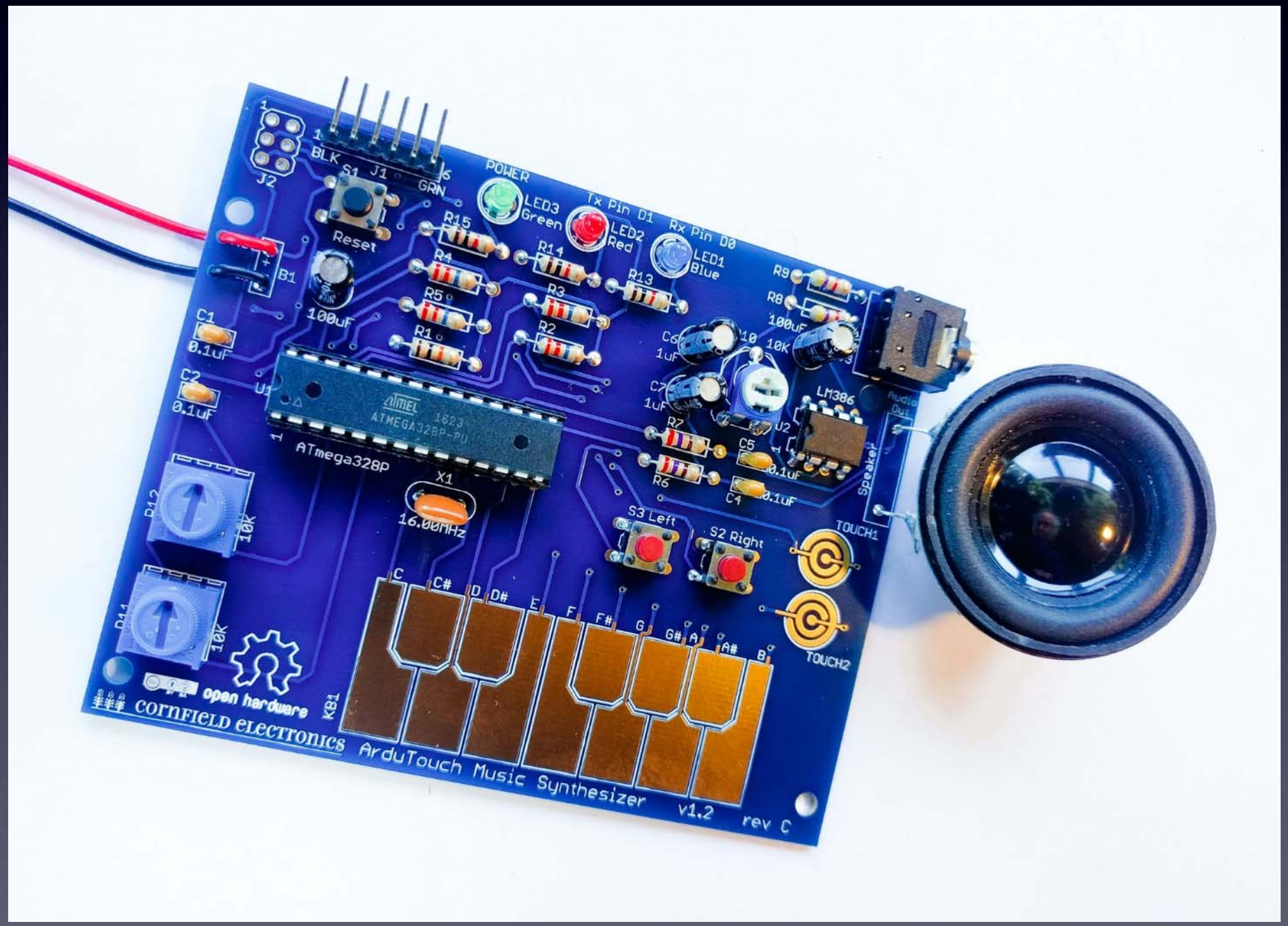
7-Jun-2023

ArduTouch Music Synthesizer

Assembly Instructions



rev C

CORNFIELD ELECTRONICS

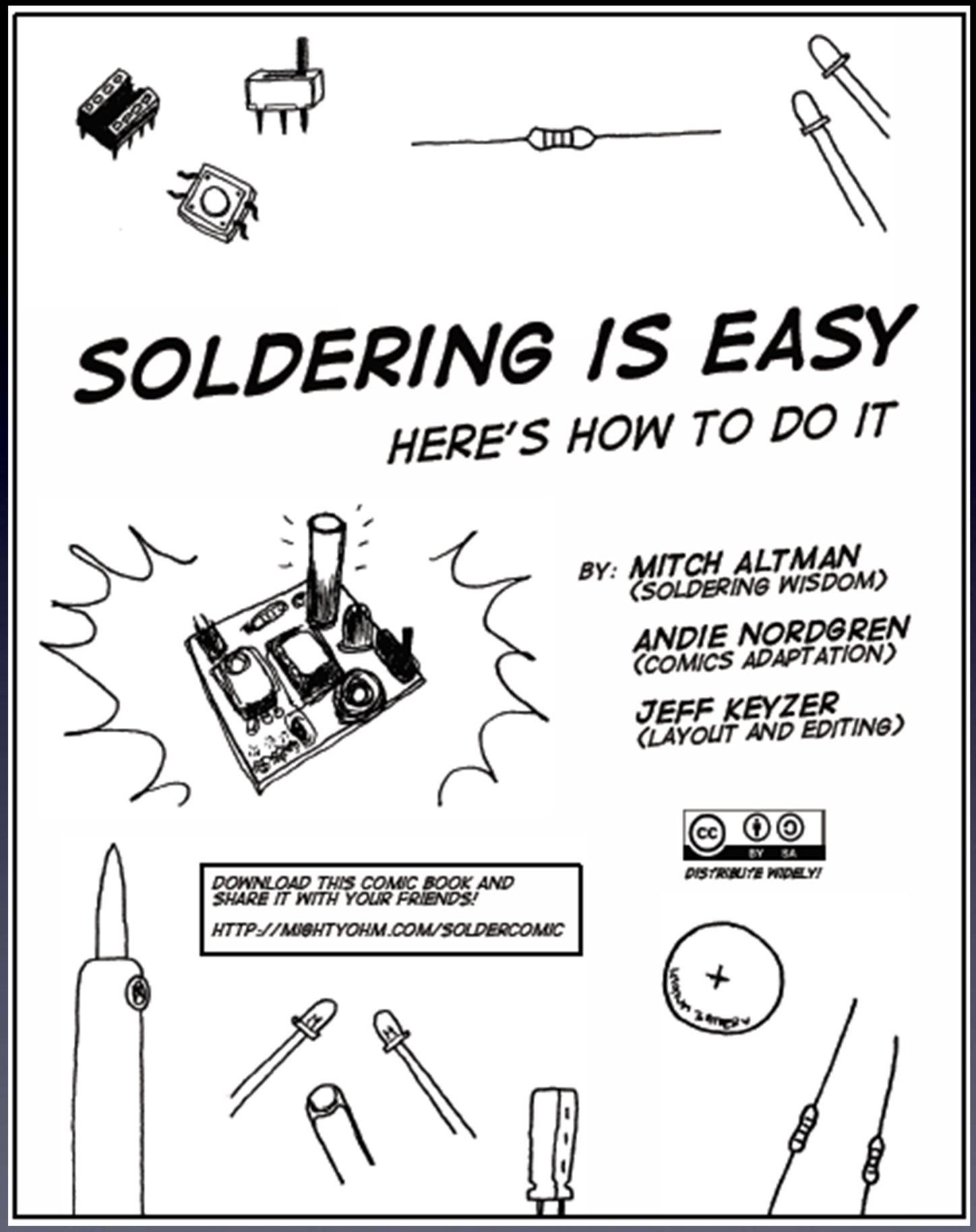
Learn To Solder

The following photos will
show you how to solder.

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

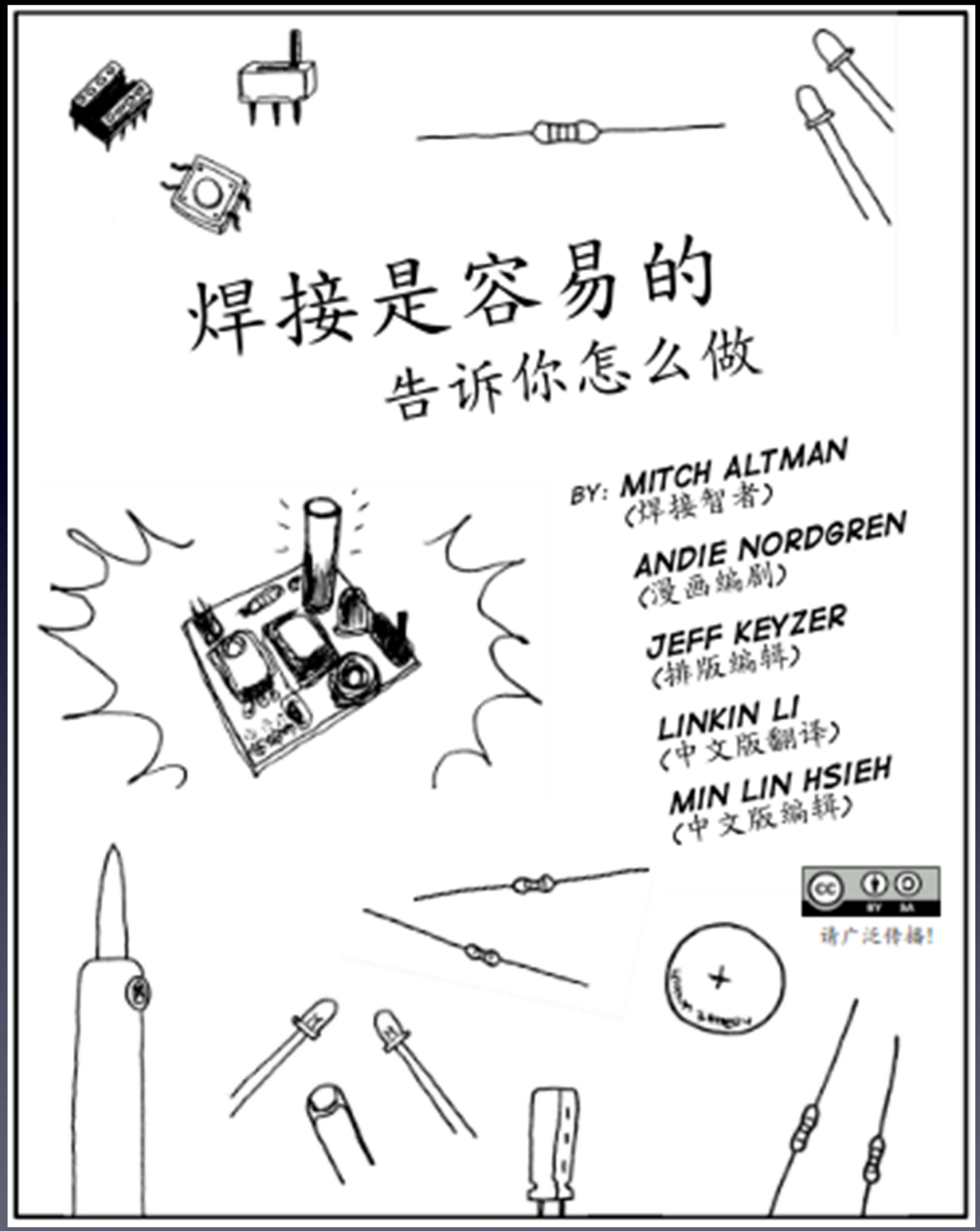
download for free at:
http://mightyohm.com/soldercomic

Learn To Solder



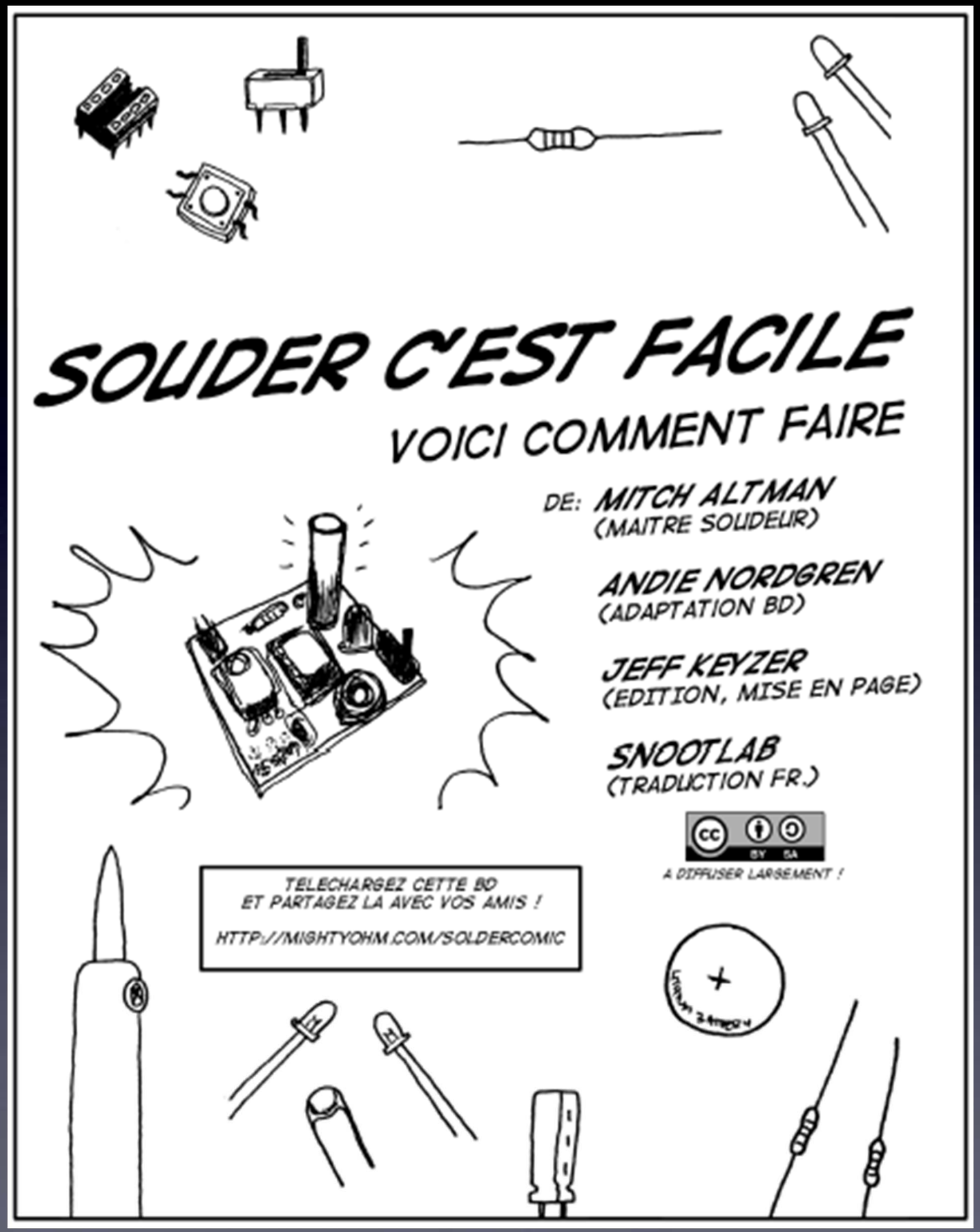
download for free at:
http://mightyohm.com/soldercomic

Learn To Solder



Download in the language of your choice for free at:
http://mightyohm.com/soldercomic

Learn To Solder



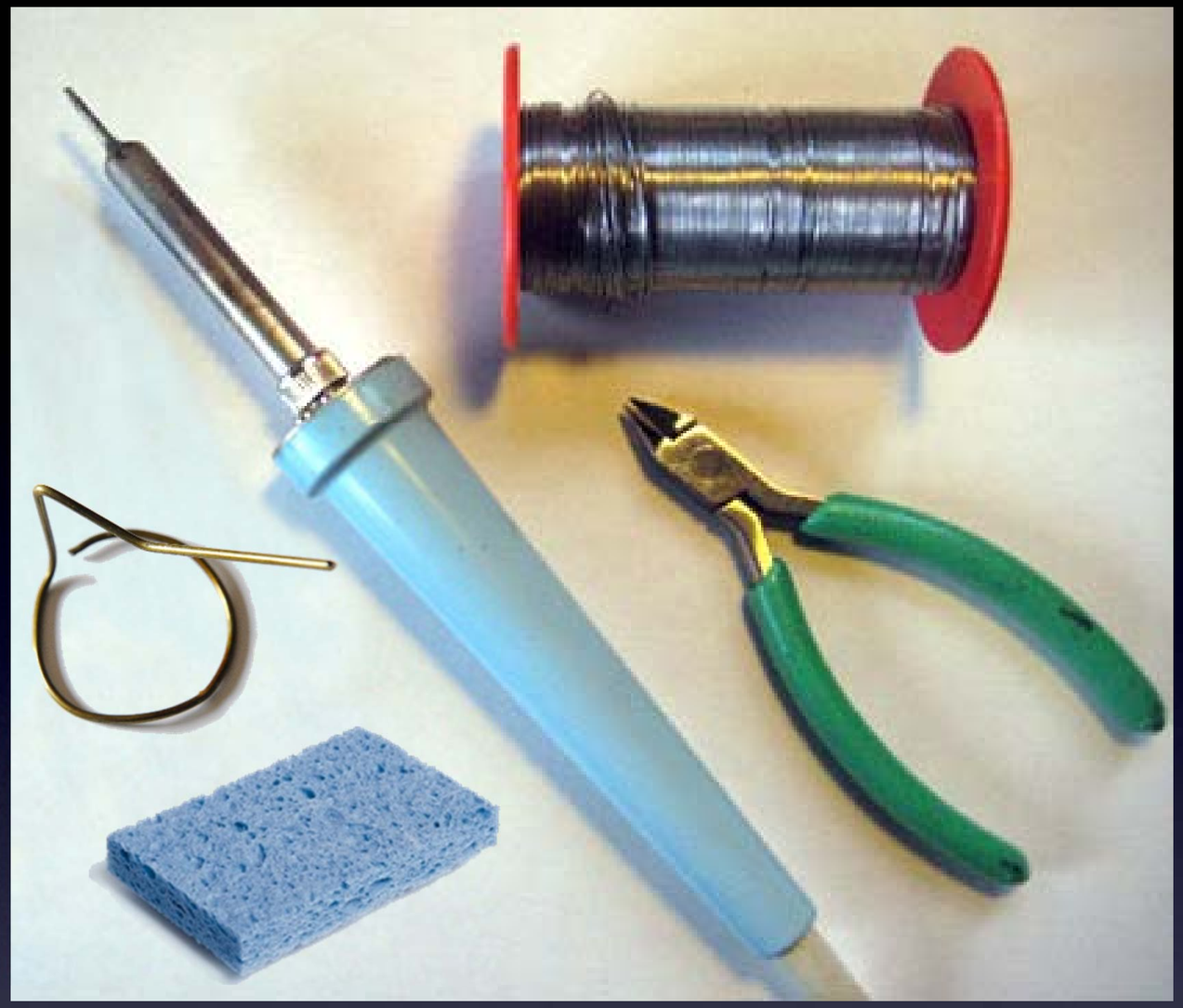
Download in the language of your choice for free at:
http://mightyohm.com/soldercomic

Learn To Solder

Download in the language of your choice for free at:
http://mightyohm.com/soldercomic

Learn To Solder

Download in the language of your choice for free at:
http://mightyohm.com/soldercomic

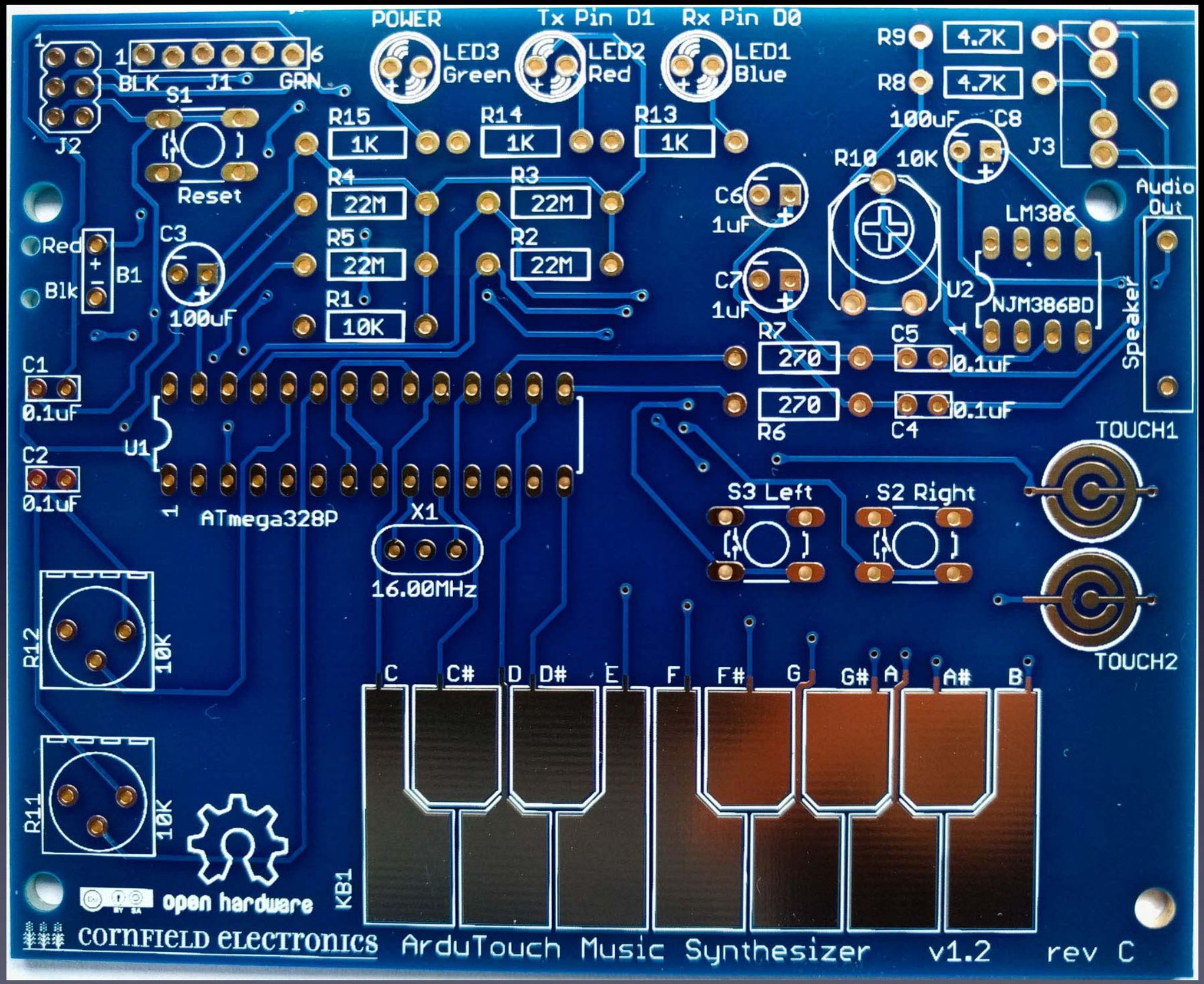


<u>Important:</u>
Use solder WITH lead (Pb) !!
Unleaded solder has very poisonous fumes!

<u>The tools you'll need</u>:

- soldering Iron (35W or less)
- solder (60/40 Sn/Pb, rosin core, 0.031" (0.7mm) diameter or less)
- soldering iron stand
- cellulose kitchen sponge *(not plastic!)*
- *small* wire cutter

(63/37 is also good)

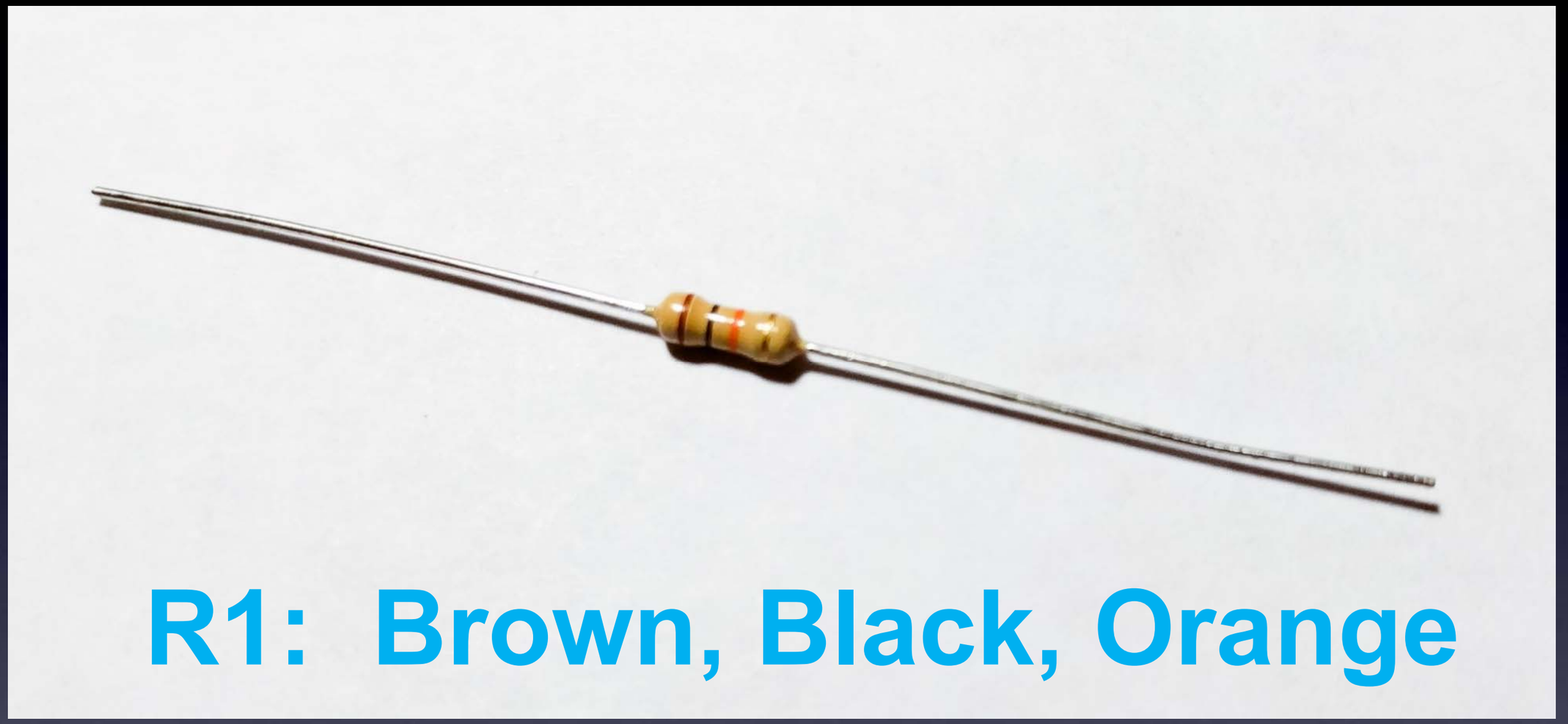


The board we'll solder the parts to

Some parts are inside of this battery pack

All of the parts

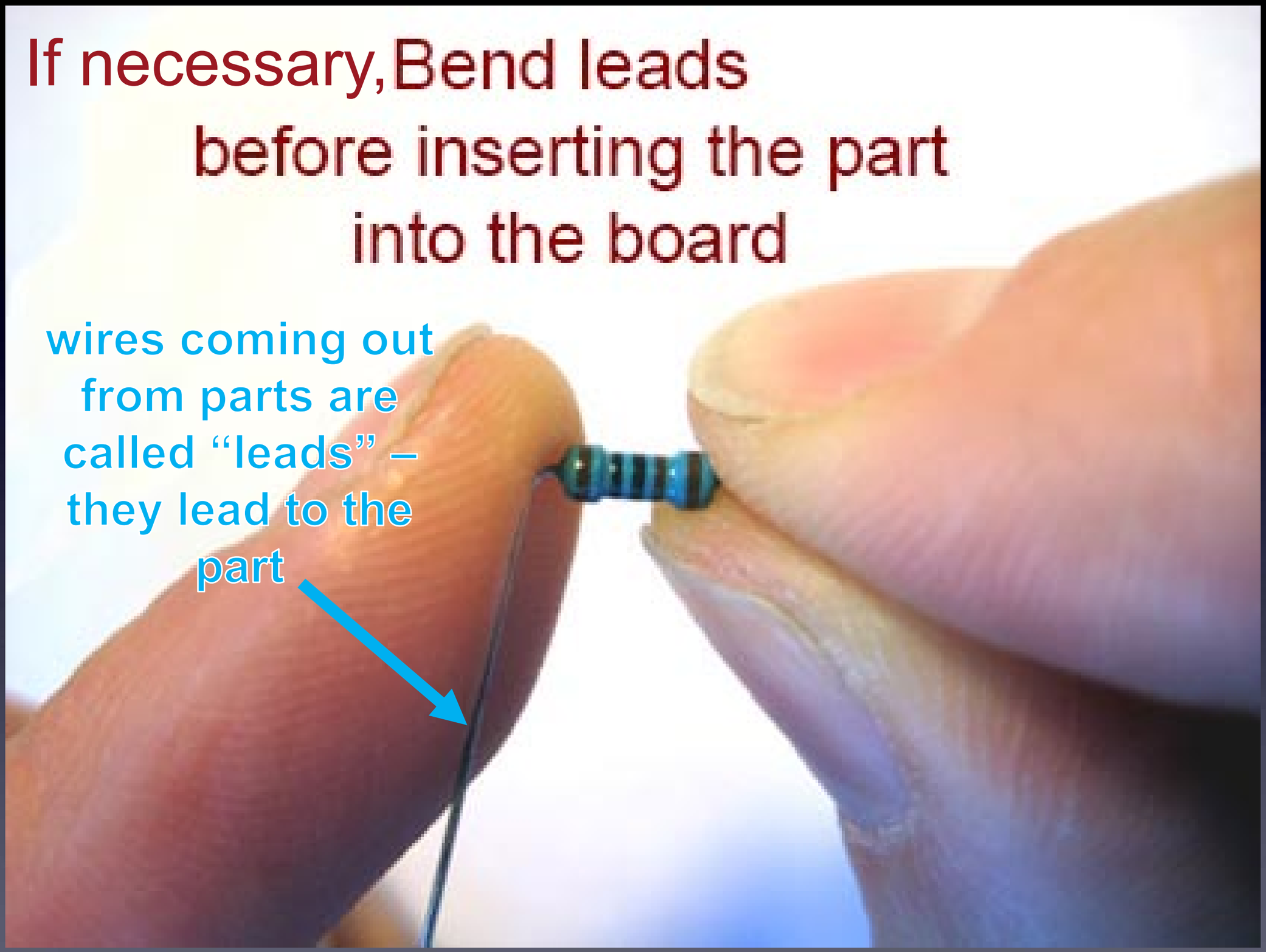
Our first part



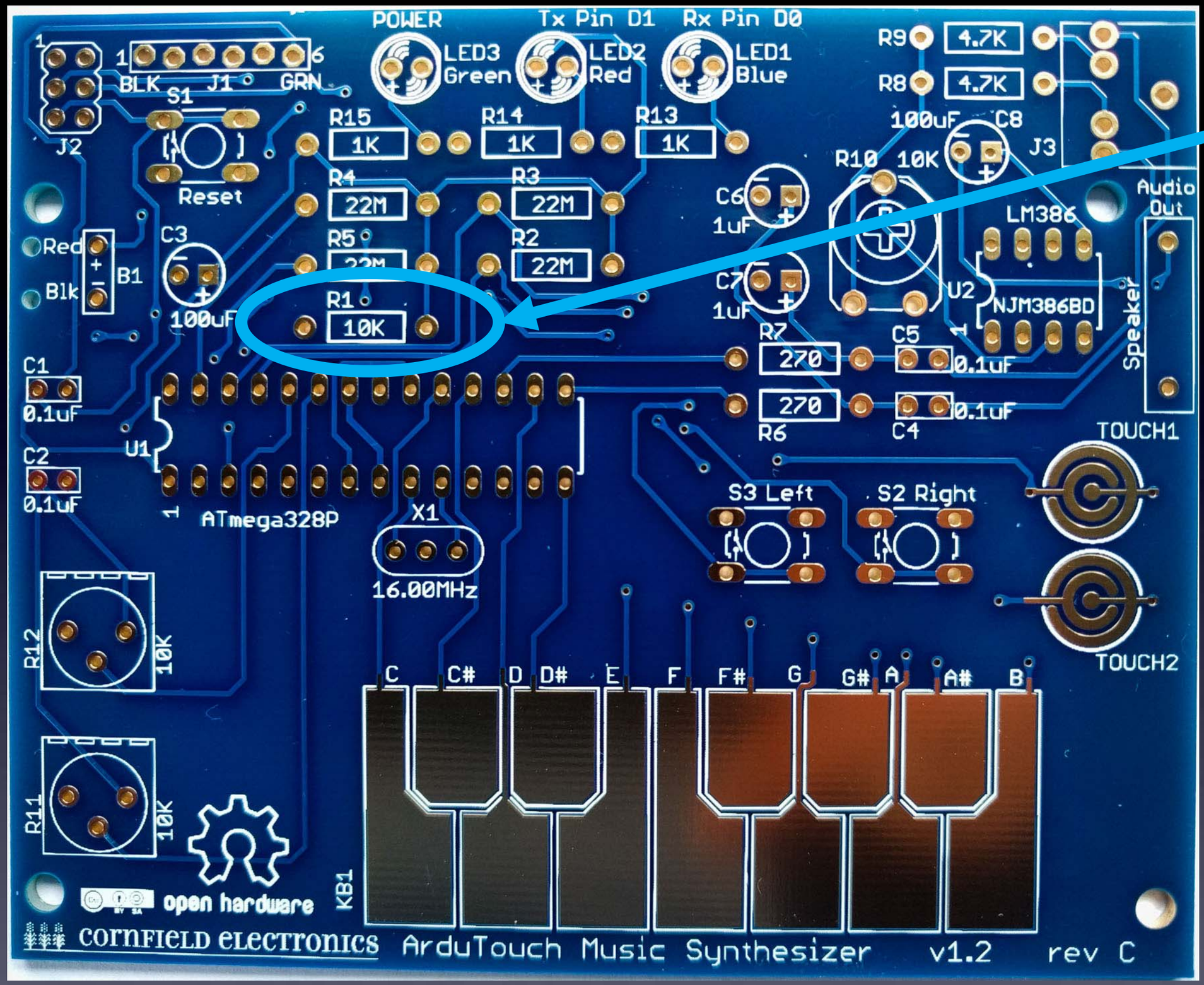
R1: Brown, Black, Orange

(*not* Brown, Black, Red)

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

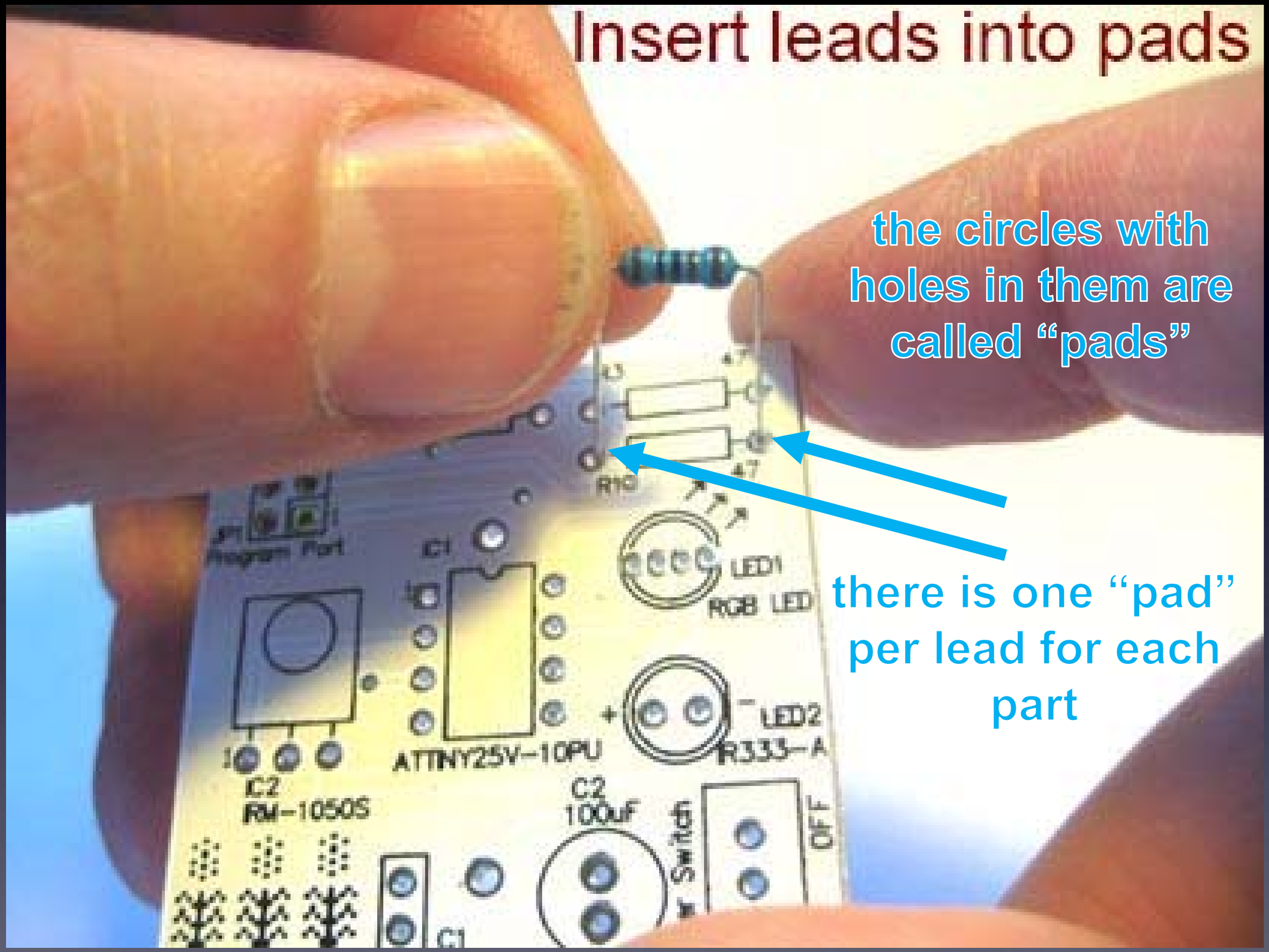


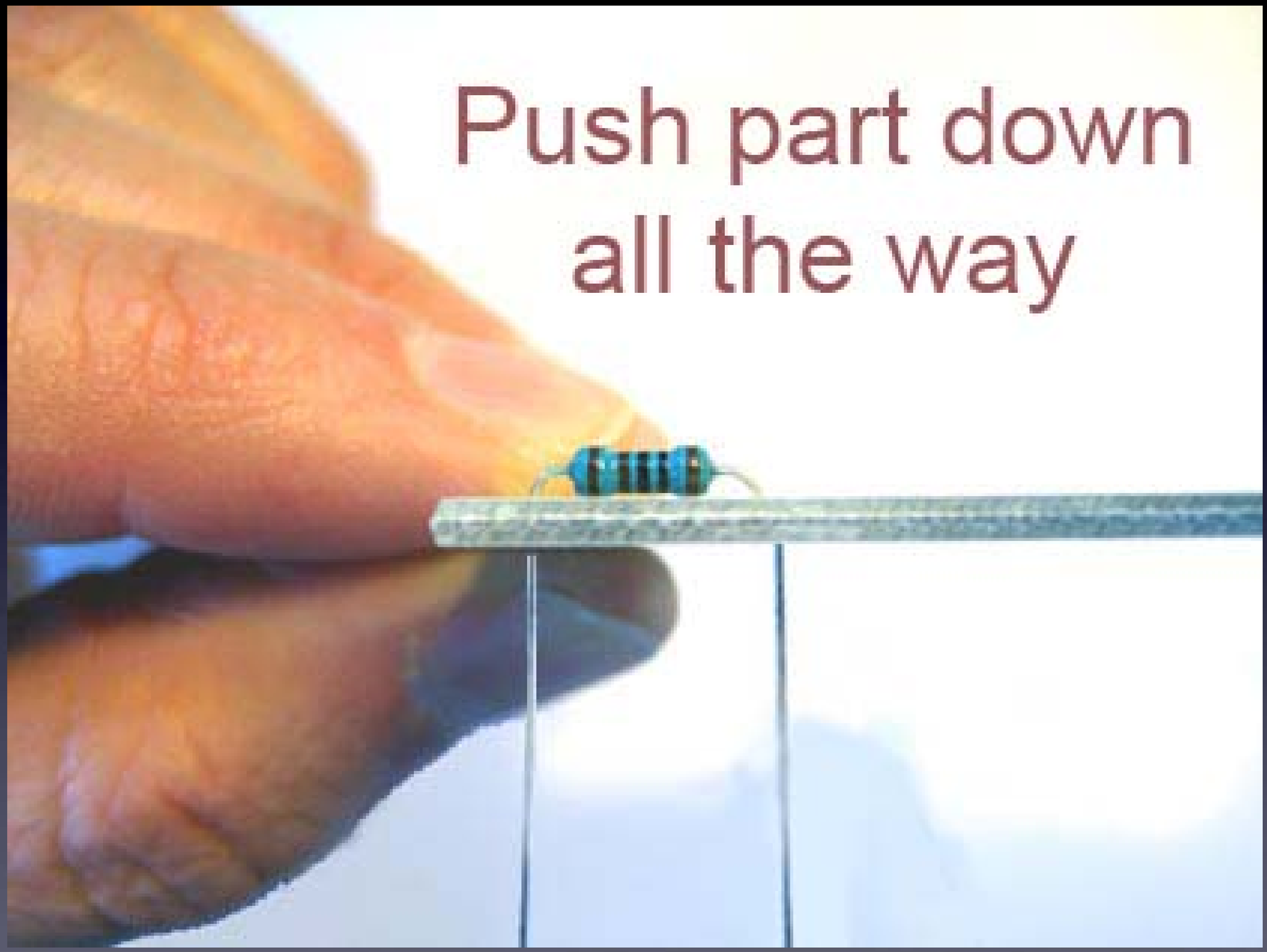
R1 – this is how it will look *before* inserting it into the board

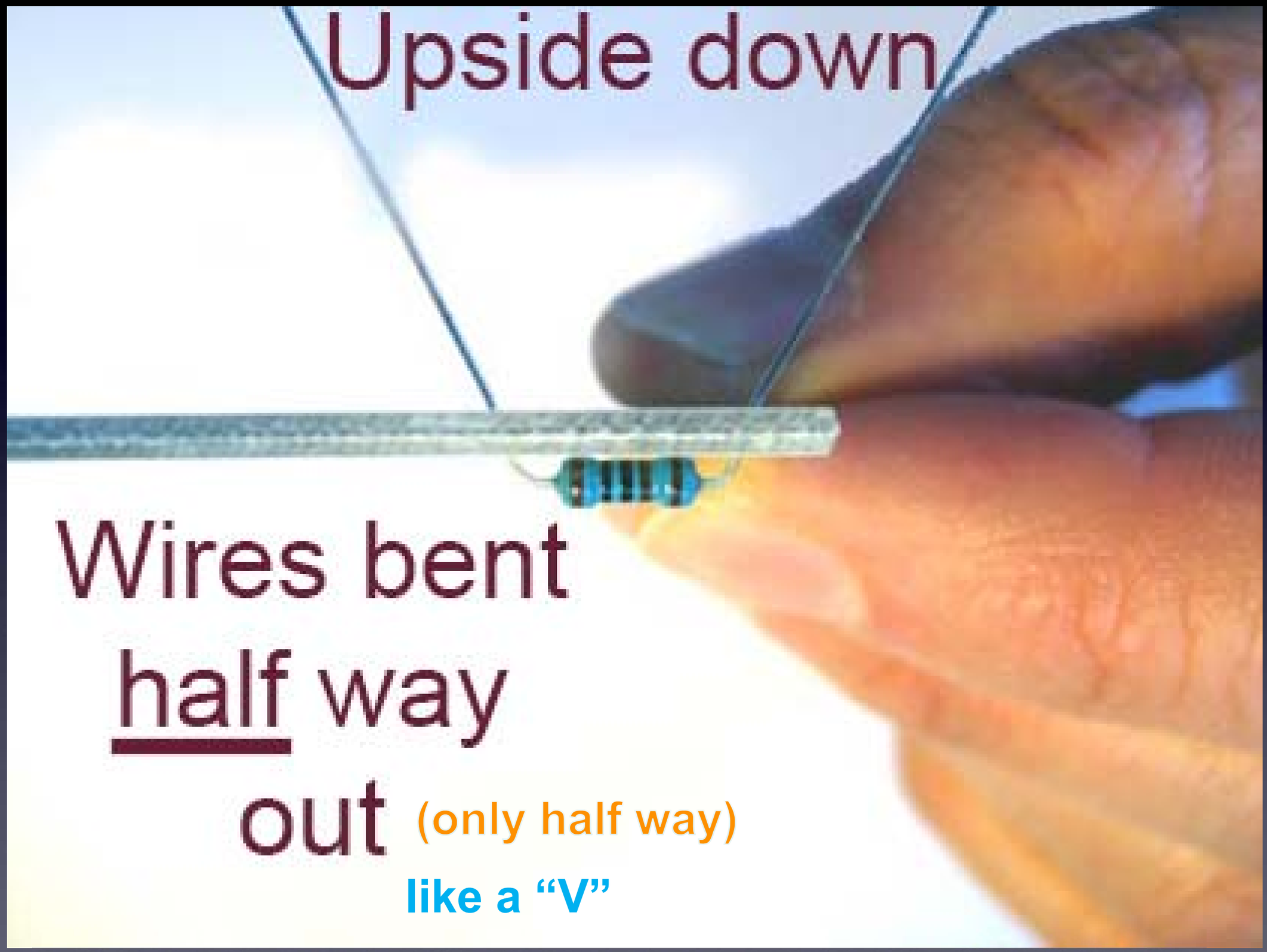


R1

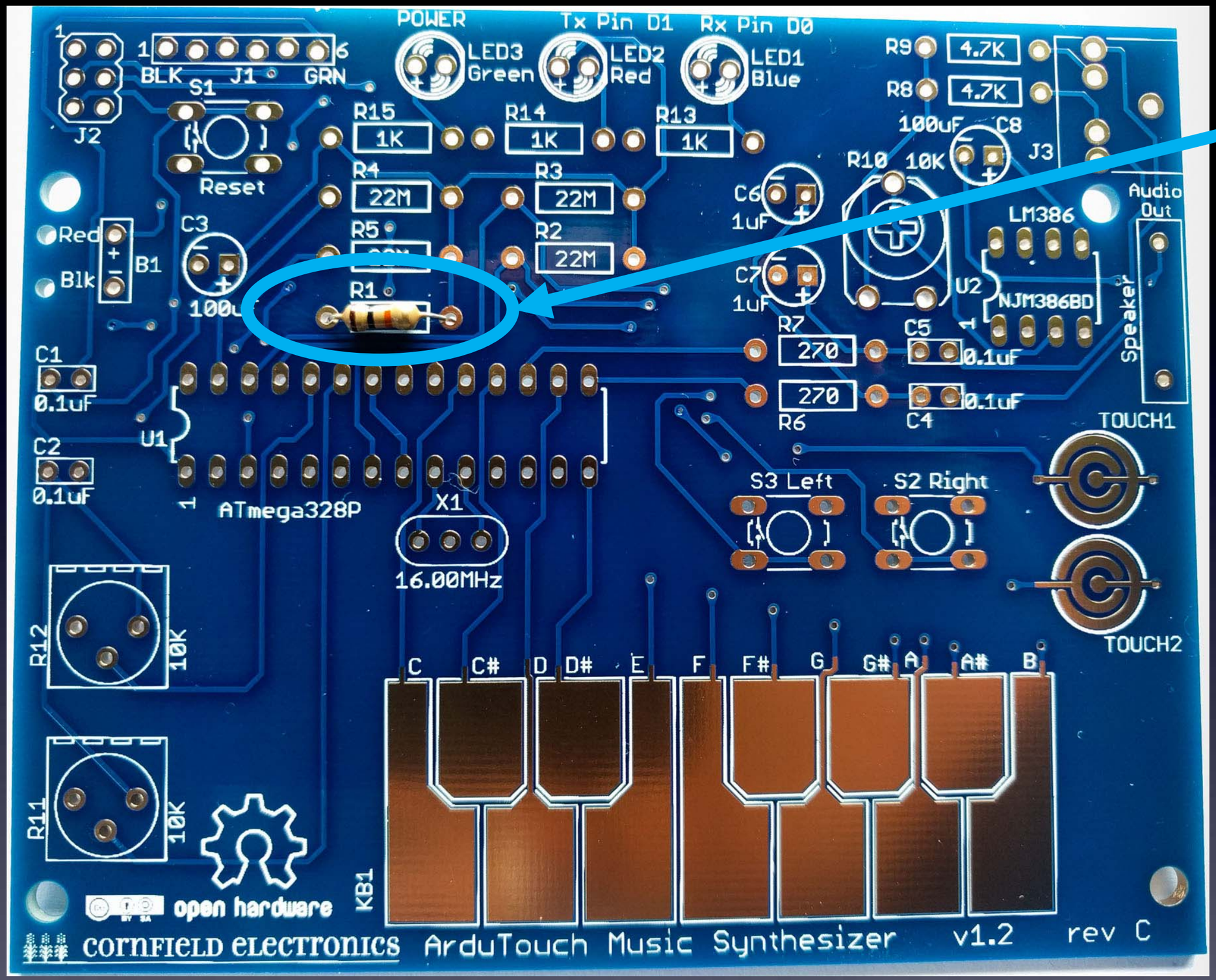
R1 – this is where it goes


Insert leads into pads
the circles with holes in them are called “pads”
there is one “pad” per lead for each part
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



R1 – inserted into the board

How to hold a soldering iron

(Like a pencil – held from underneath)

Important

The perfect kind of solder for electronics:

60/40 rosin core,

(63/37 is also good)

0.031” (0.7mm) diameter (or smaller)

<u>Important</u>:

Use solder WITH lead (Pb) !!
lead-free solder
has very poisonous fumes!

3 Safety Tips…

Safety Tip #1:

Hot !!

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

Safety Tip #2:

Lead (Pb) is toxic

But it easily washes 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)

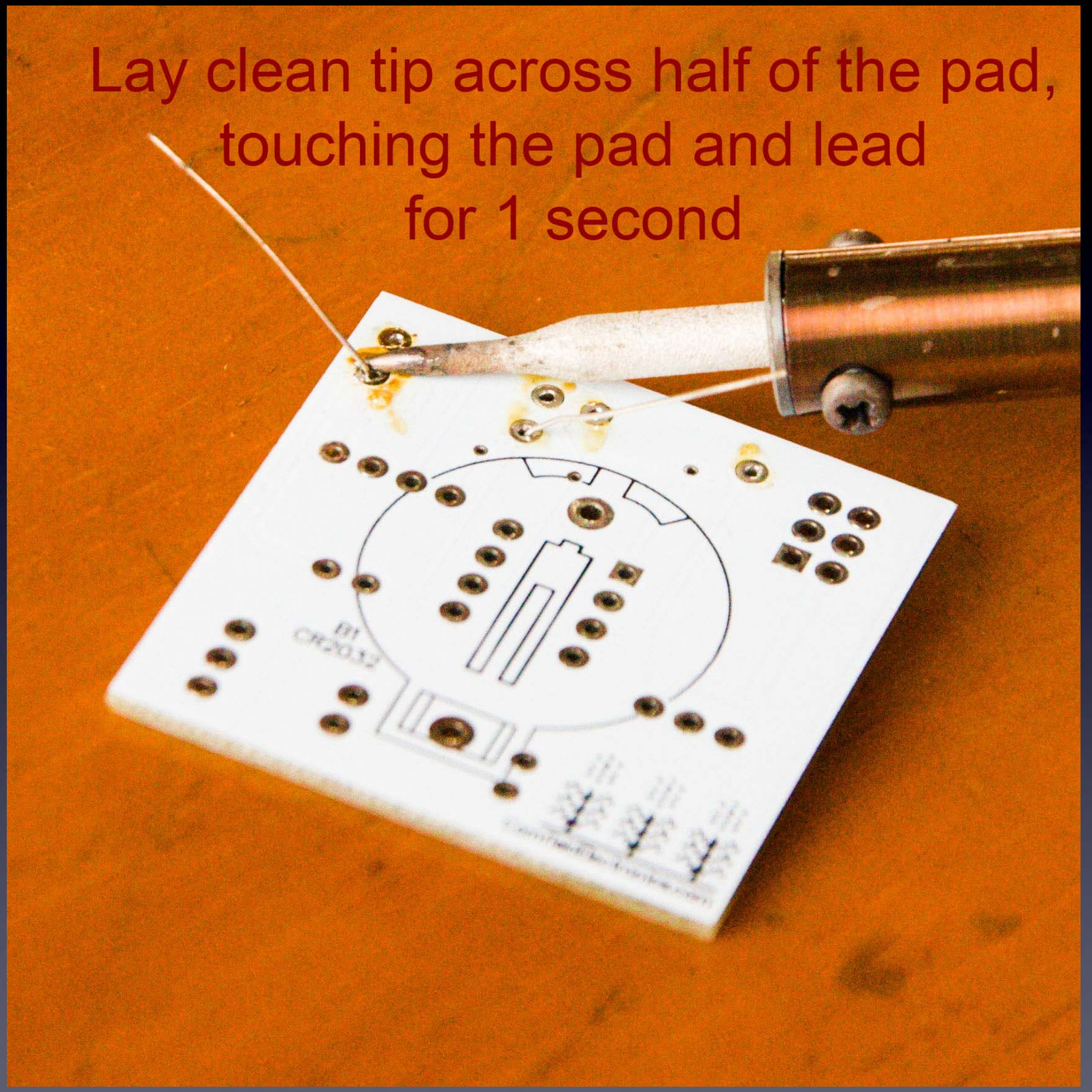
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

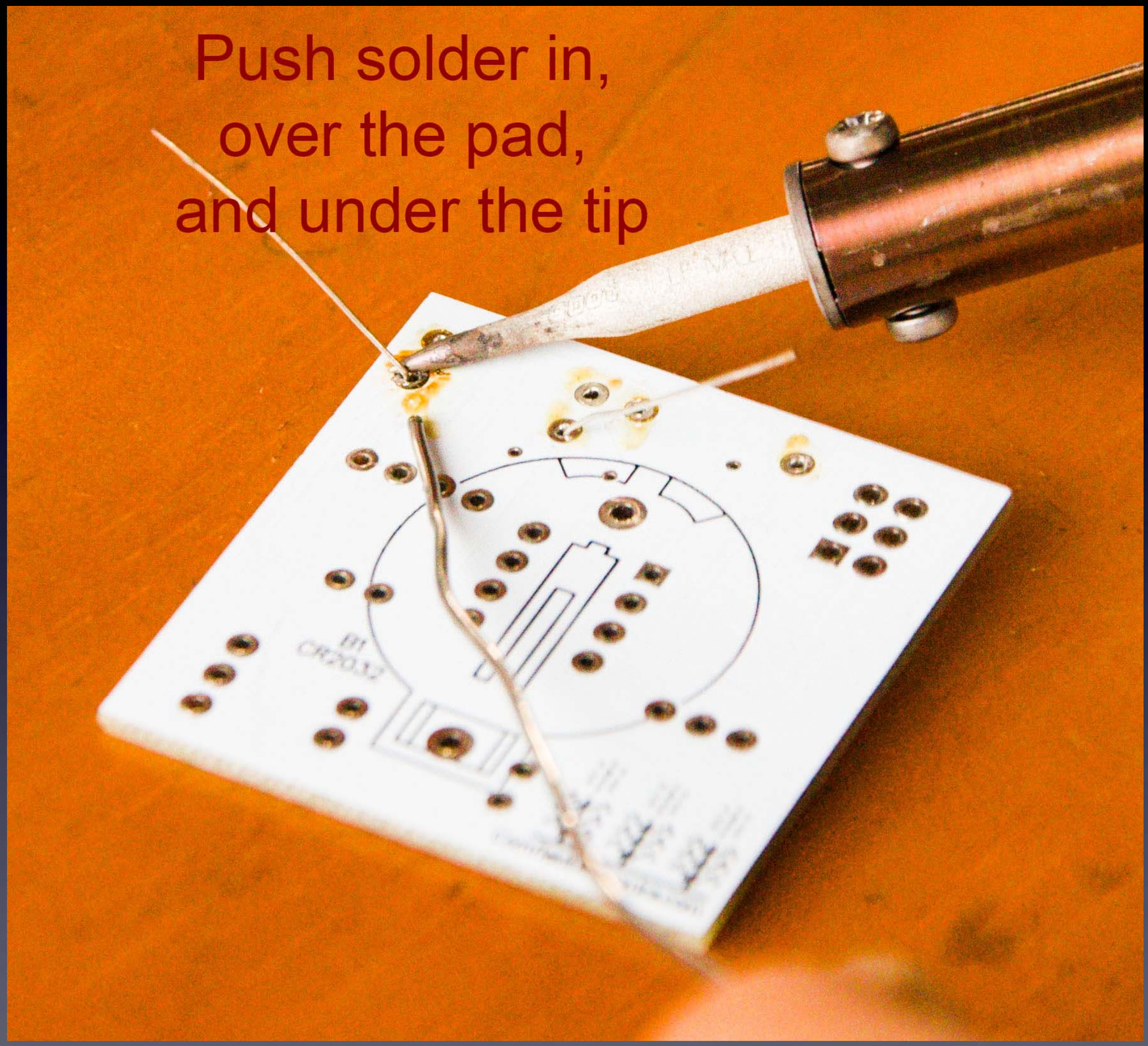
Keep the tip shiny silver!

knock solder off the tip

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

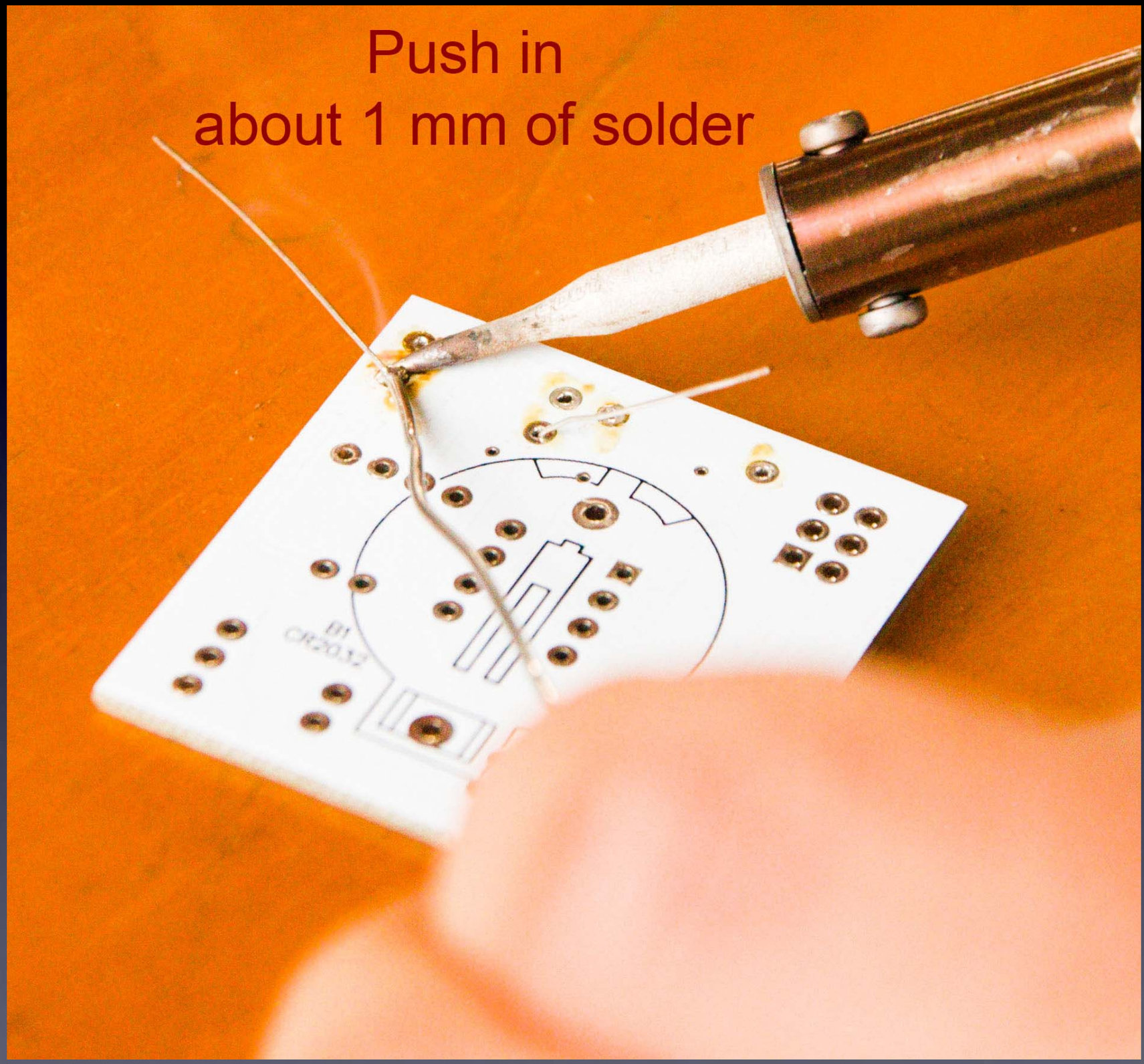


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second

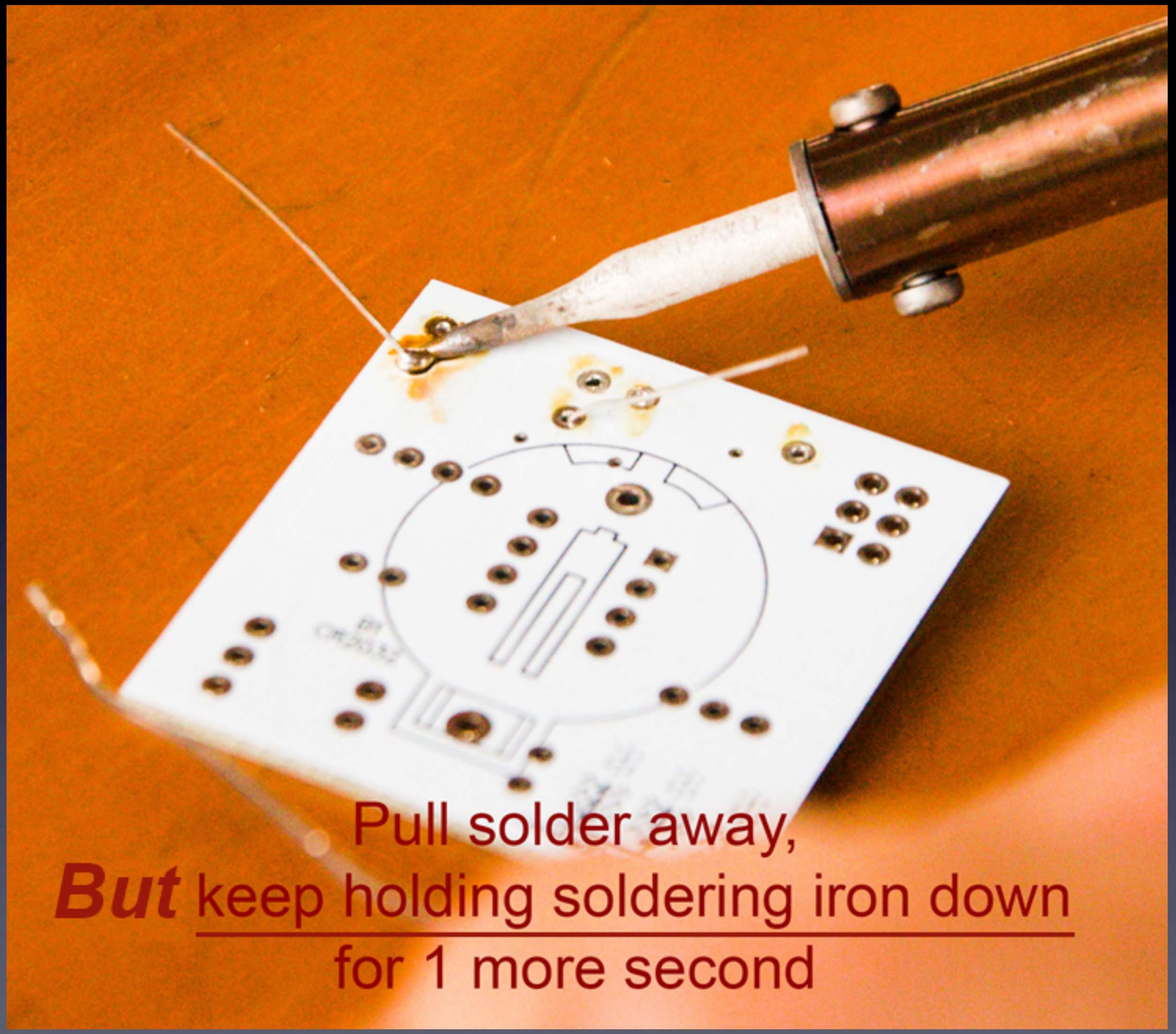


Make sure solder melts on the <u>underside</u> of the soldering iron tip
(not the side or top of the soldering iron tip)!

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



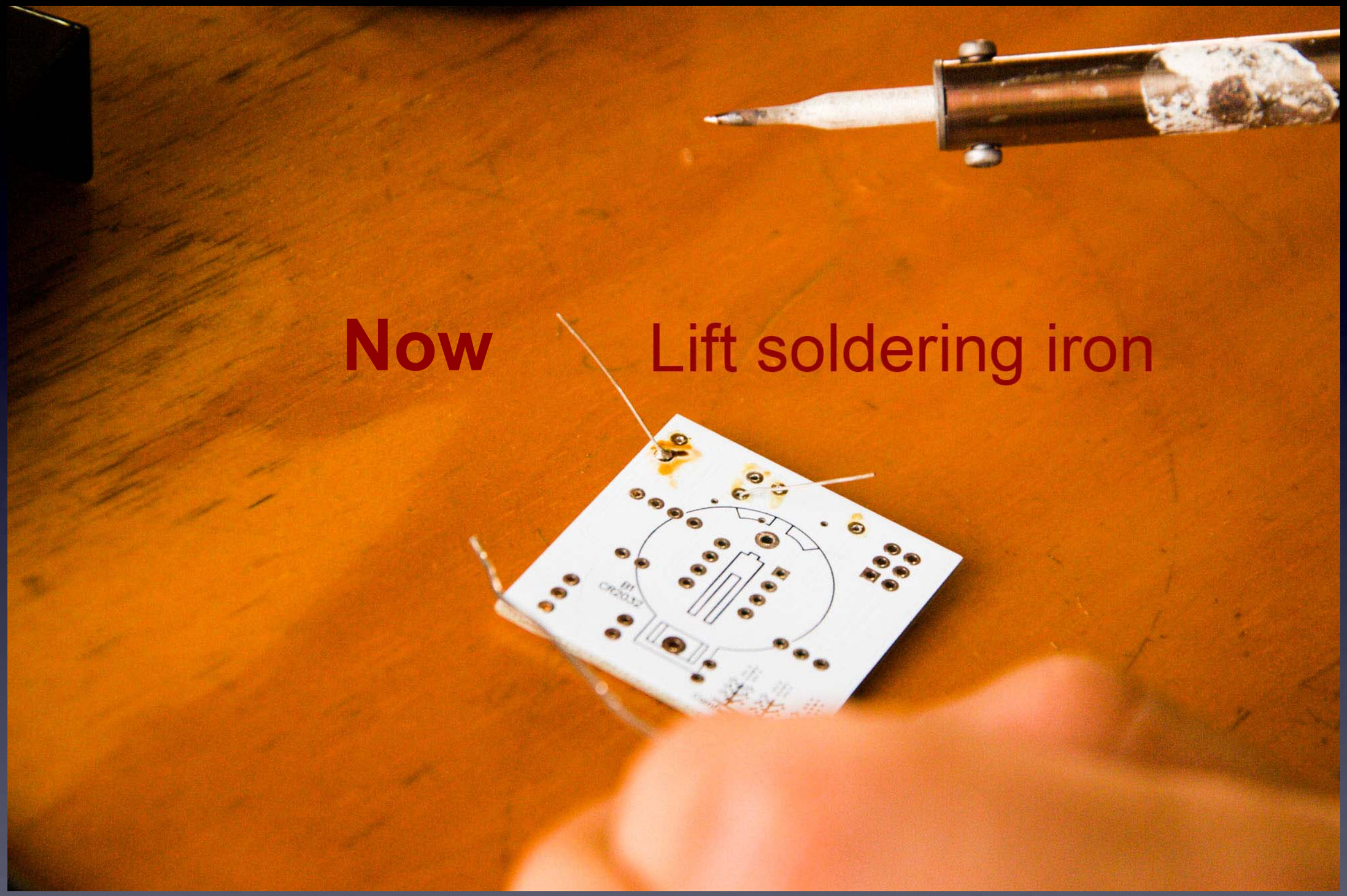
Make sure solder melts on the <u>underside</u> of the soldering iron tip
(not the side or top of the soldering iron tip)!

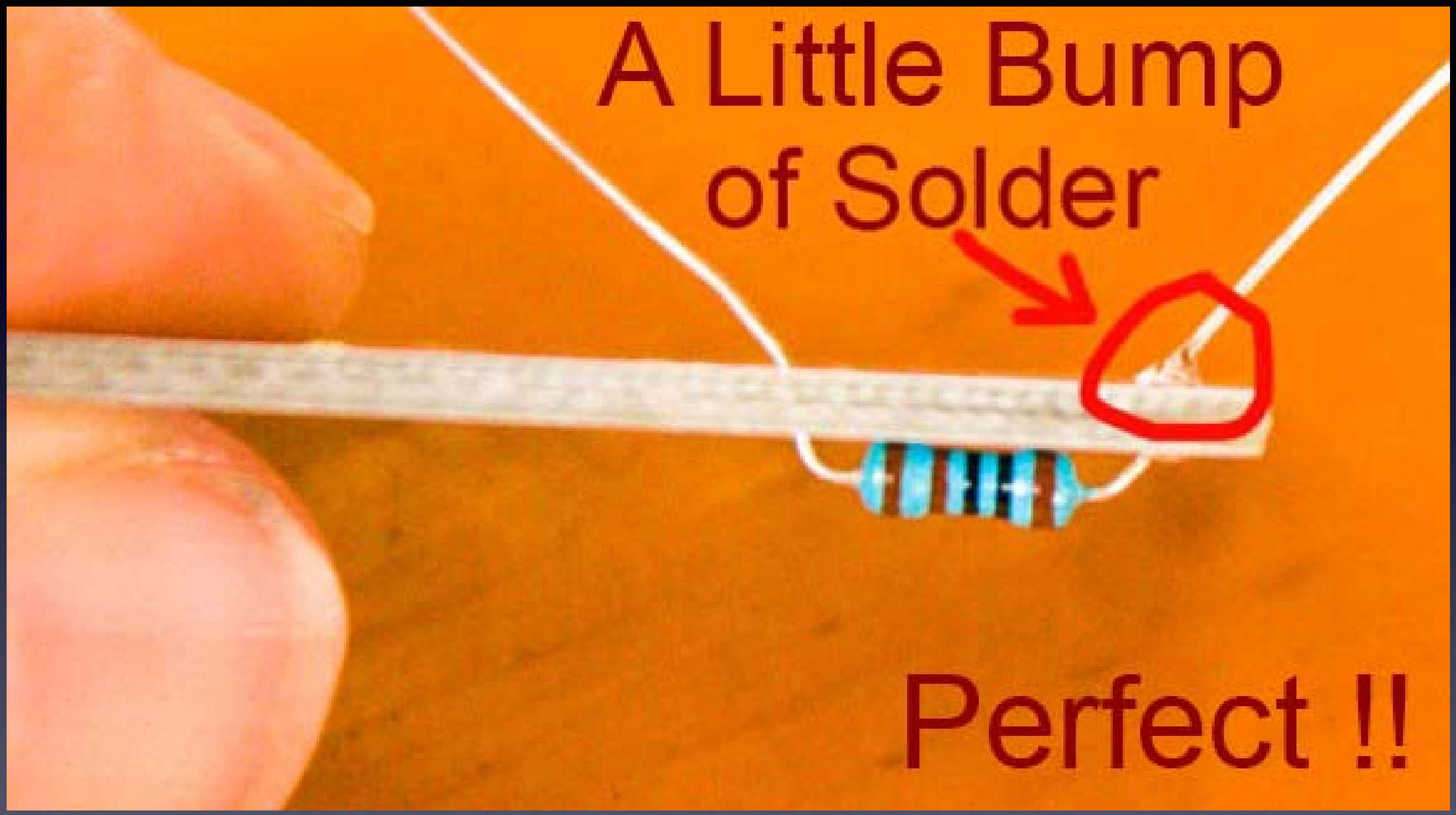

Pull solder away,
But keep holding soldering iron down
for 1 more second

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 !

The Rhythm !

and speed

Clean the tip

The Rhythm !

and speed

Tip Down

The Rhythm !

and speed

Solder In

The Rhythm !

and speed

Solder Out

The Rhythm !

and speed

WAIT !

The Rhythm !

and speed

Lift Tip

The Rhythm !

The Rhythm !

and speed

Clean the tip

The Rhythm !

and speed

Tip Down

The Rhythm !

and speed

Solder In

The Rhythm !

and speed

Solder Out

The Rhythm !

and speed

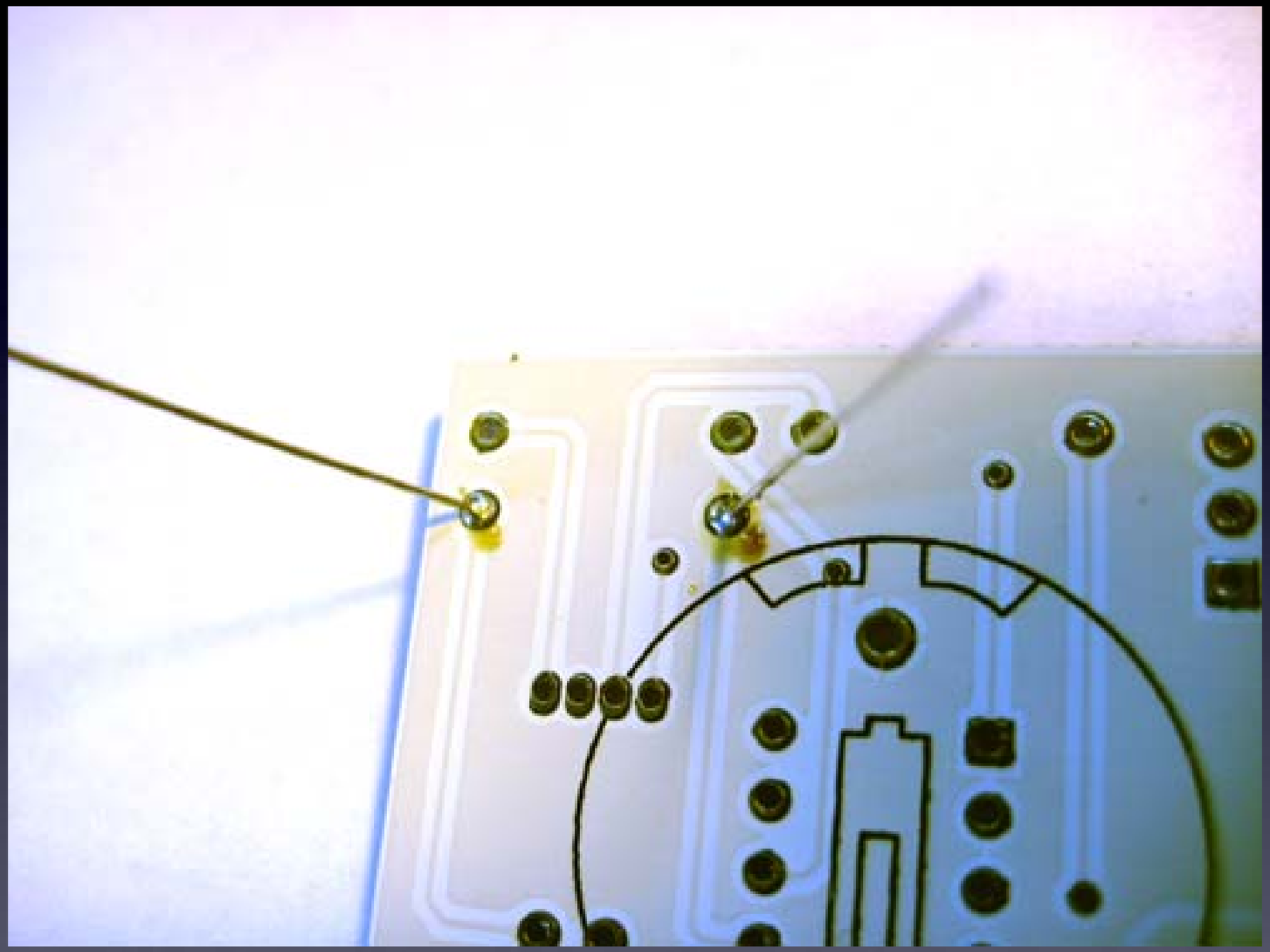
WAIT !

The Rhythm !

and speed

Lift Tip

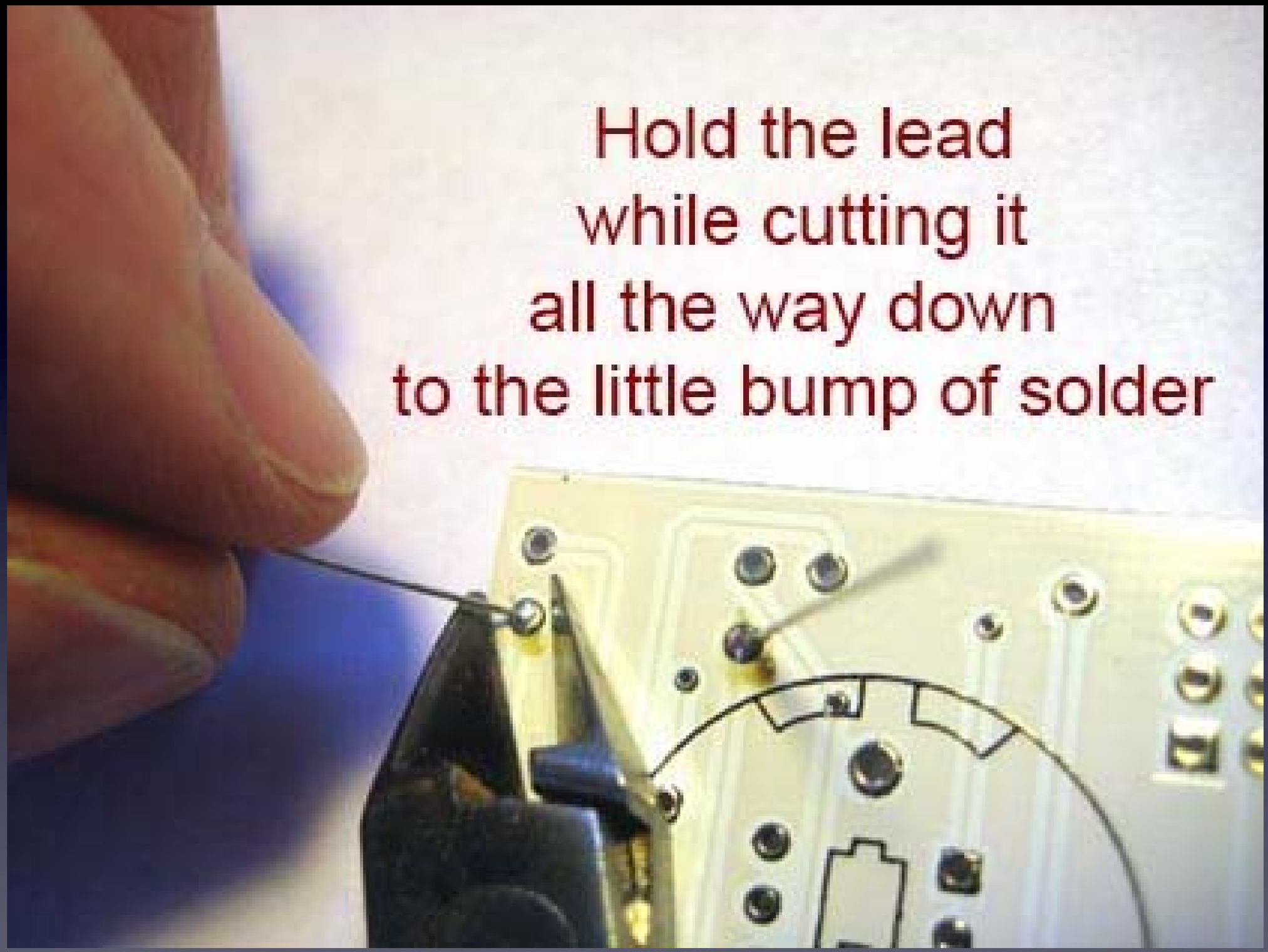
Solder all of the leads of the part to the board



For this part, there are two leads

Here you can see two good solder connections

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

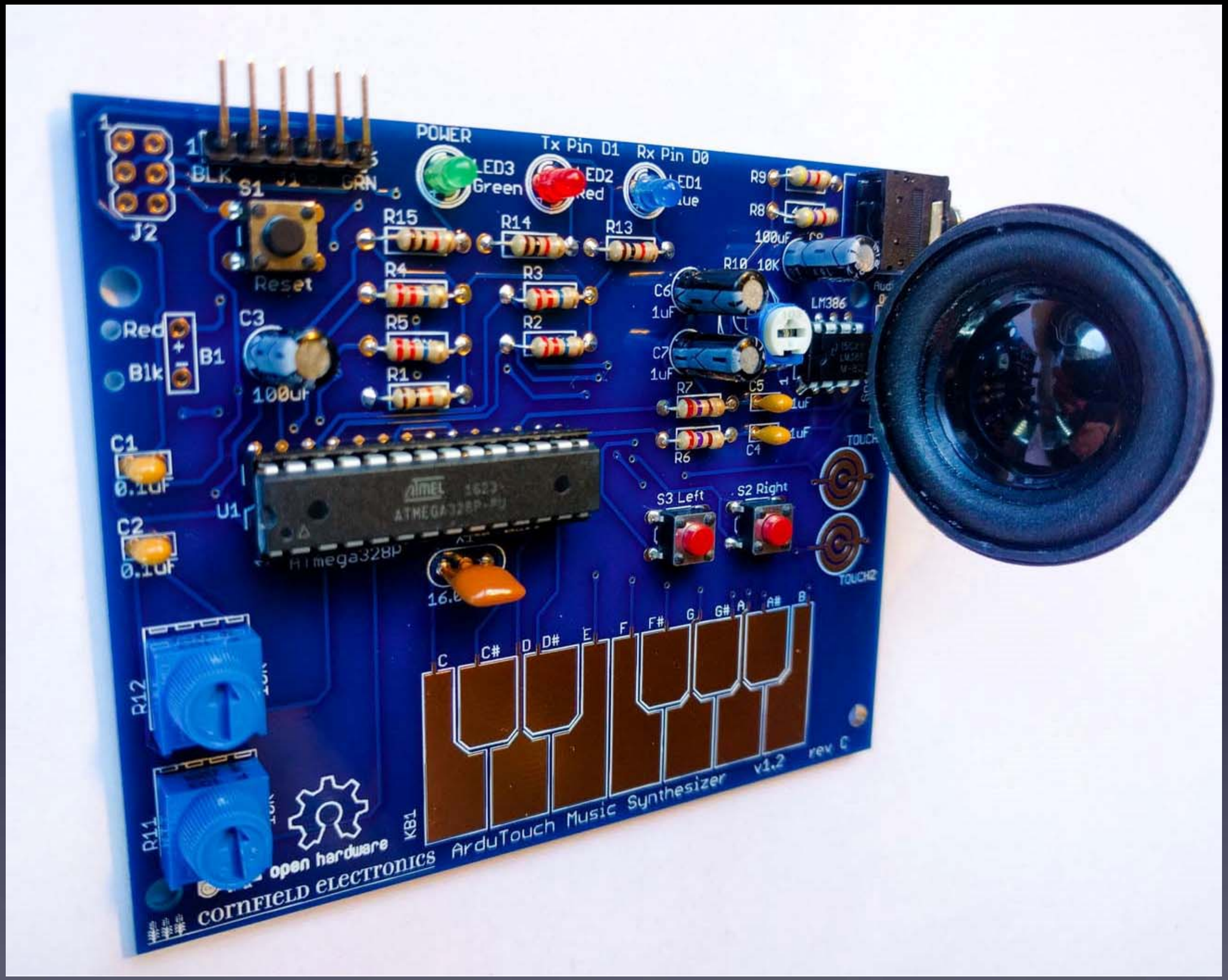
R1 soldered to the board

Notice that:

- each connection is a small bump (not flat)
- you cannot see any pad (it's totally covered with solder)
- you cannot see the hole (it's totally covered with solder)

One part at a time

Till all the parts are soldered



And it will look like this when you’re done.

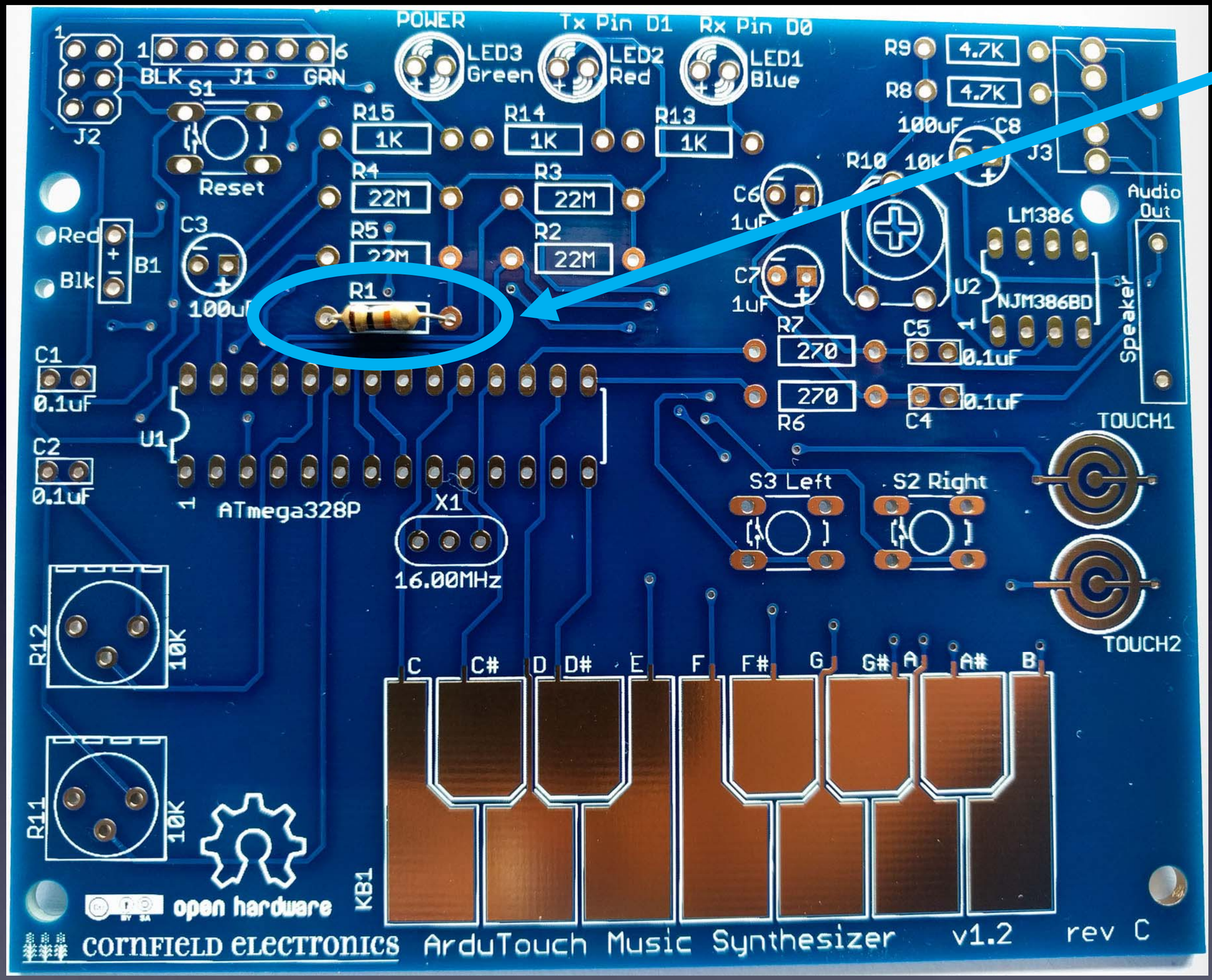
Then put in the batteries,

Turn it on,

And it works!

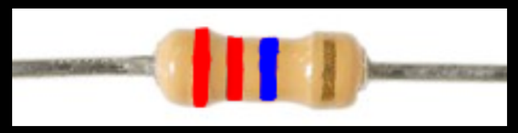
(Or you start debugging.)

Let’s start!



If you haven’t done so already, solder R1: brown, black, orange

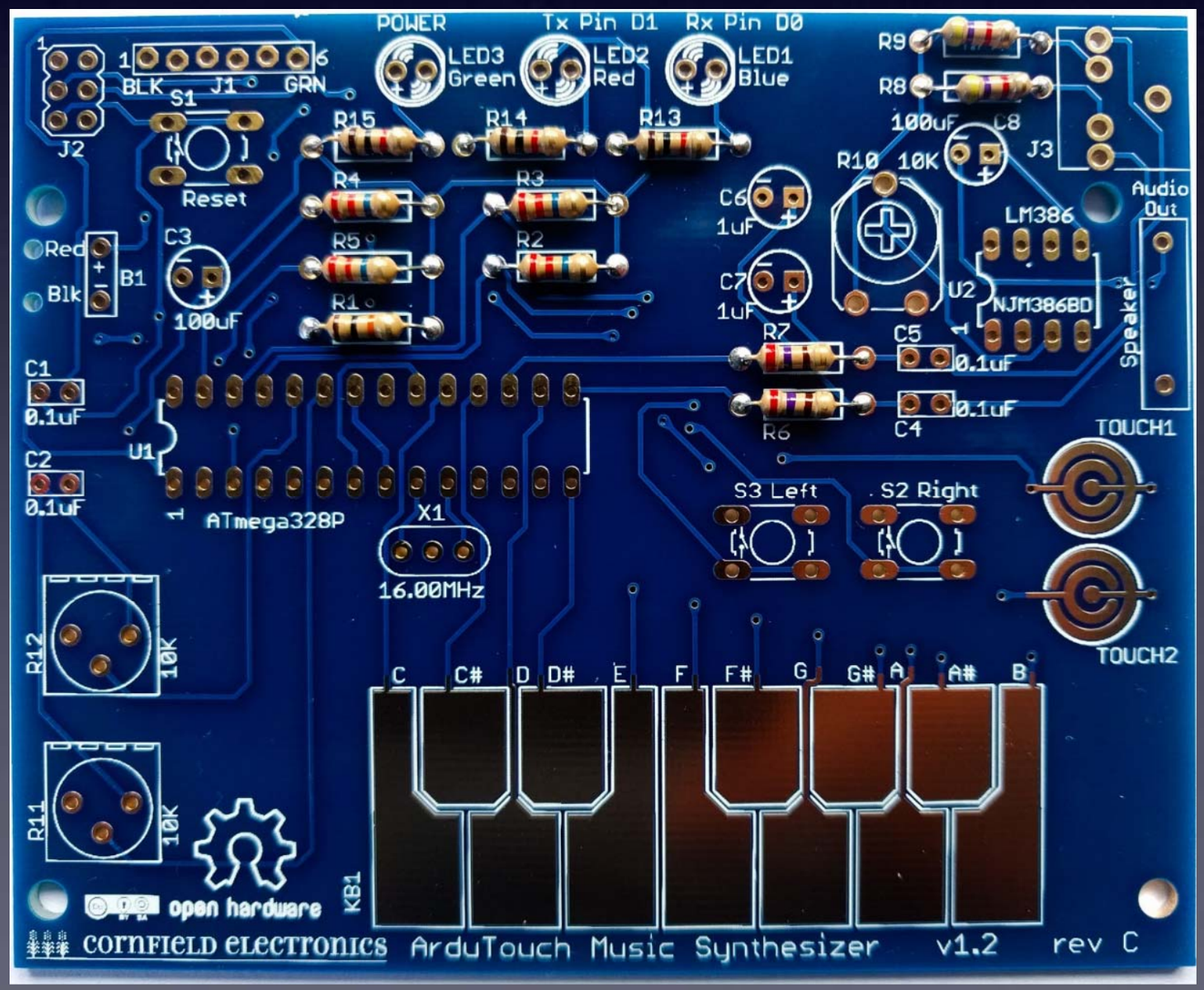
R1: 10K: Brown, Black, Orange

R2, R3, R4, R5:  22M: Red, Red, Blue

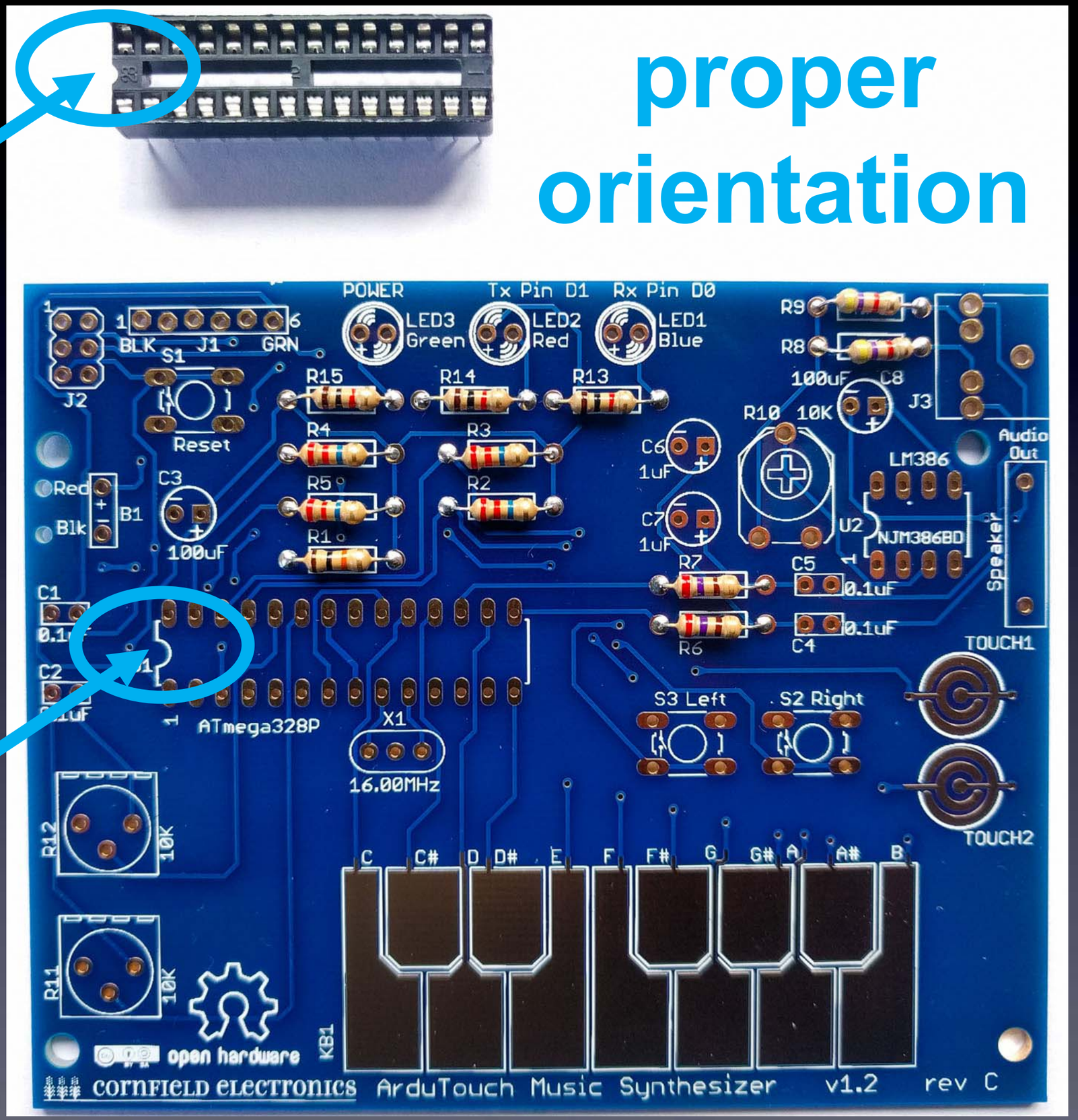
R6, R7: 270: Red, Violet, Brown

R8, R9: 4.7K: Yellow, Violet, Red

R13, R14, R15: 1K: Brown, Black, Red

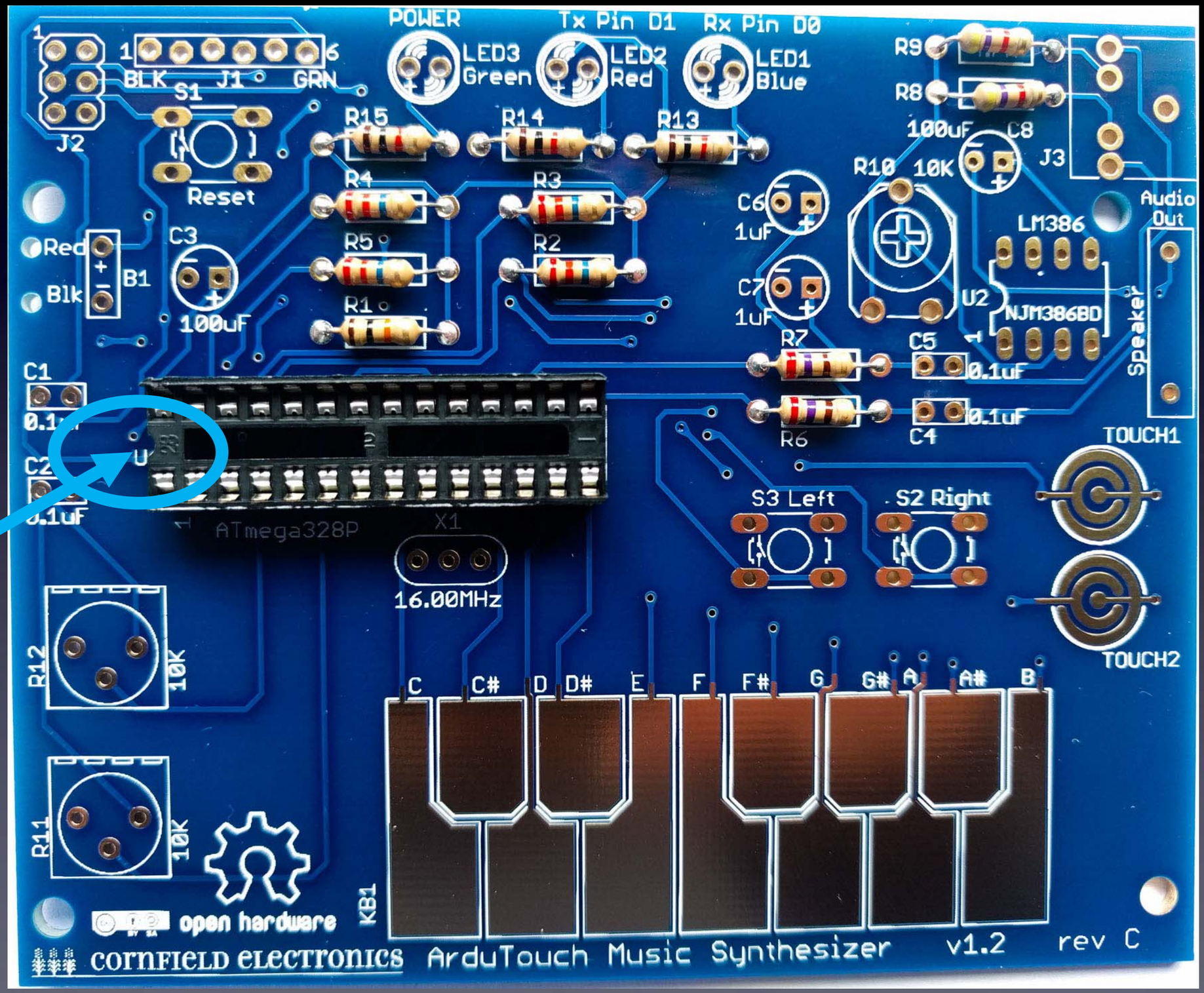


U1: microcontroller socket

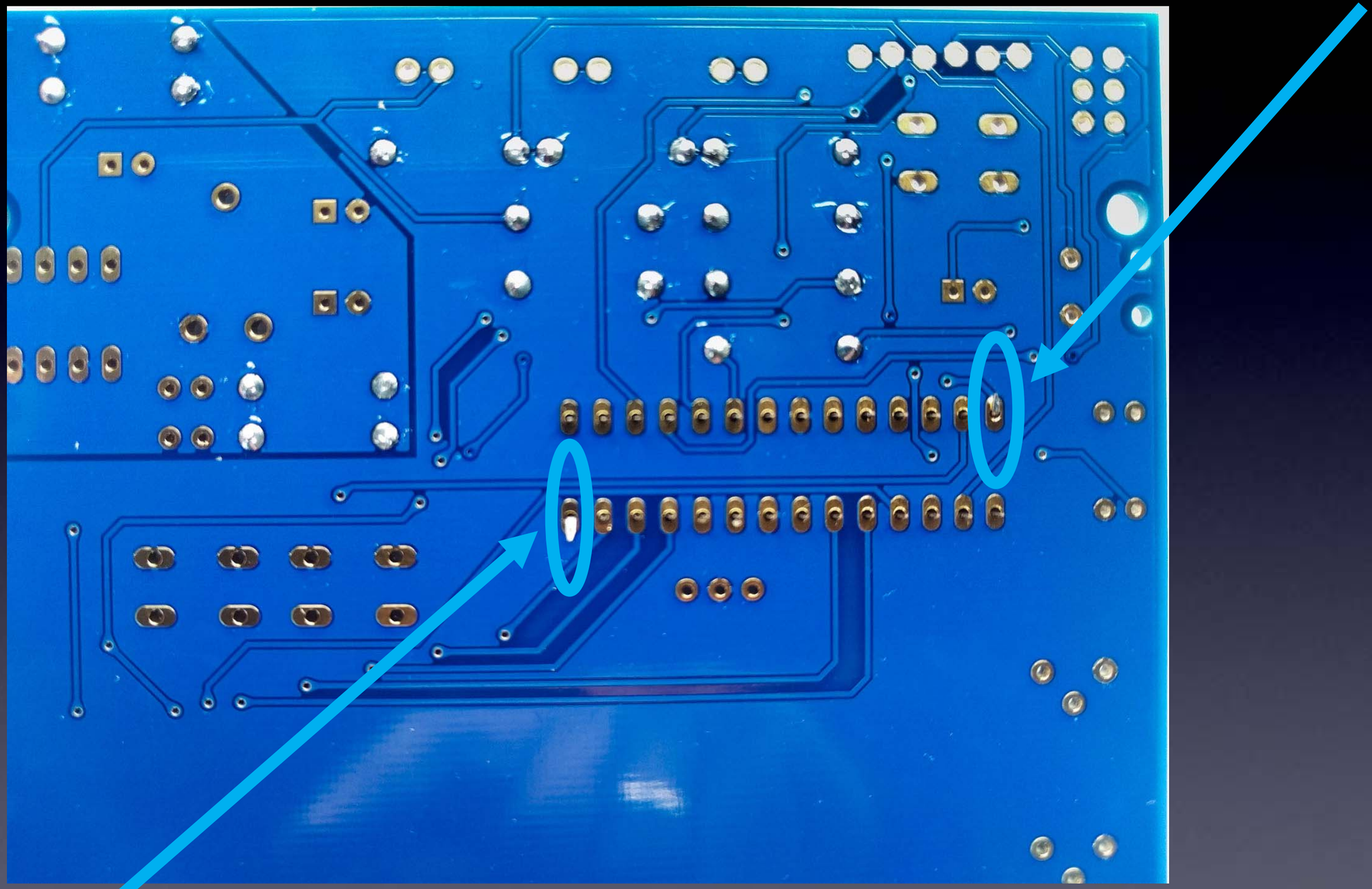


U1: microcontroller socket:

inserted correctly

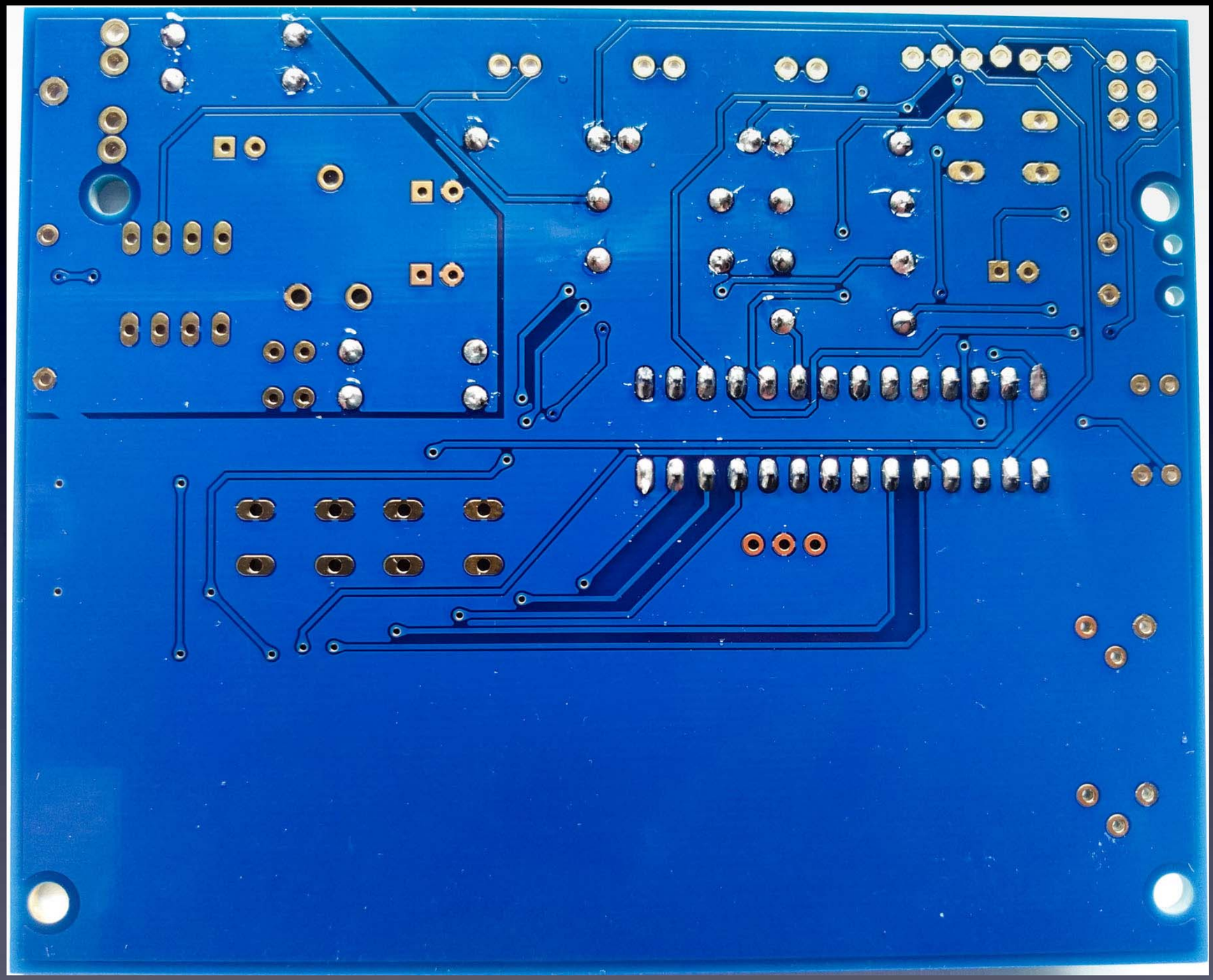


U1: microcontroller socket



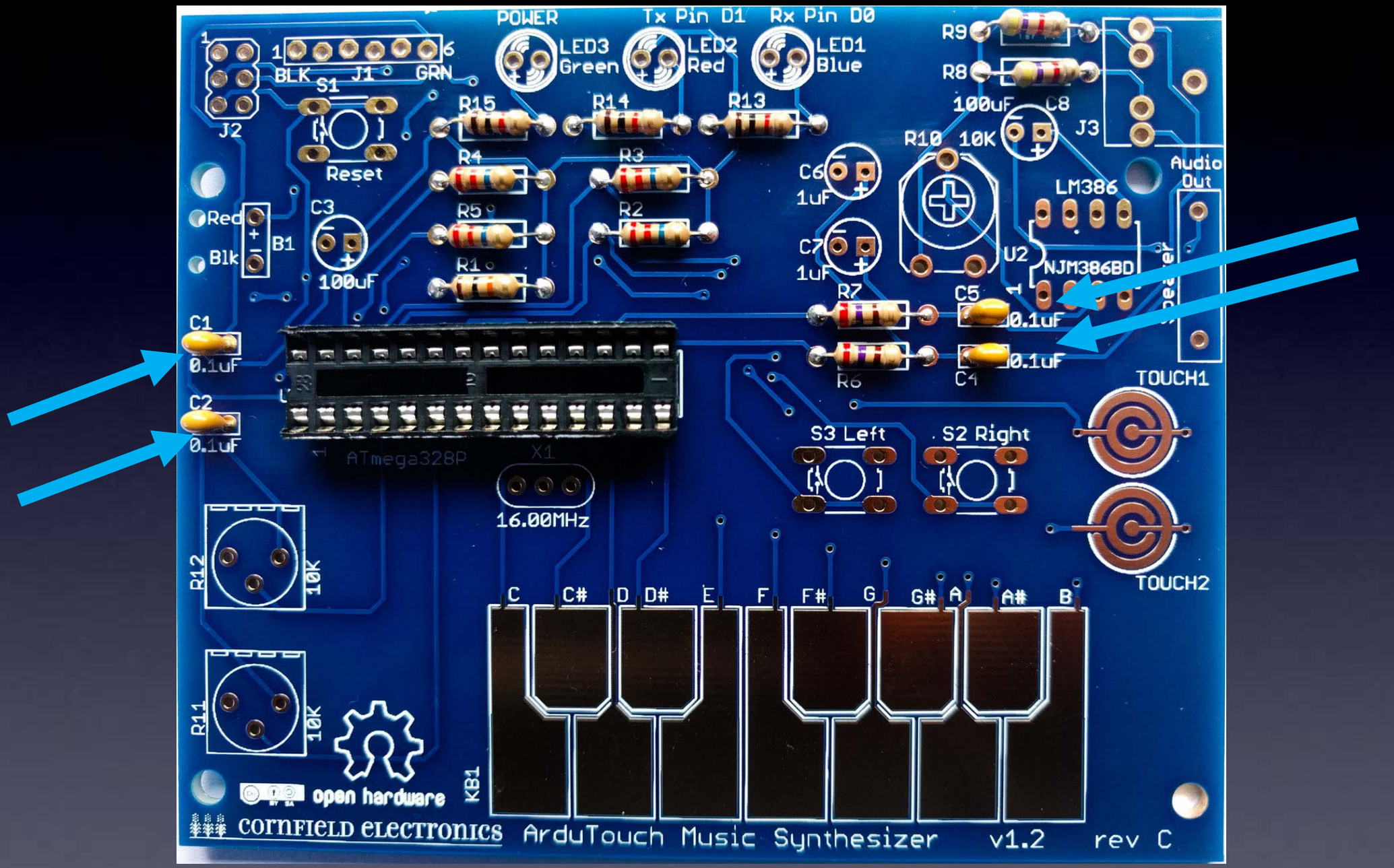
bend pins down on two corners,
and solder all 28 leads to the board

U1: microcontroller socket

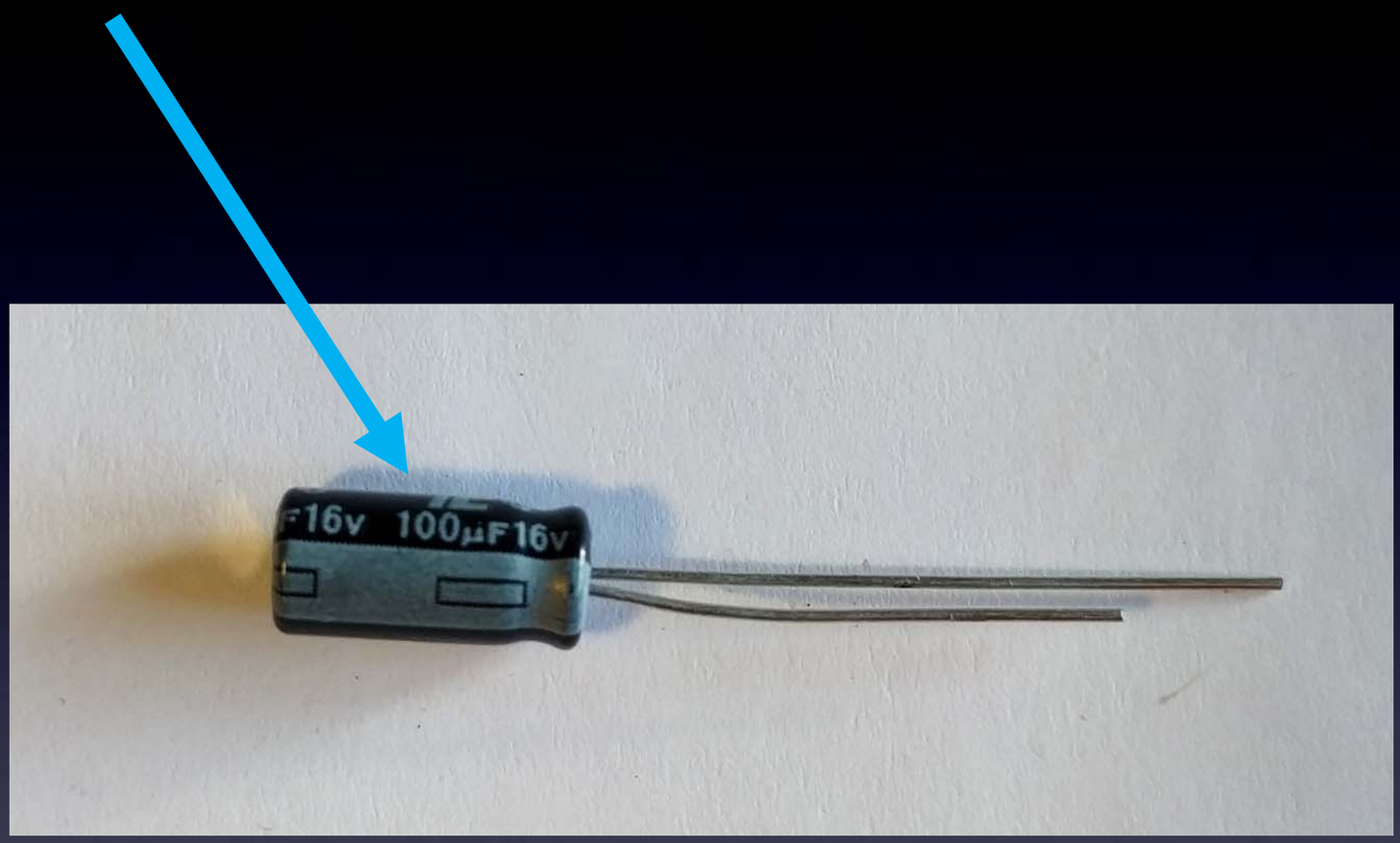


All 28 leads soldered to the board:

→ Notice that each has a little bump of solder (not flat). ←


POWER
Tx Pin D1
Rx Pin D0
LED3 Green
LED2 Red
LED1 Blue
J1
BLK
GRN
J2
S1
Reset
R15
R14
R13
R4
R3
R5
R2
R1
C3
100uF
Red
Blk
B1
C1
0.1uF
C2
0.1uF
ATmega328P
X1
16.00MHz
R12
10K
R11
10K
open hardware
cornfield electronics
KB1
C
C#
D
D#
E
F
F#
G
G#
A
A#
B
R9
R8
100uF
C8
J3
R10
10K
C6
1uF
C7
1uF
LM386
U2
NJM386BD
Audio Out
R7
C5
0.1uF
R6
C4
0.1uF
S3 Left
S2 Right
TOUCH1
TOUCH2
ArduTouch Music Synthesizer
v1.2
rev C

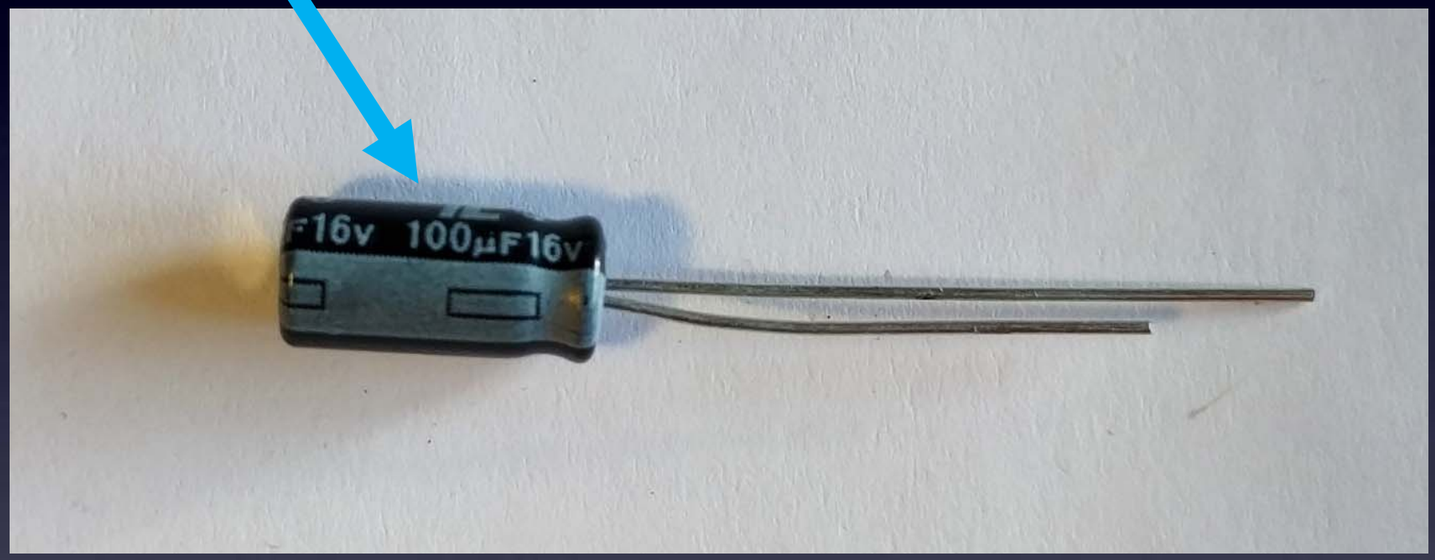
C1, C2, C4, C5



C3, C8: 100uF

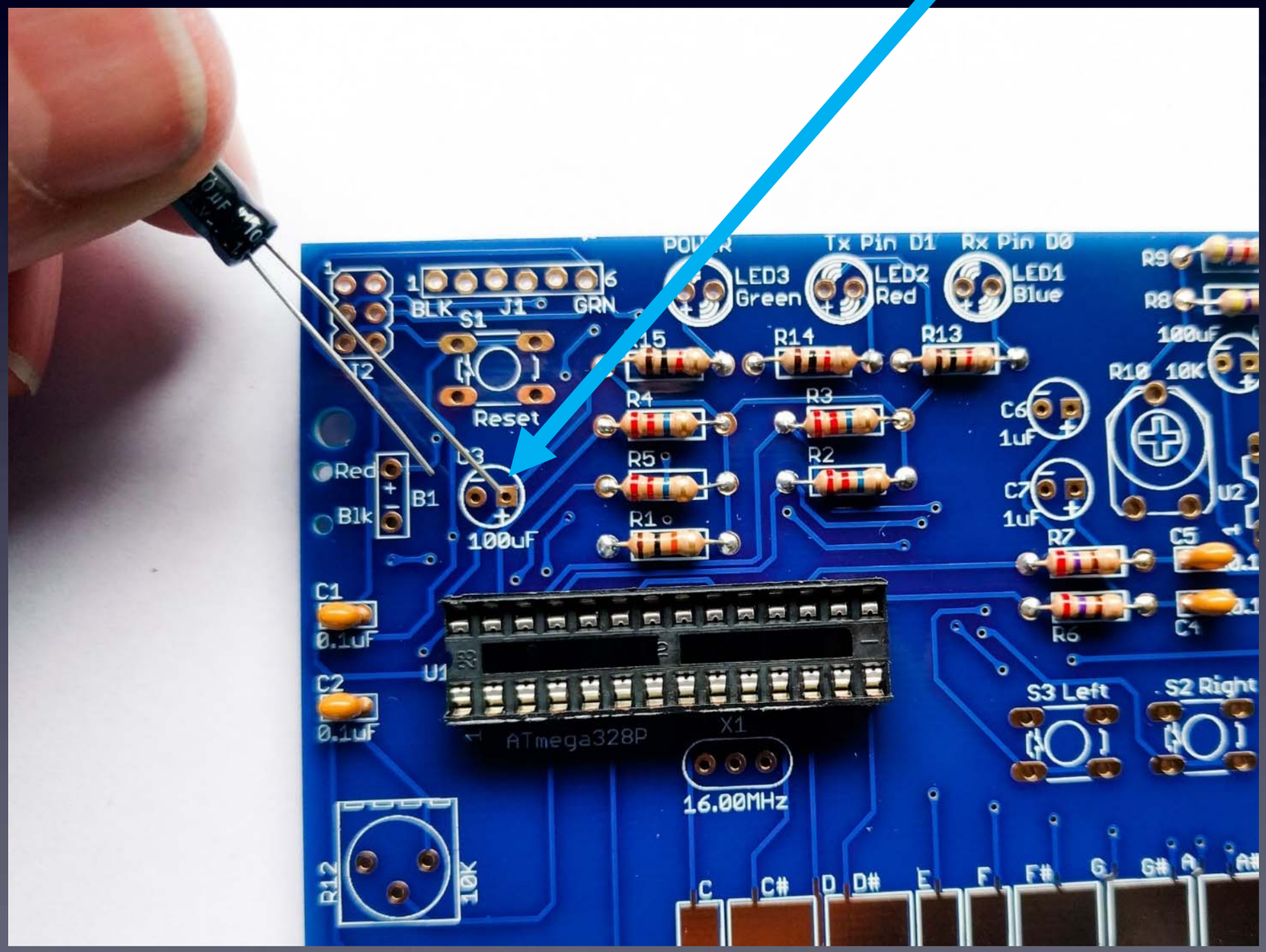
Different than C3, C8 !

C6, C7: 1uF

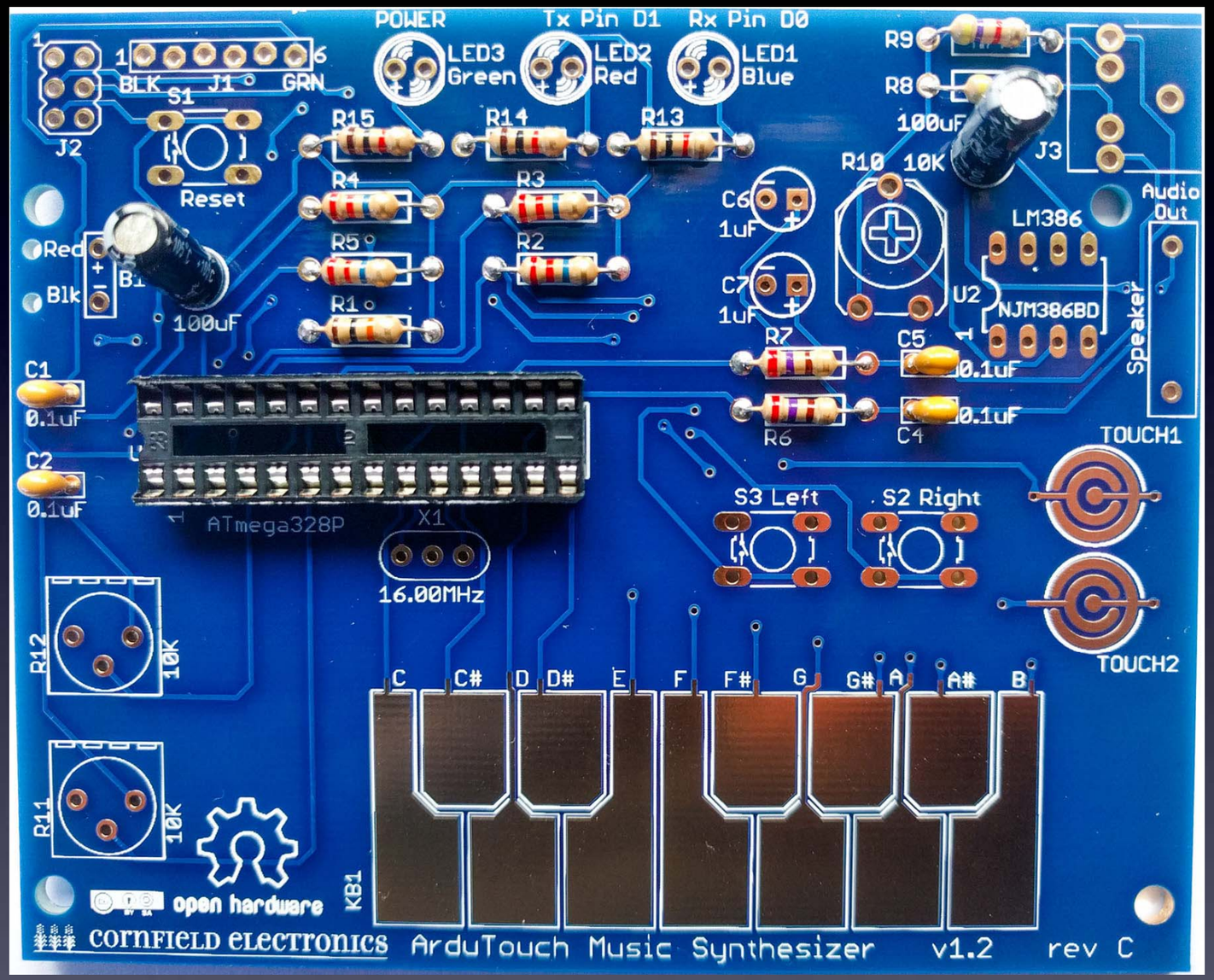


C3, C8: 100uF

C3, C8:
Long Lead “+”

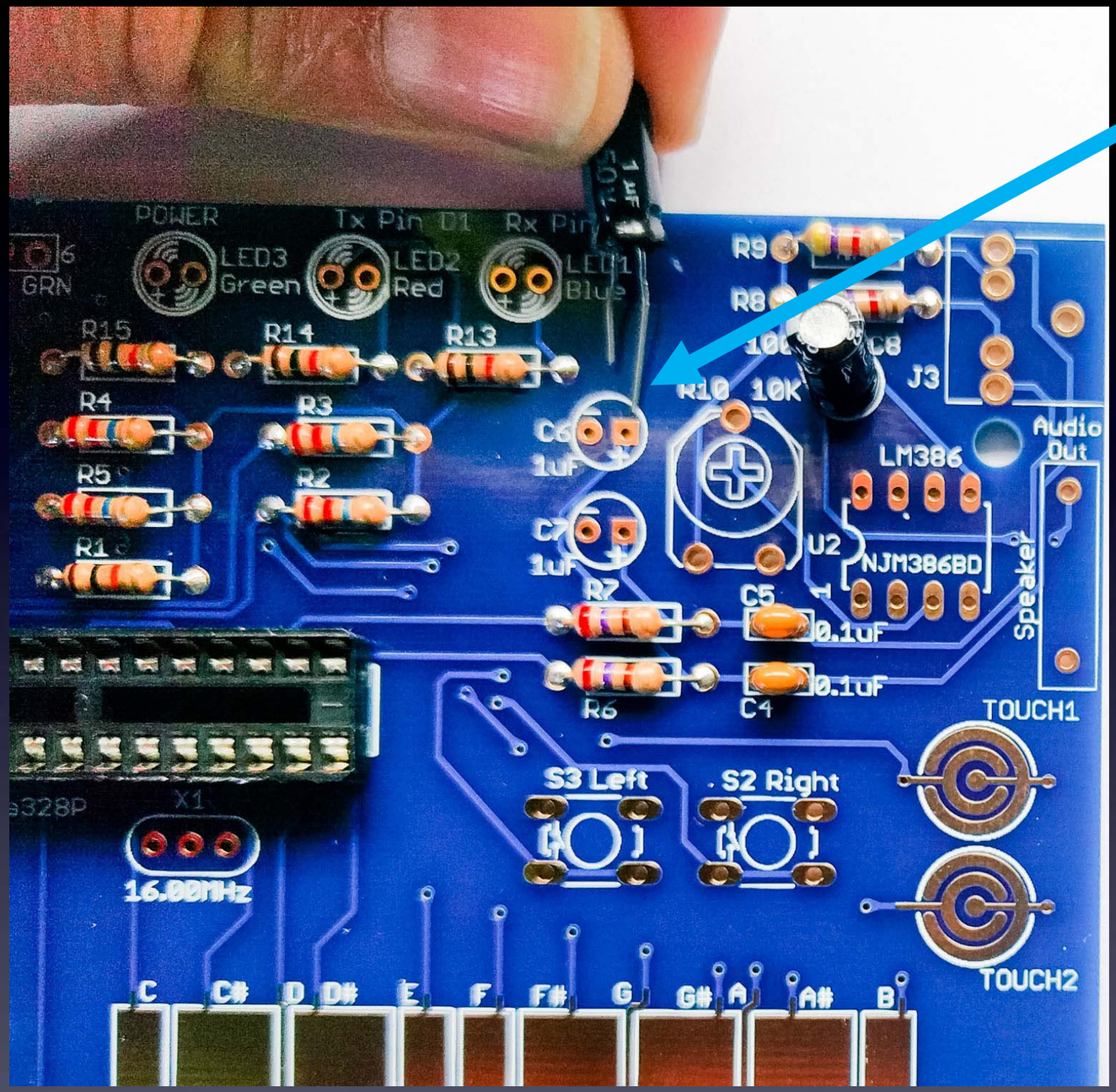


Use 100uF !!



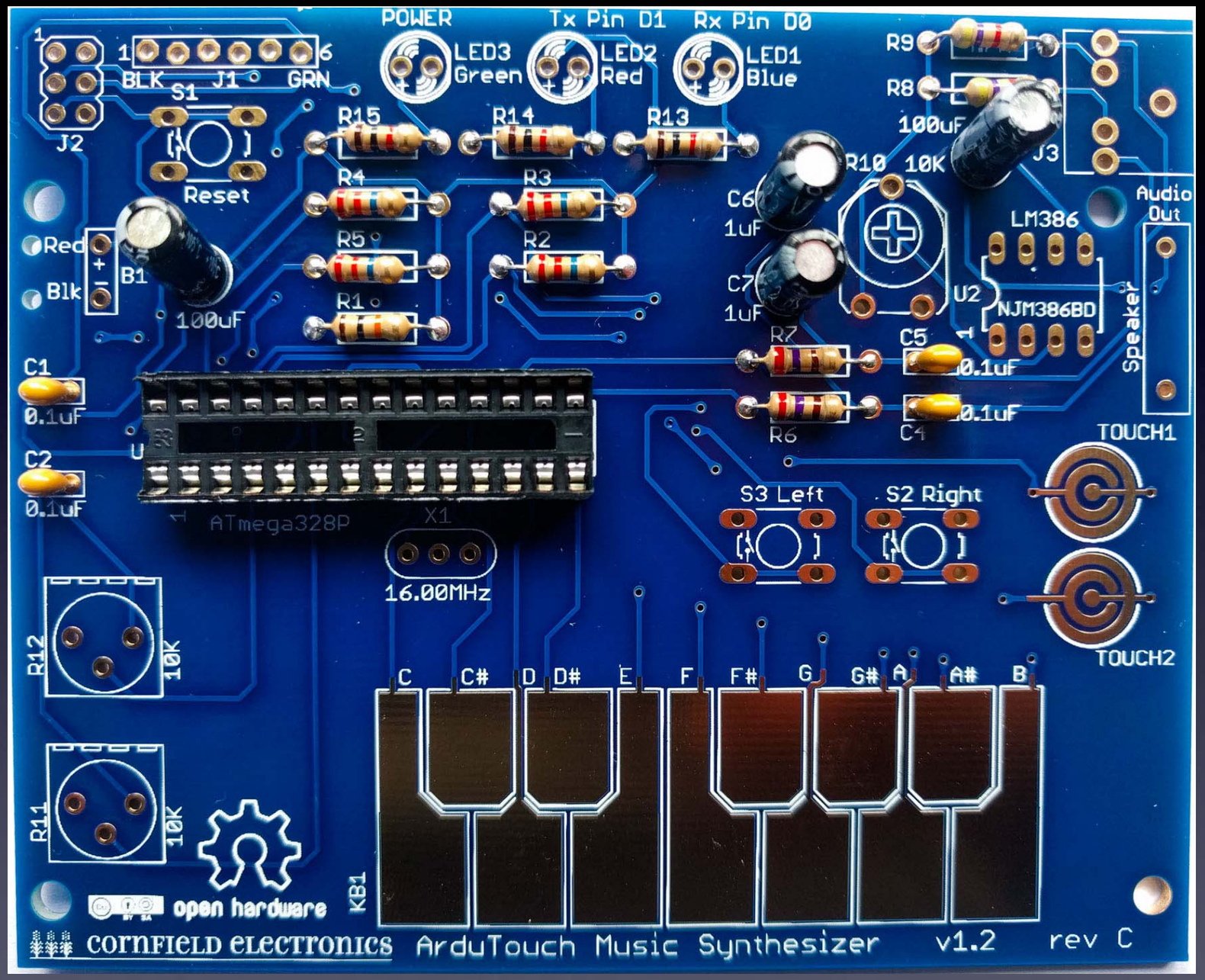
C3, C8: 100uF – soldered to board

C6, C7: 1uF



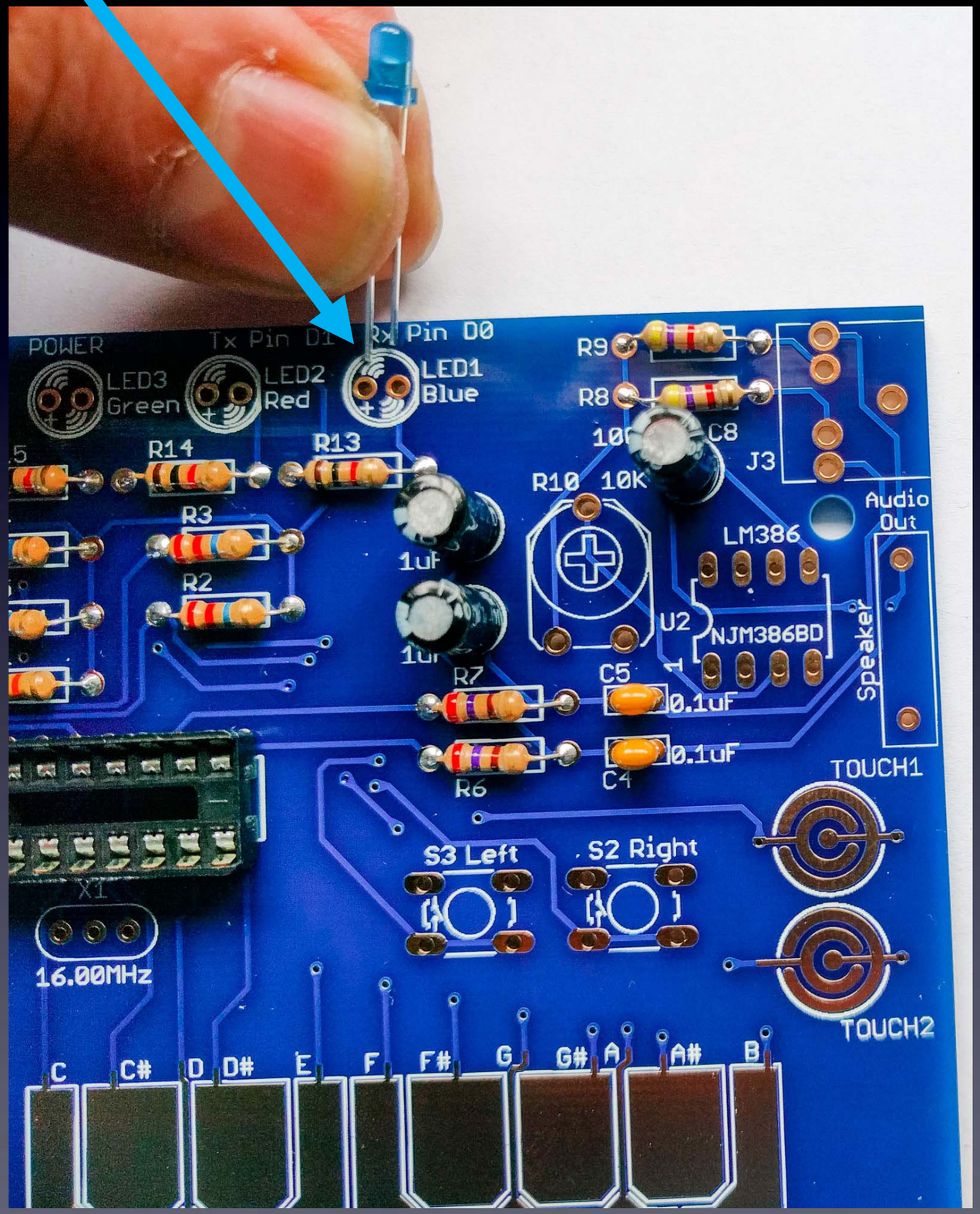
C6, C7: Long Lead “+”

Use 1uF !!



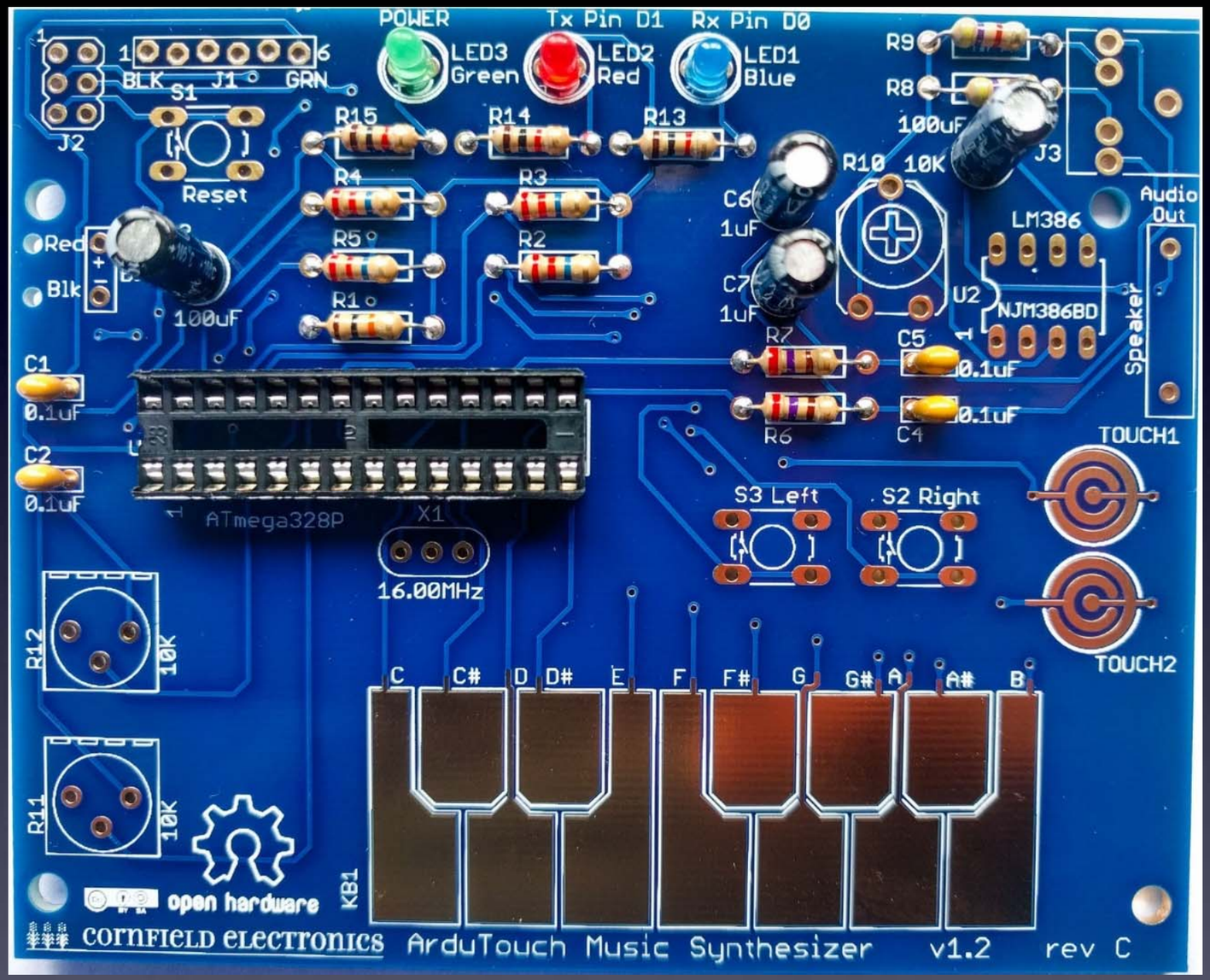
C6, C7: 1uF – soldered to board

LED1, LED2, LED3: Long Lead “+”



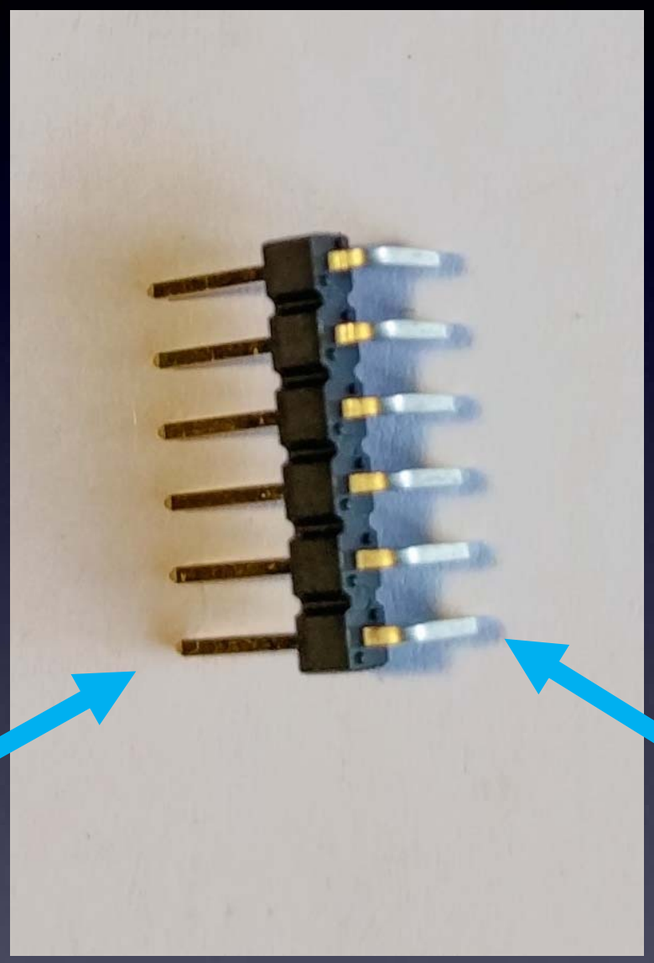
Save these leads

We’ll use them for the speaker



LED1, LED2, LED3

Green, Red, Blue – soldered to board



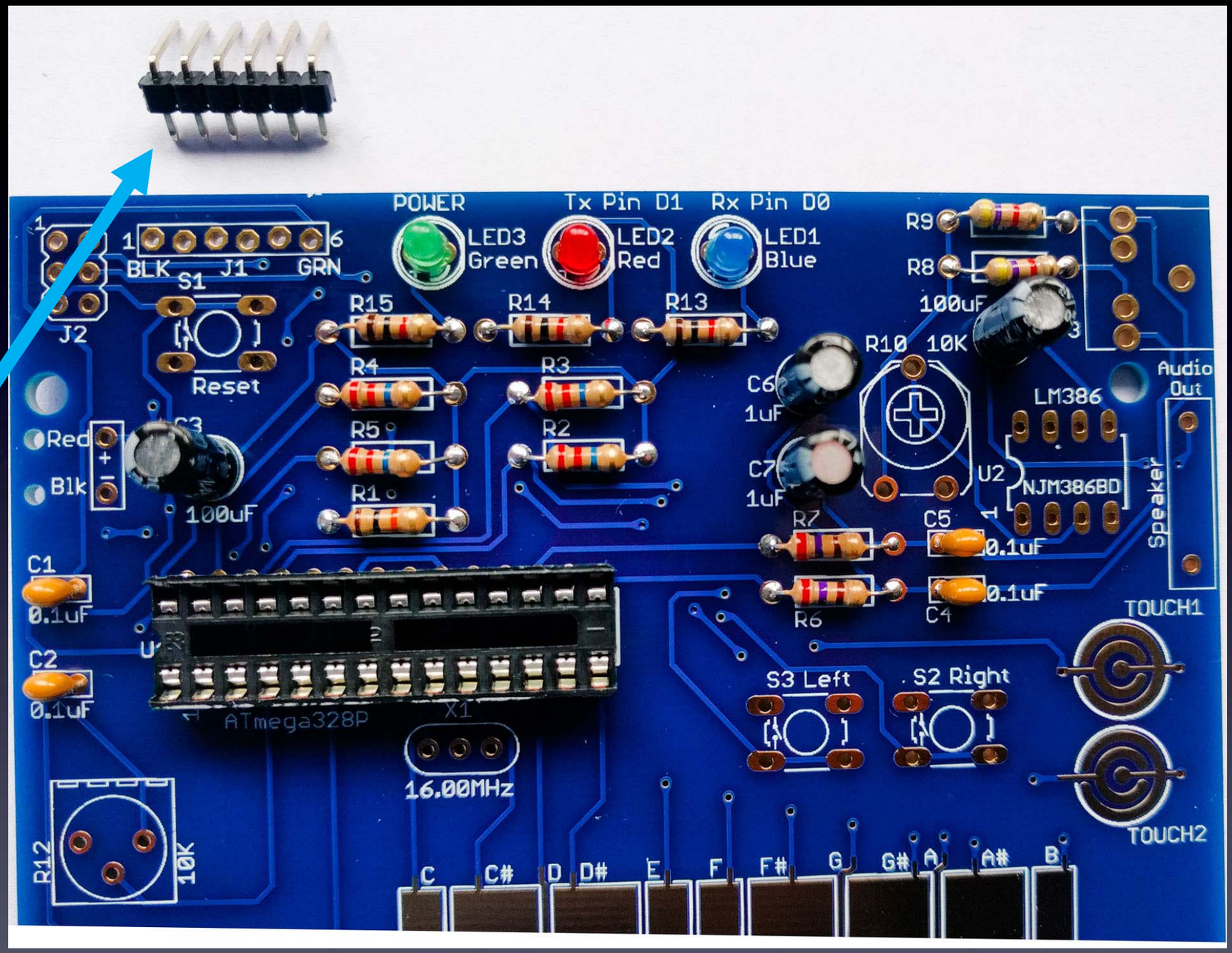
long leads

short leads

J1

Short leads into board

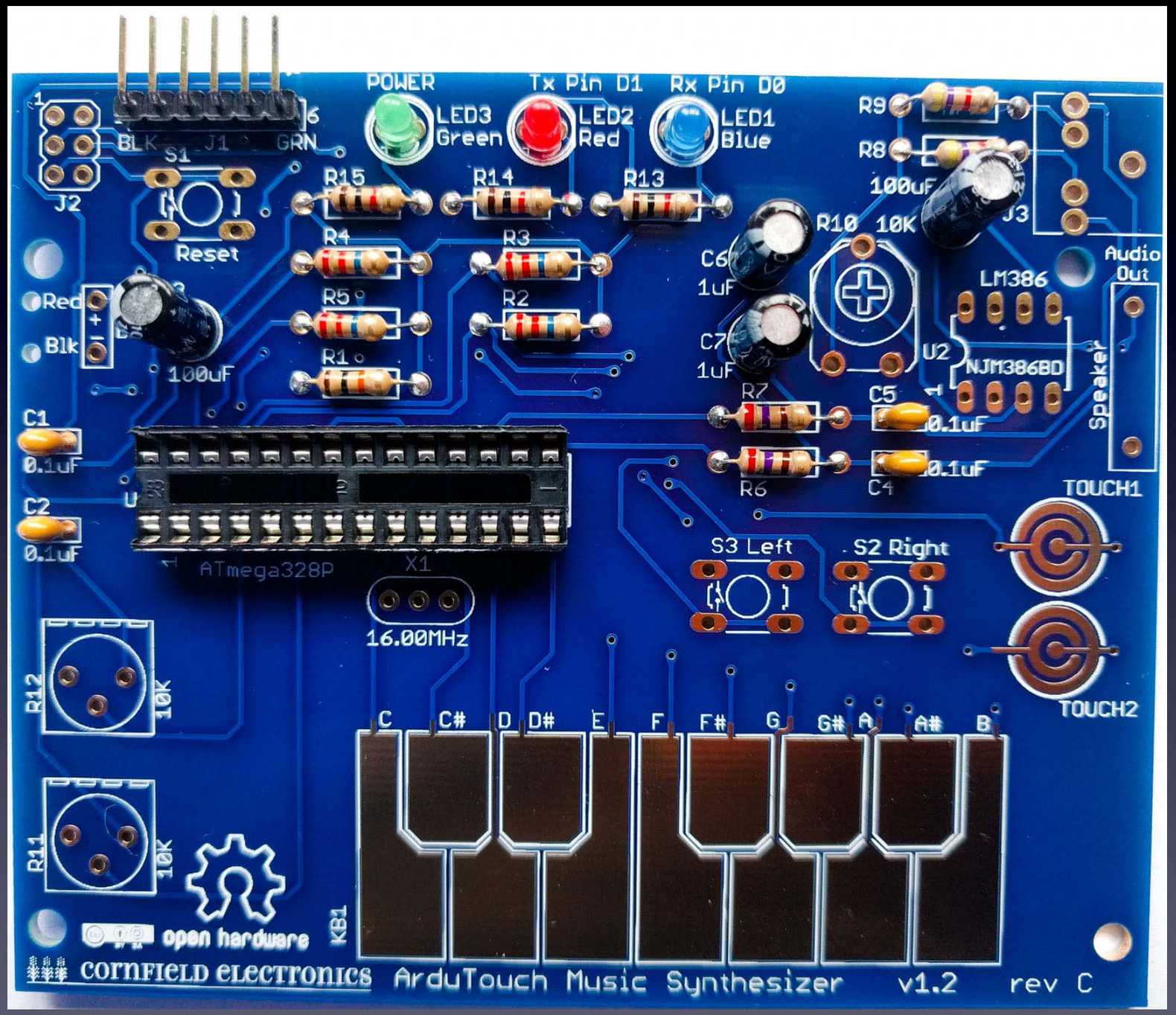
J1

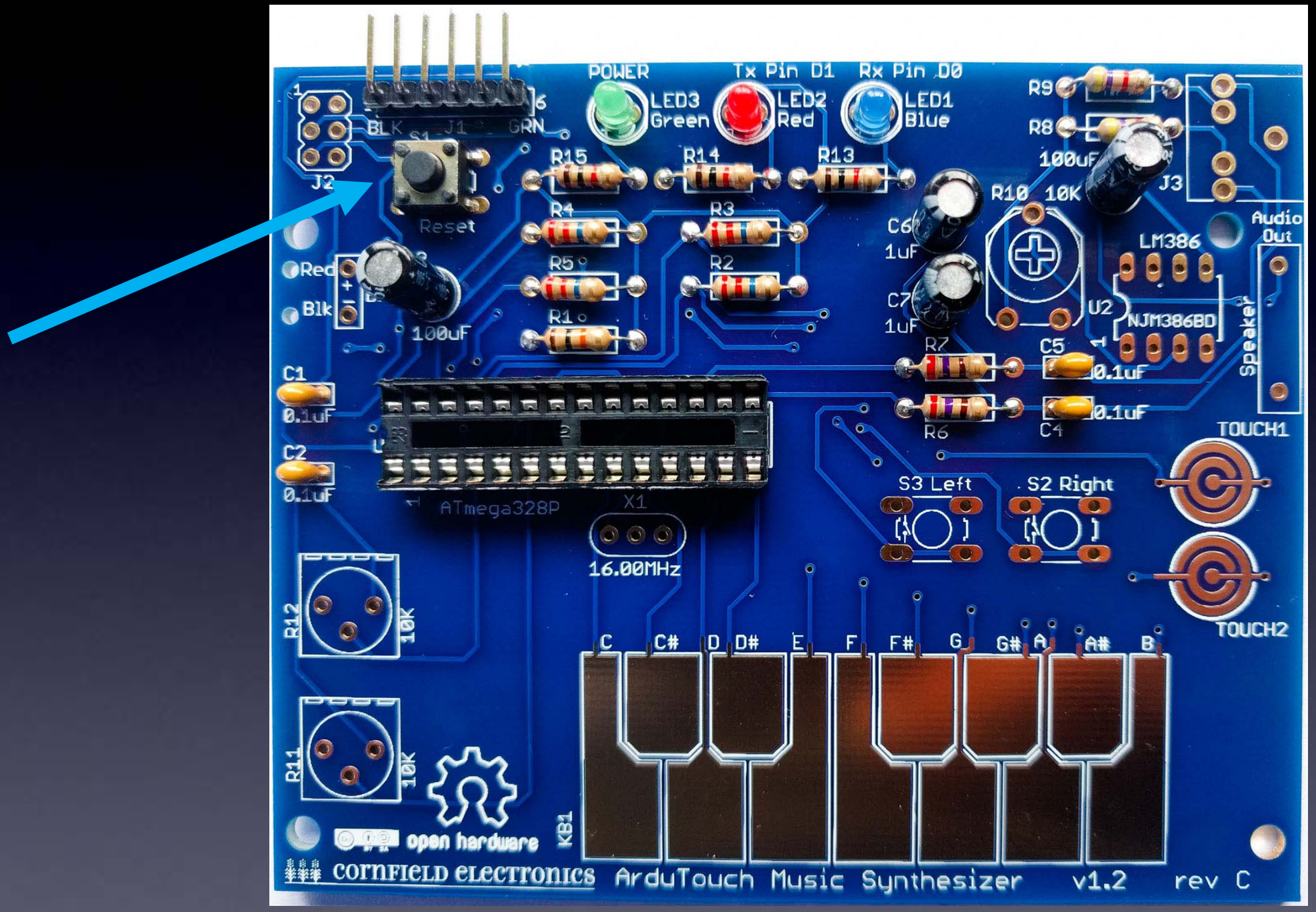


short leads
go into the board

→ long leads sticking out from board

J1


POWER
LED3 Green
Tx Pin D1
LED2 Red
Rx Pin D0
LED1 Blue
J1
BLK
GRN
J2
S1
Reset
R15
R14
R13
R4
R3
R5
R2
R1
Red
Blk
100uF
C1
0.1uF
C2
0.1uF
ATmega328P
X1
16.00MHz
R12
10K
R11
10K
open hardware
CORNFIELD ELECTRONICS
KB1
R9
R8
100uF
R10
10K
J3
C6
1uF
C7
1uF
U2
LM386
NJM386BD
Audio Out
Speaker
R7
C5
0.1uF
R6
C4
0.1uF
TOUCH1
S3 Left
S2 Right
TOUCH2
C C# D D# E F F# G G# A A# B
ArduTouch Music Synthesizer v1.2 rev C

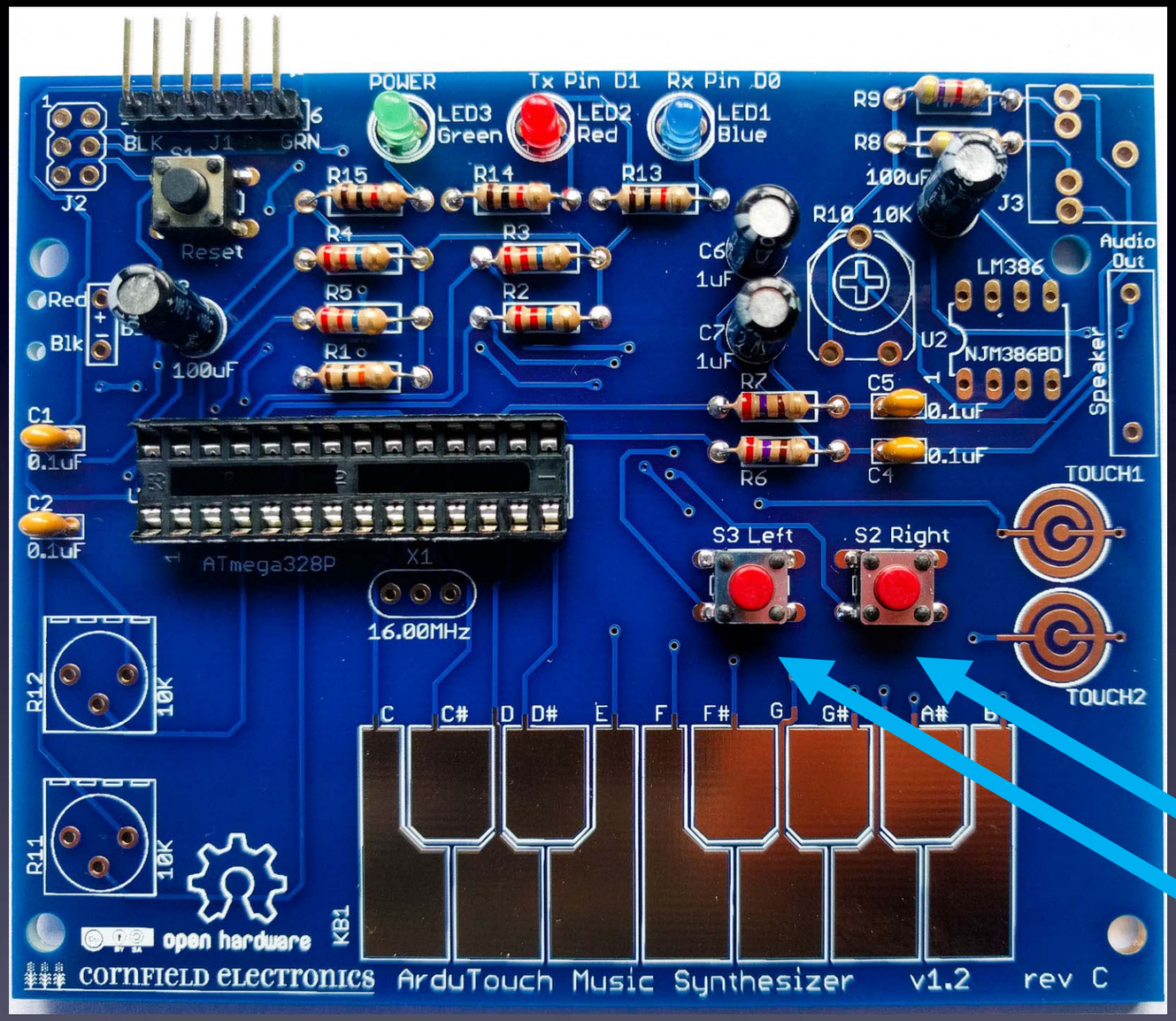


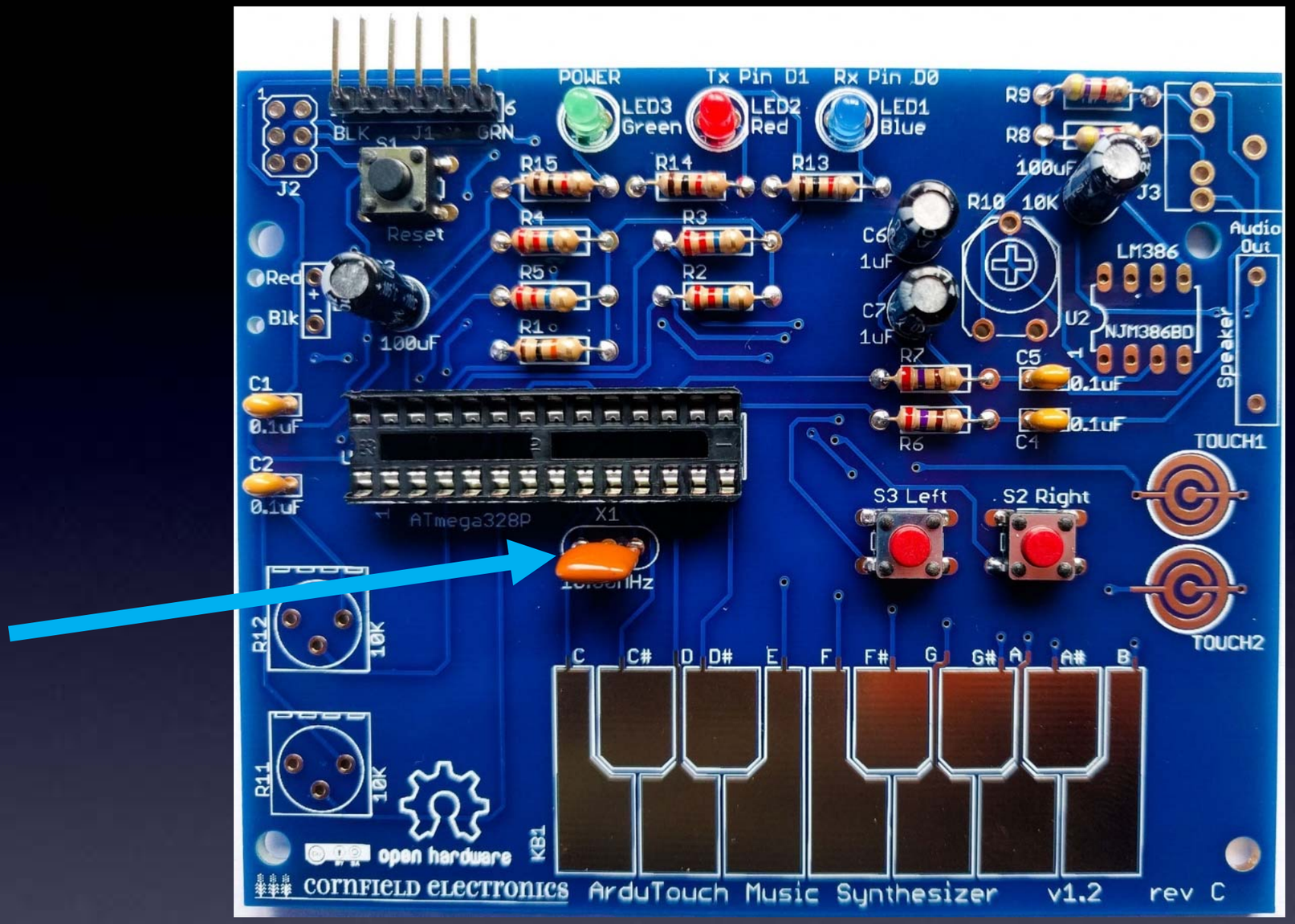
S1: black Reset button

Note: The color of this switch is not important (some kits may have different colors).

S2, S3: Red buttons

Note: The color of these switches is not important (some kits may have different colors).



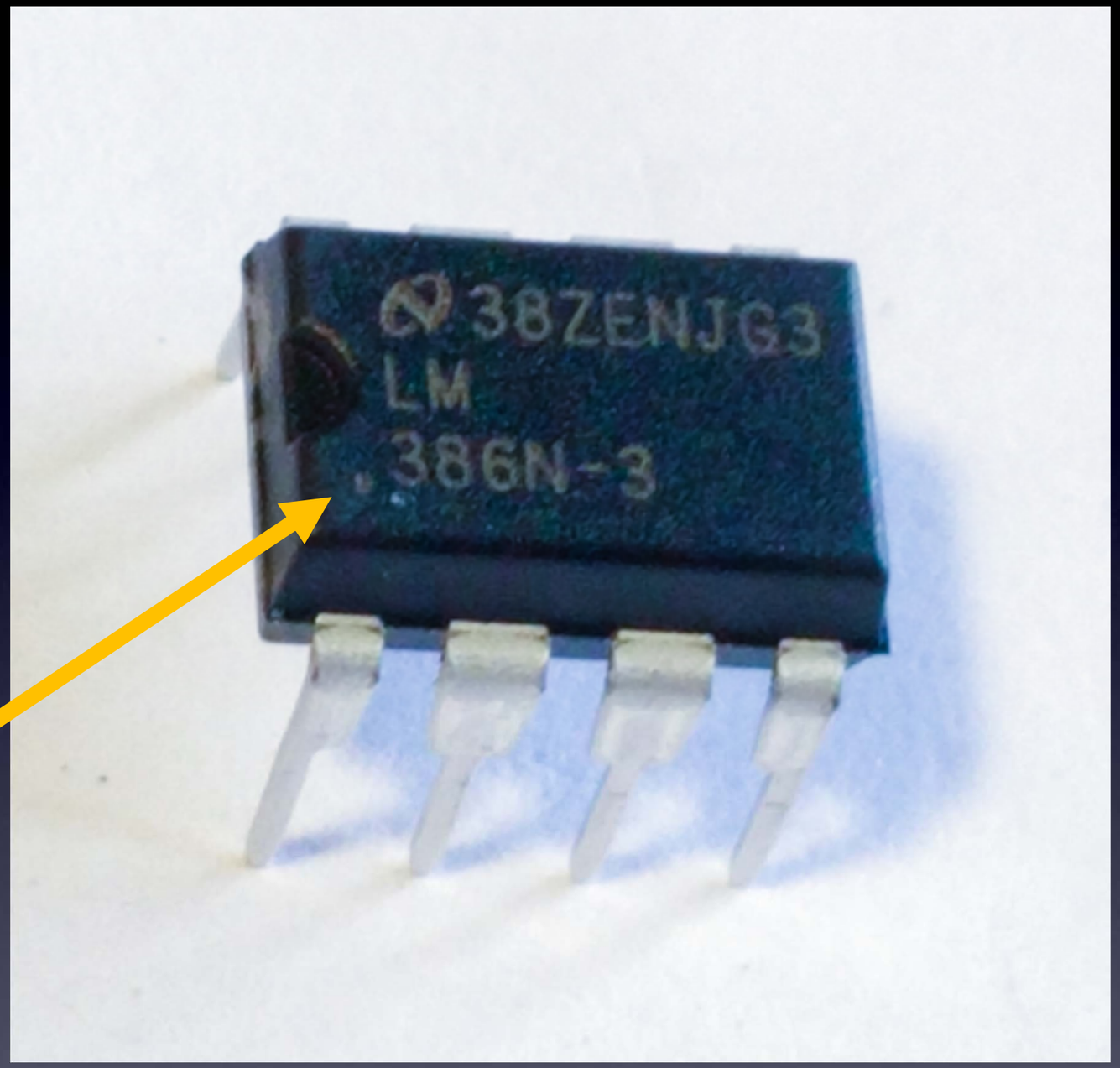


X1

The orientation of X1 does not matter.

Note: X1 may be yellow or blue.

U2

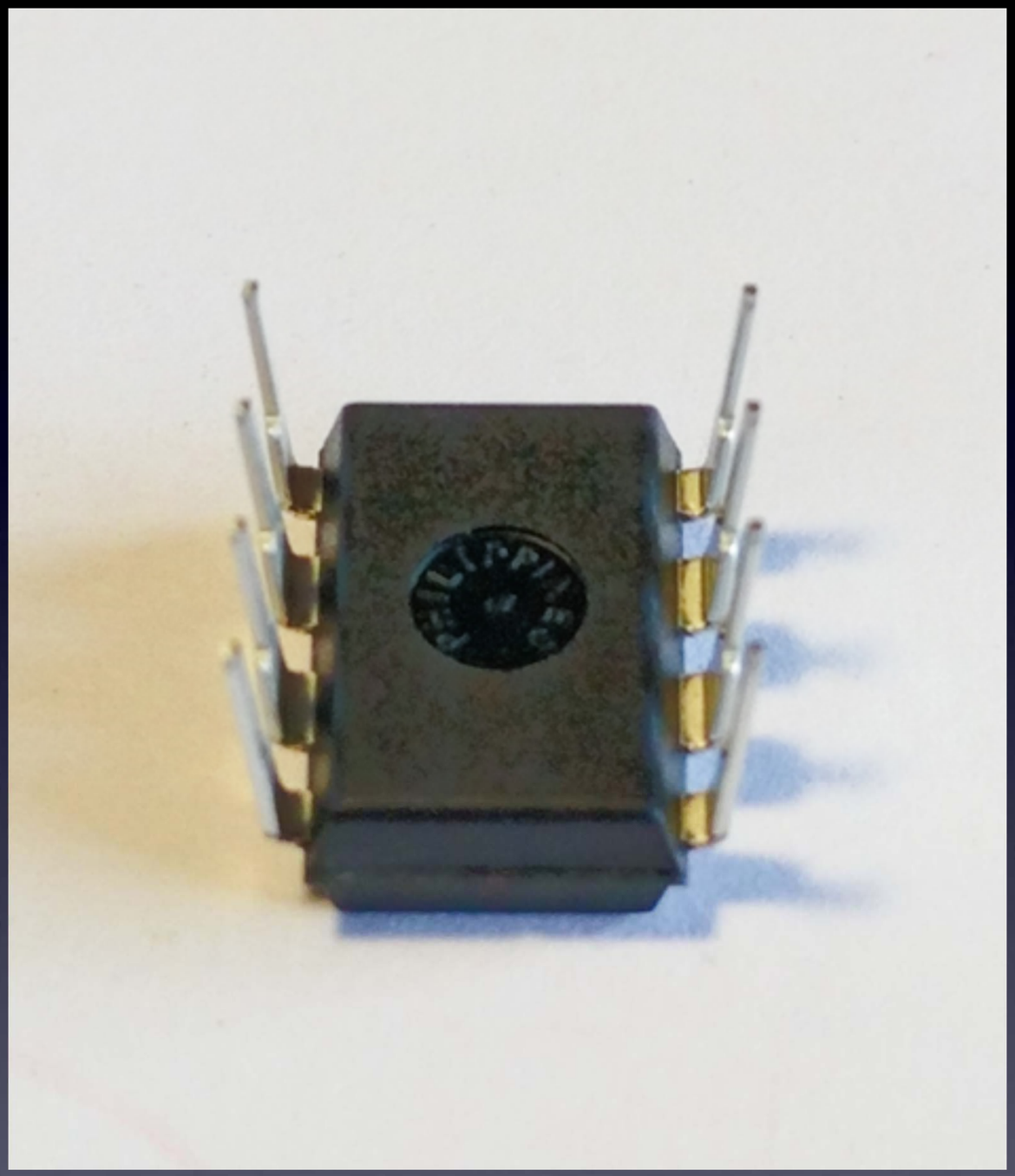


Indented black dot
Pin 1

Note: Your chip may be marked differently, but “386” will be printed on it somewhere.

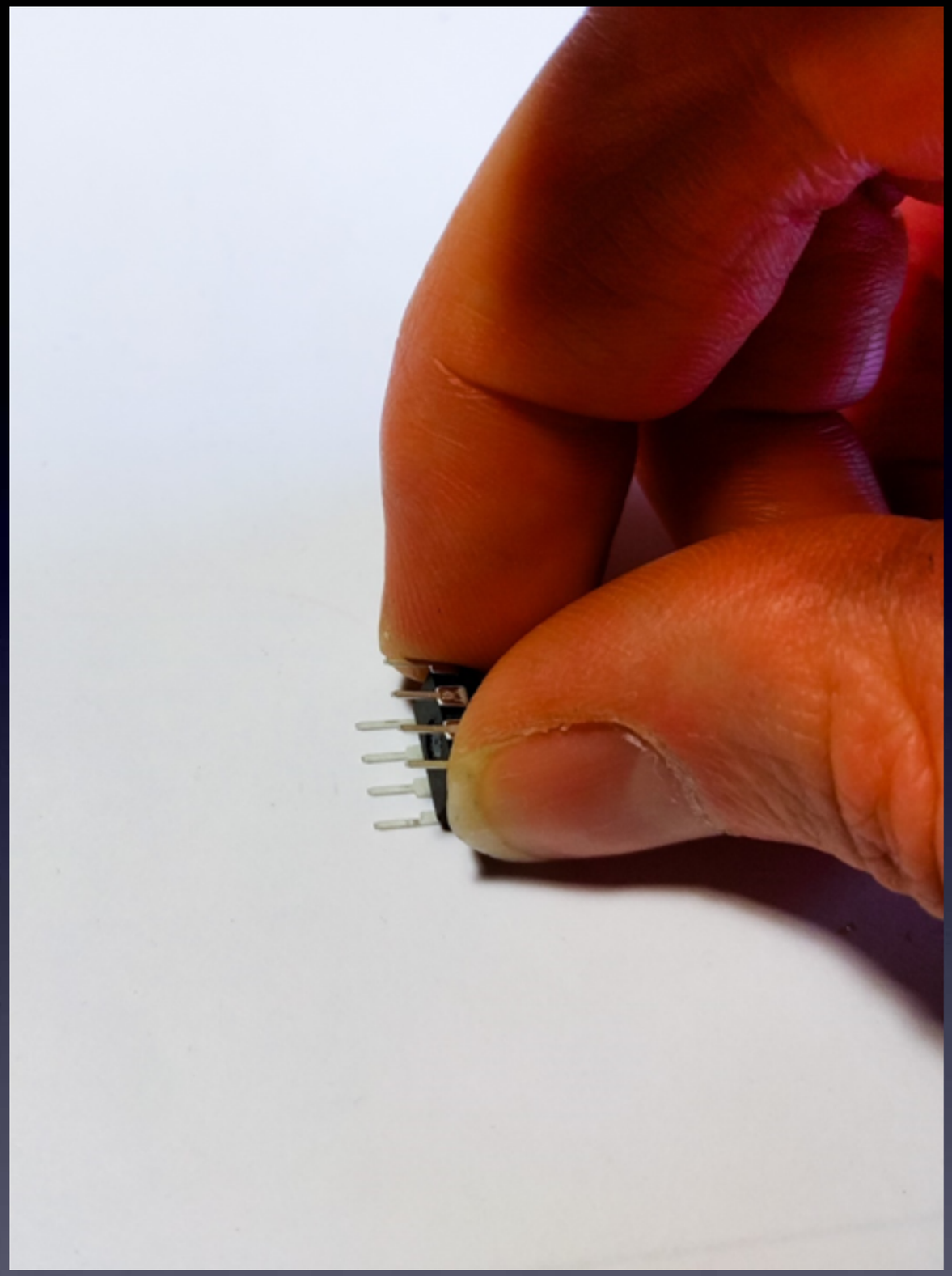
Note: Your chip may or may not have the indented half-moon at the left,
it may have a black indented dot at the lower-left corner showing Pin 1.

U2



When chips are new,
their pins are bent out.

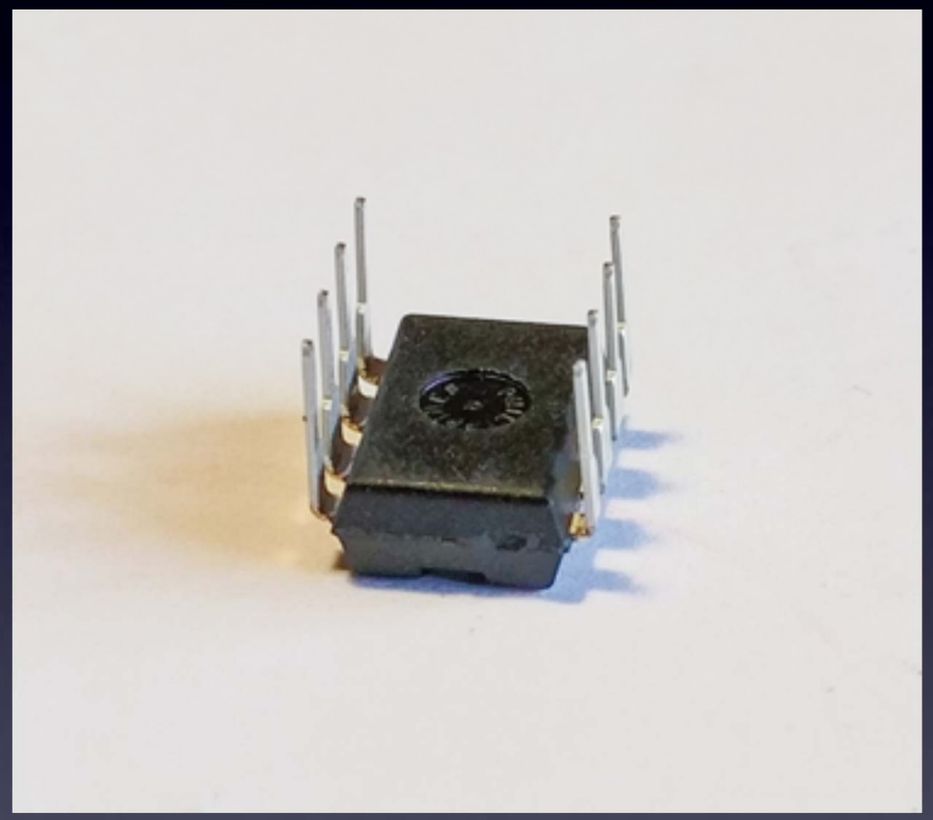
U2

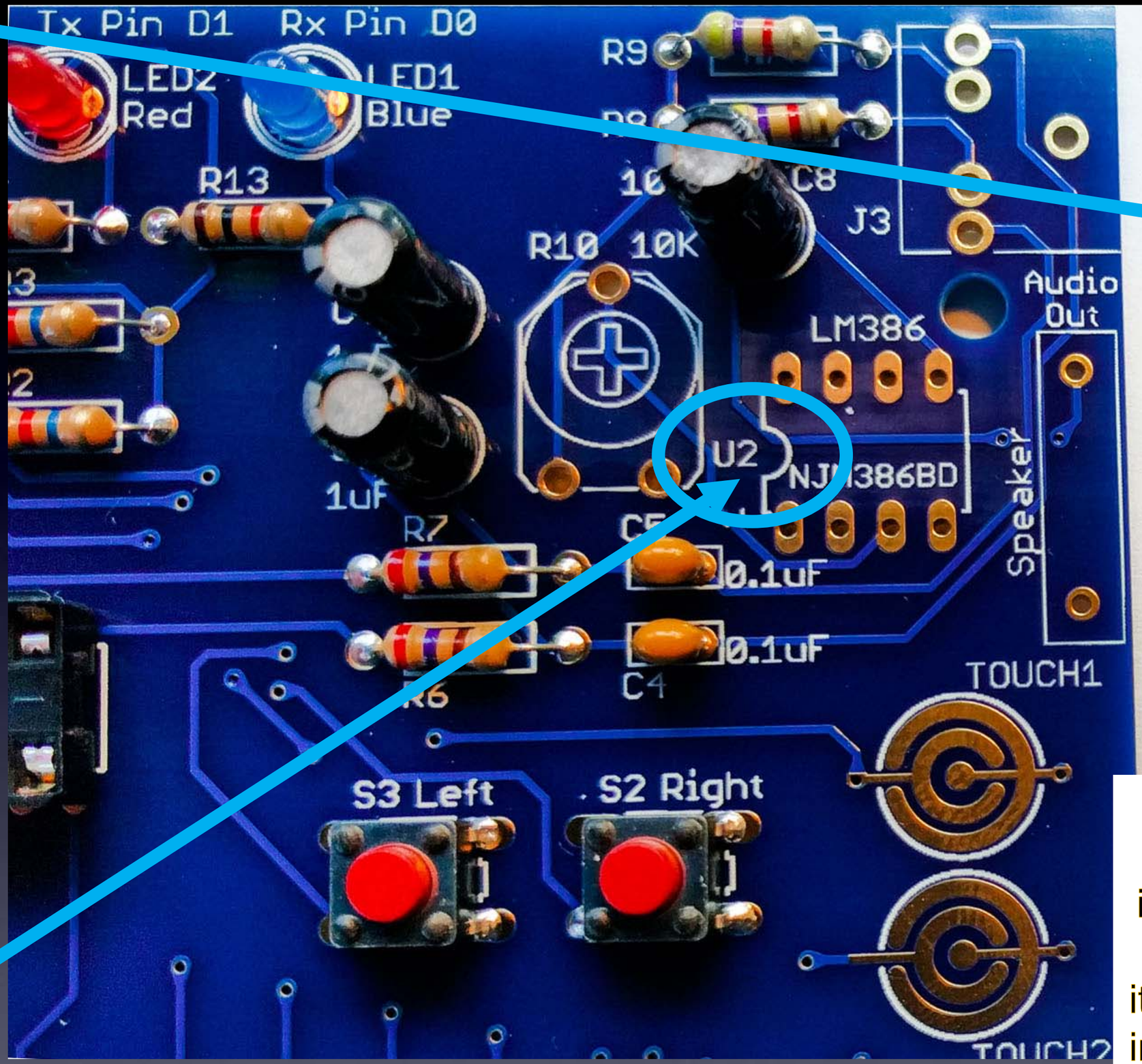


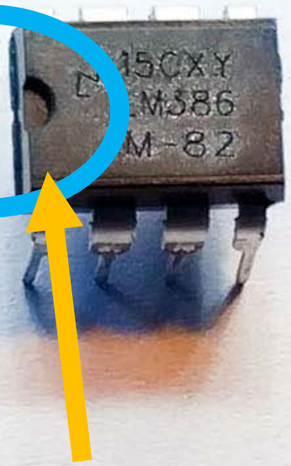
We need the pins bent straight and parallel.
Use your work table to (gently) bend the leads.

U2

Gently
bend leads
so they’re straight
and parallel





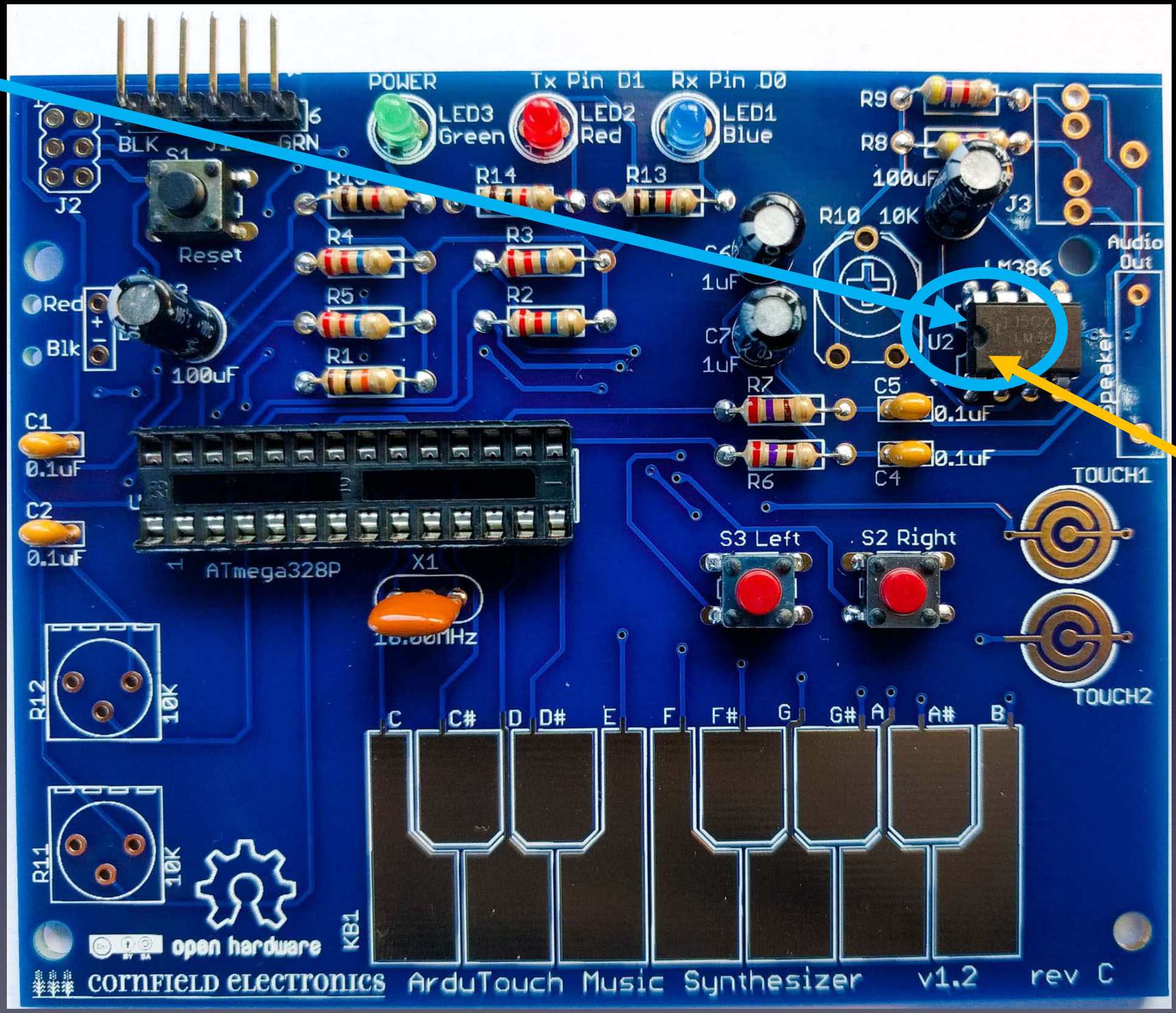


Indented black dot
Pin 1

proper orientation

Note: Your chip may or may not have the indented half-moon at the left,
it may have a black indented dot at the lower-left corner showing Pin 1.

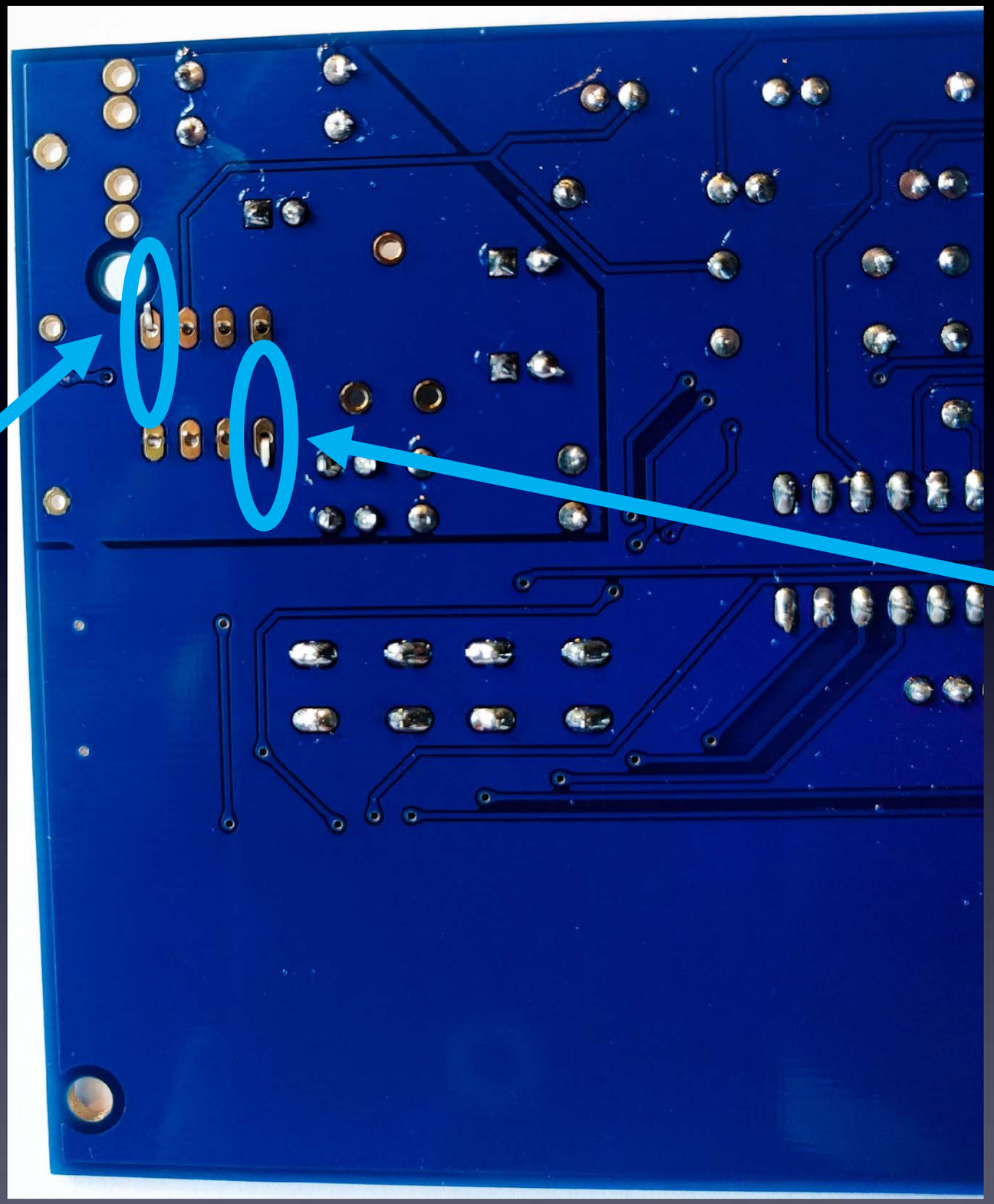
U2: audio amp chip



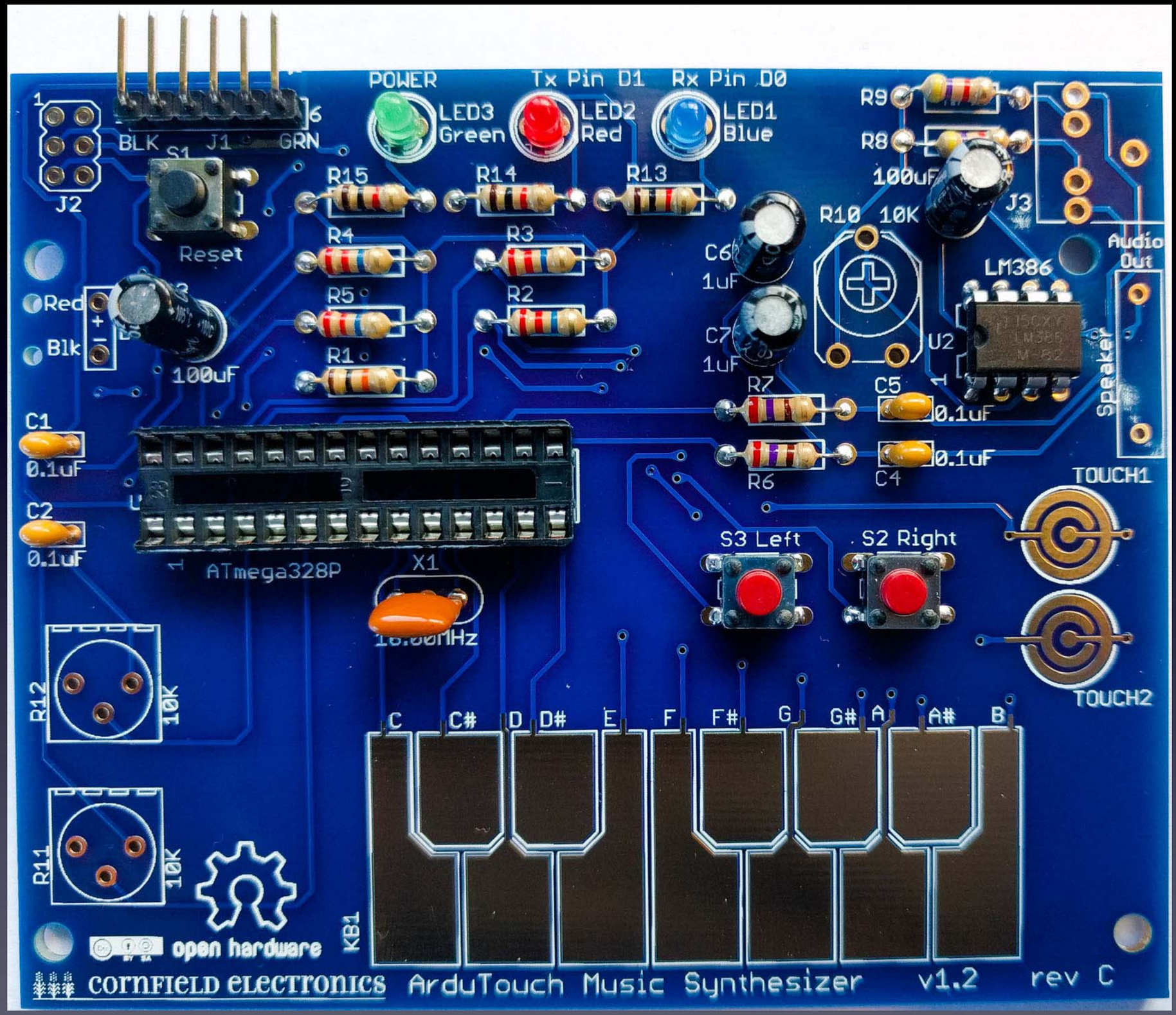
Indented black dot
Pin 1

U2: inserted correctly

U2

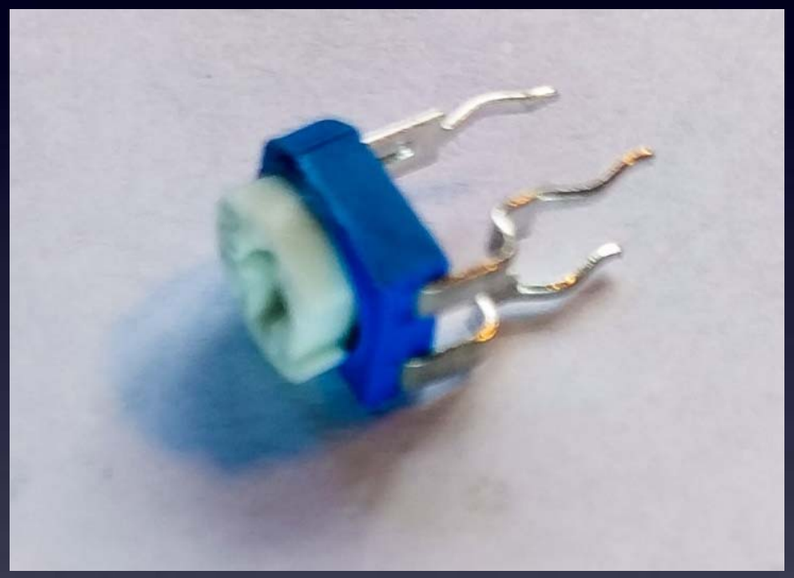


bend pins down on two corners,
and solder all 8 leads to the board



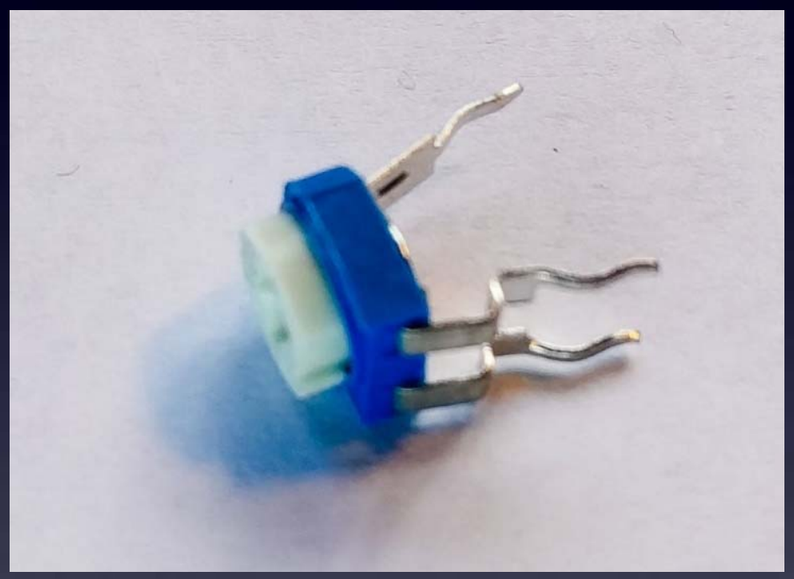
U2 – soldered to board

R10: volume control



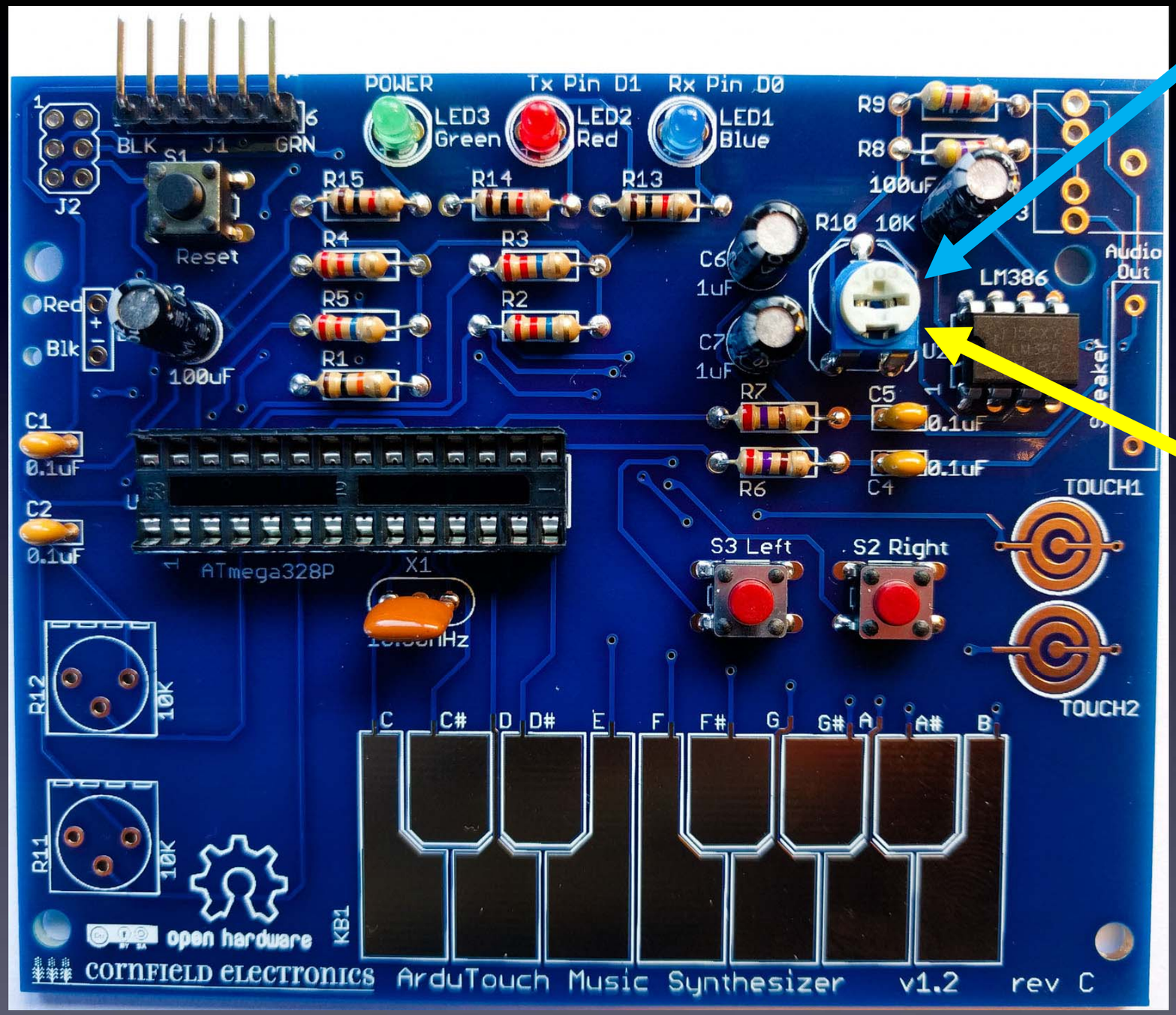
When new, the pins point straight down.

R10: volume control



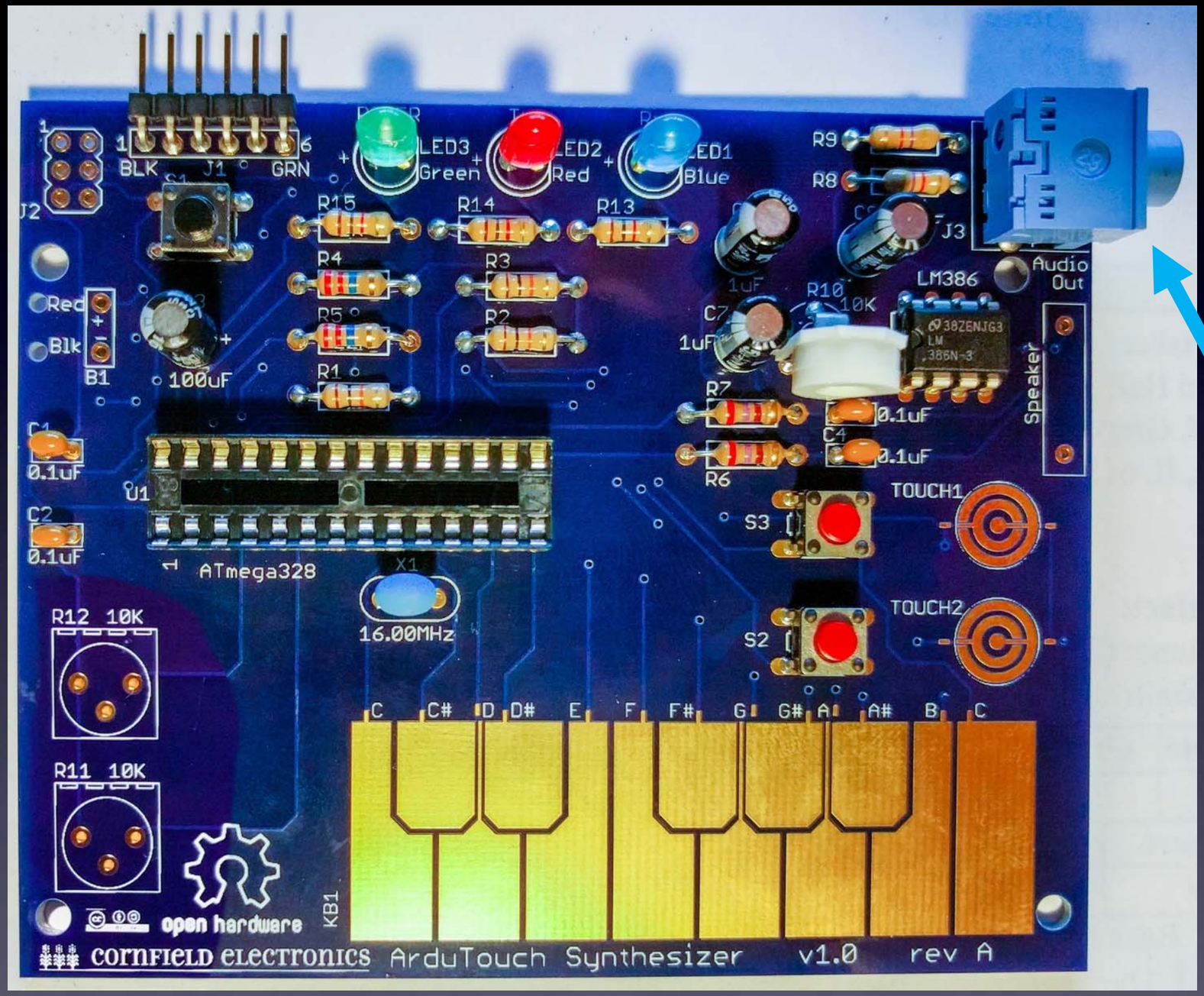
We need to bend them out a little to fit into the board.

R10: volume control

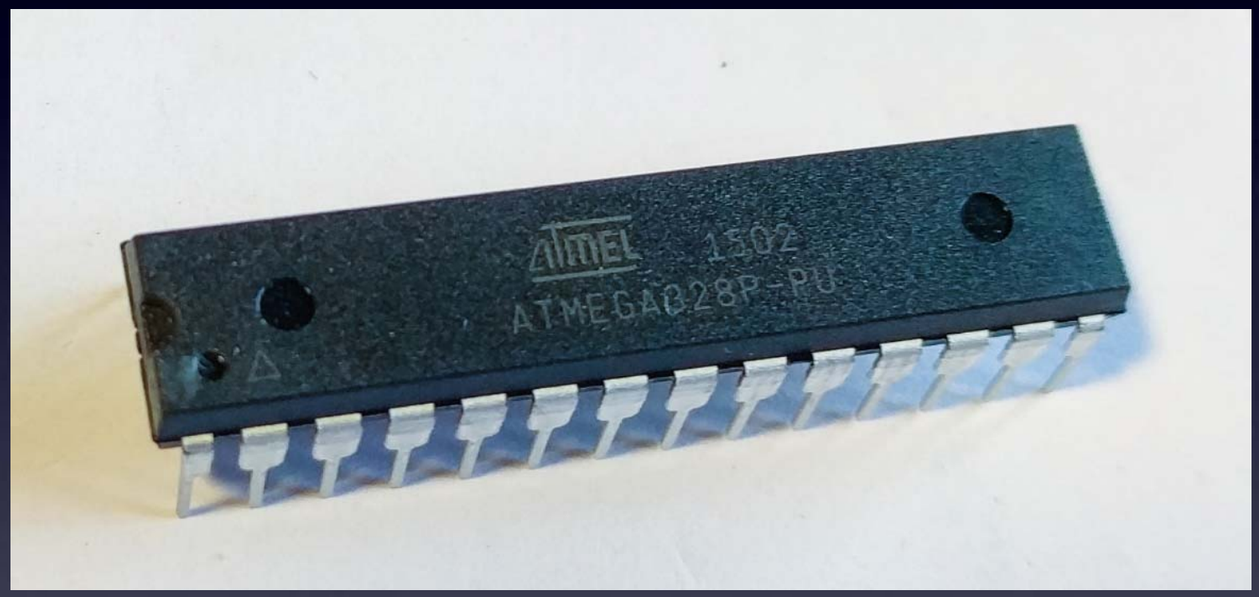


If necessary, rotate the white top so that it looks like this photo

(rotated half-way)

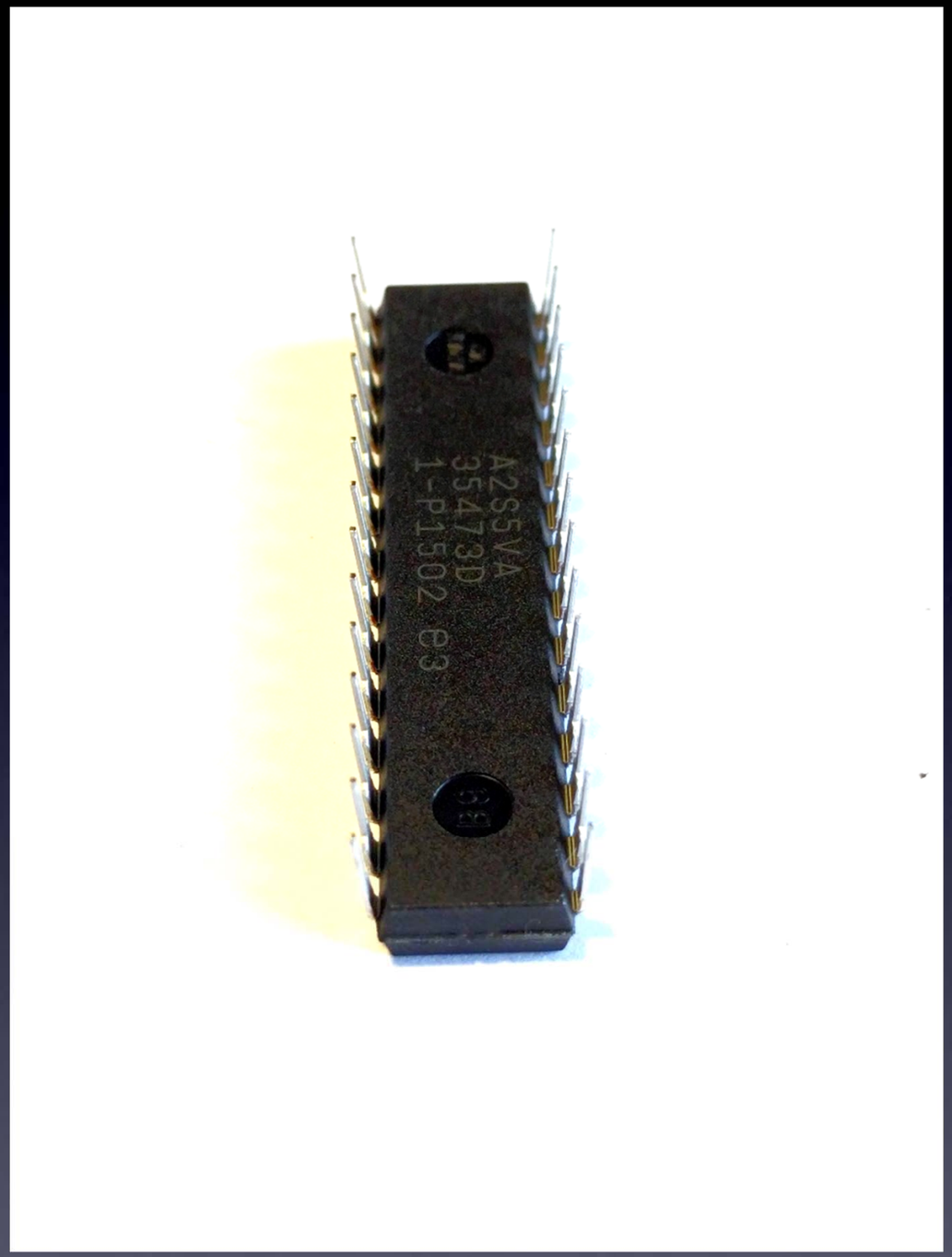


J3: headphone / output jack



U1: microcontroller

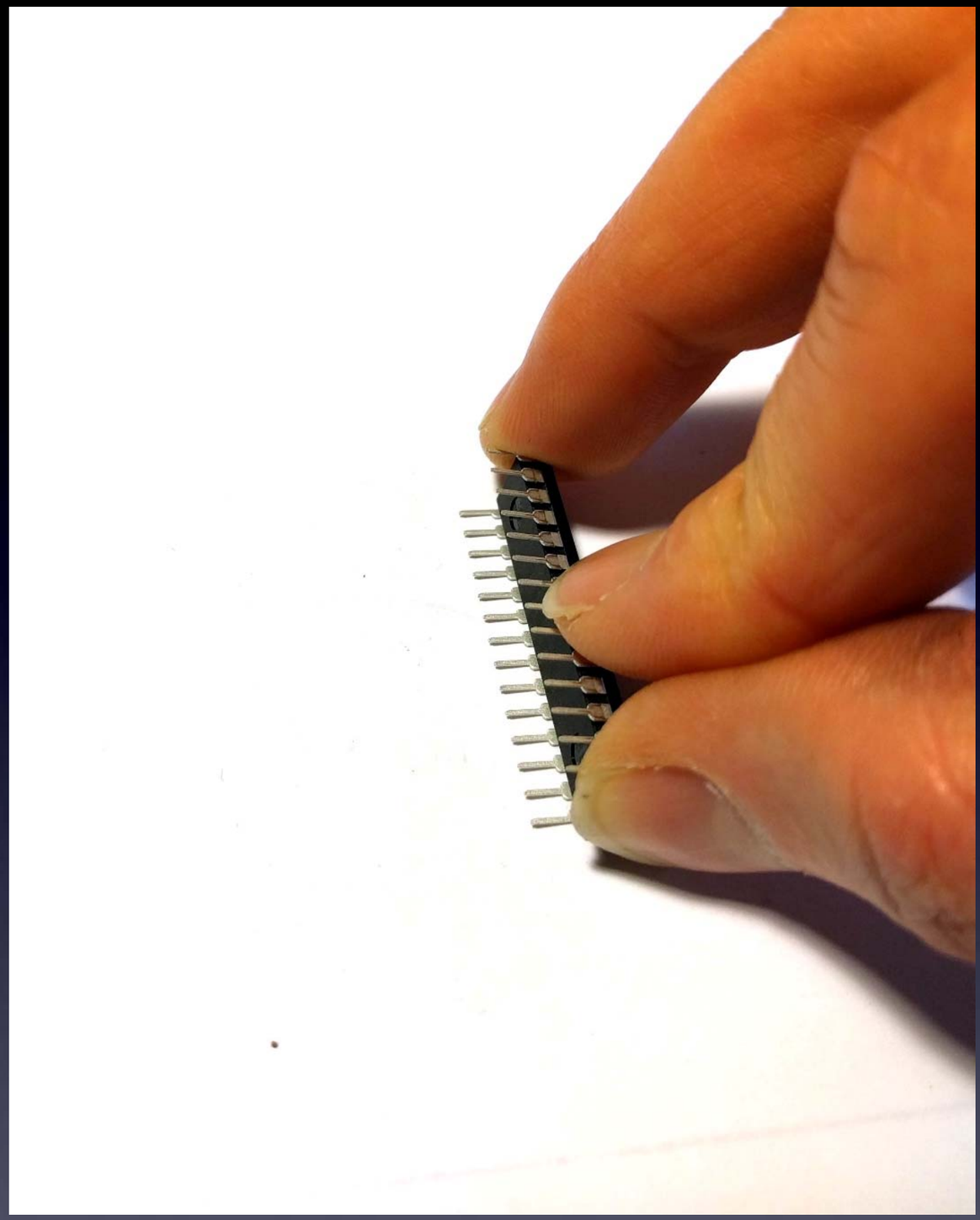
U1



When chips are new, their pins are bent out.

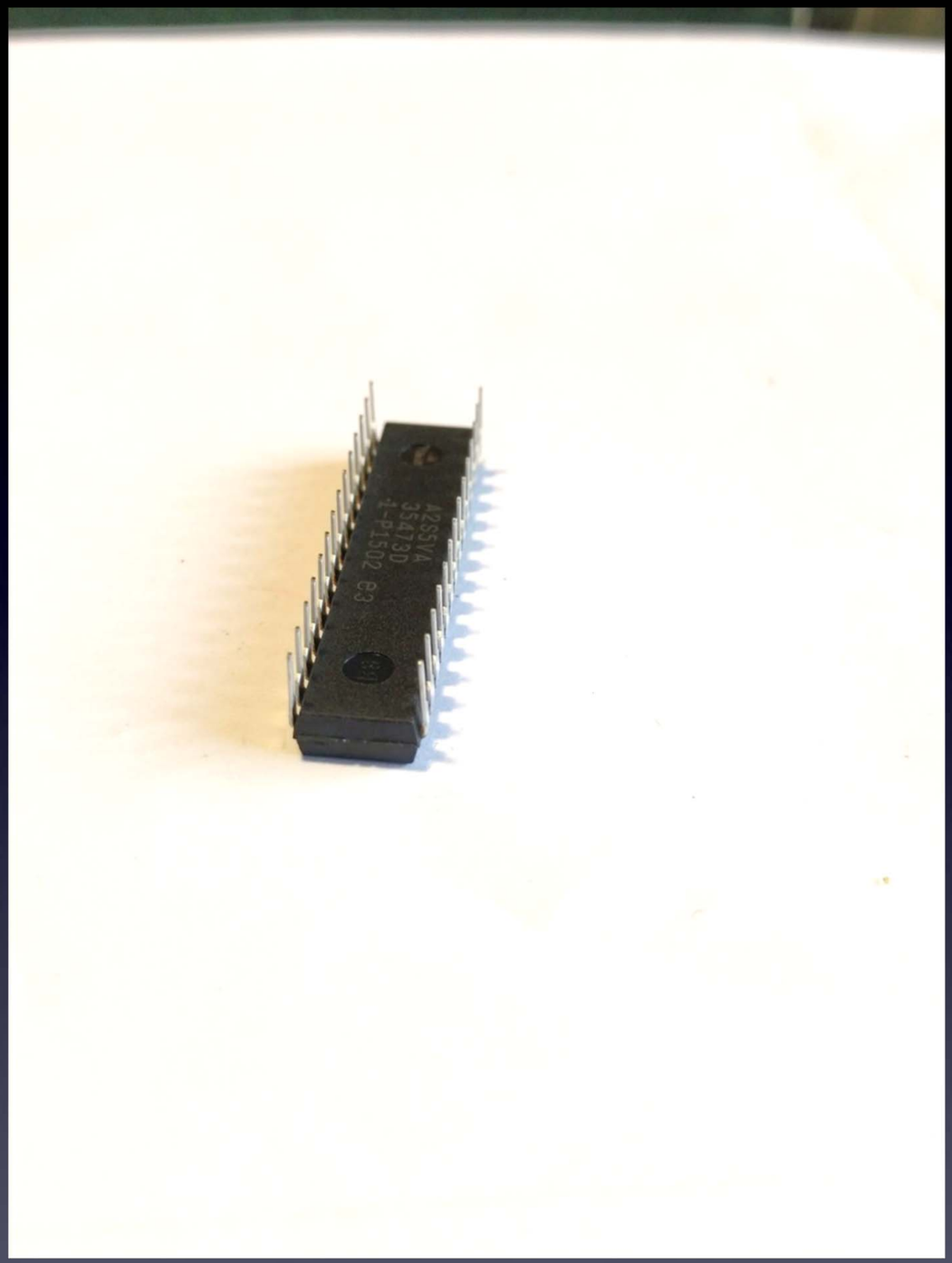
Note: Your kit's U1 chip may or may not have its pins already bent straight and parallel.
If not, you need to bend them, as shown in the next picture.

U1



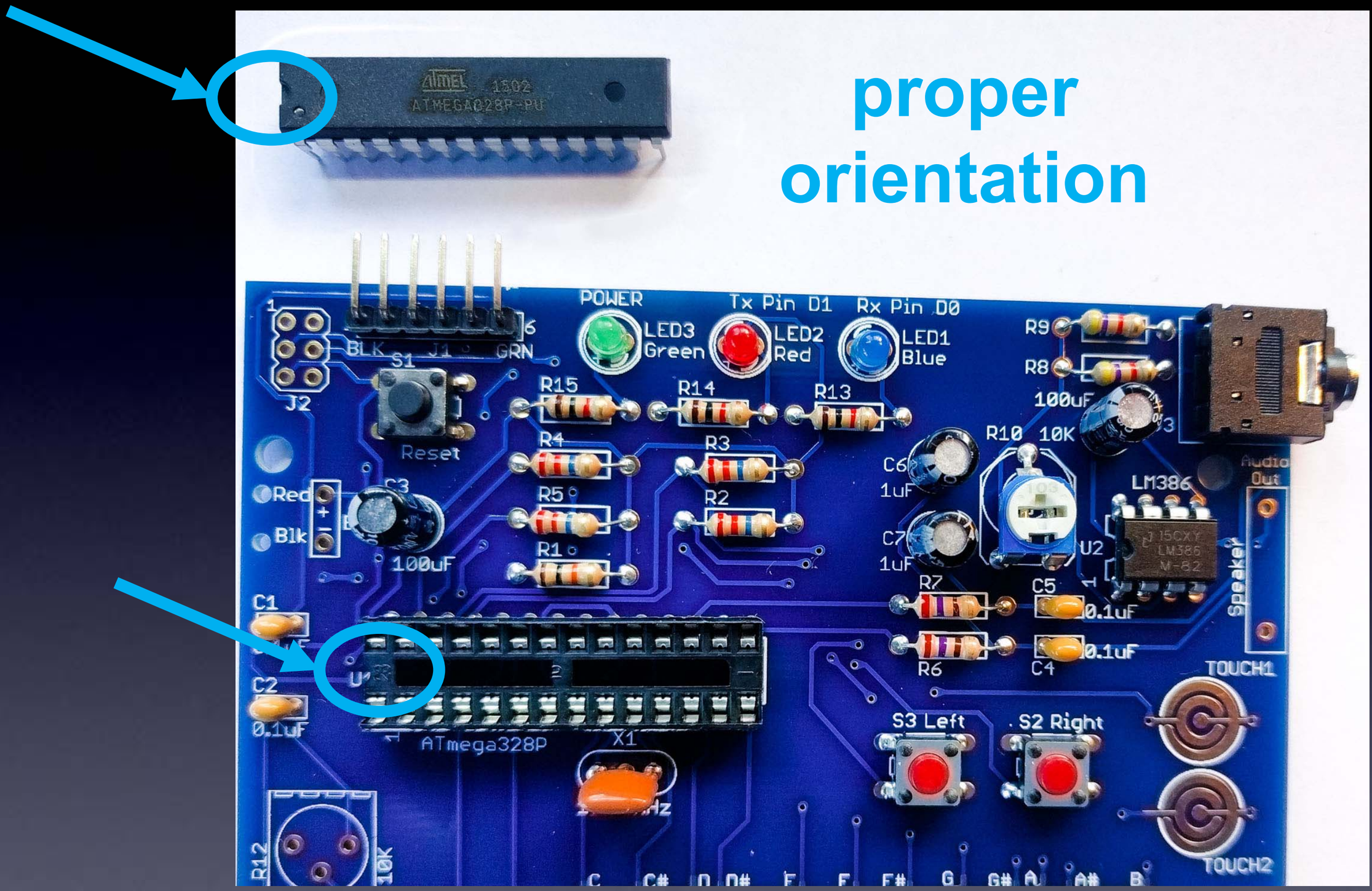
Note: Your kit's U1 chip may or may not have its pins already bent straight and parallel.
If not, you need to bend them, as shown in this picture.

We need the pins bent straight and parallel.
Use your work table to (gently) bend the leads.

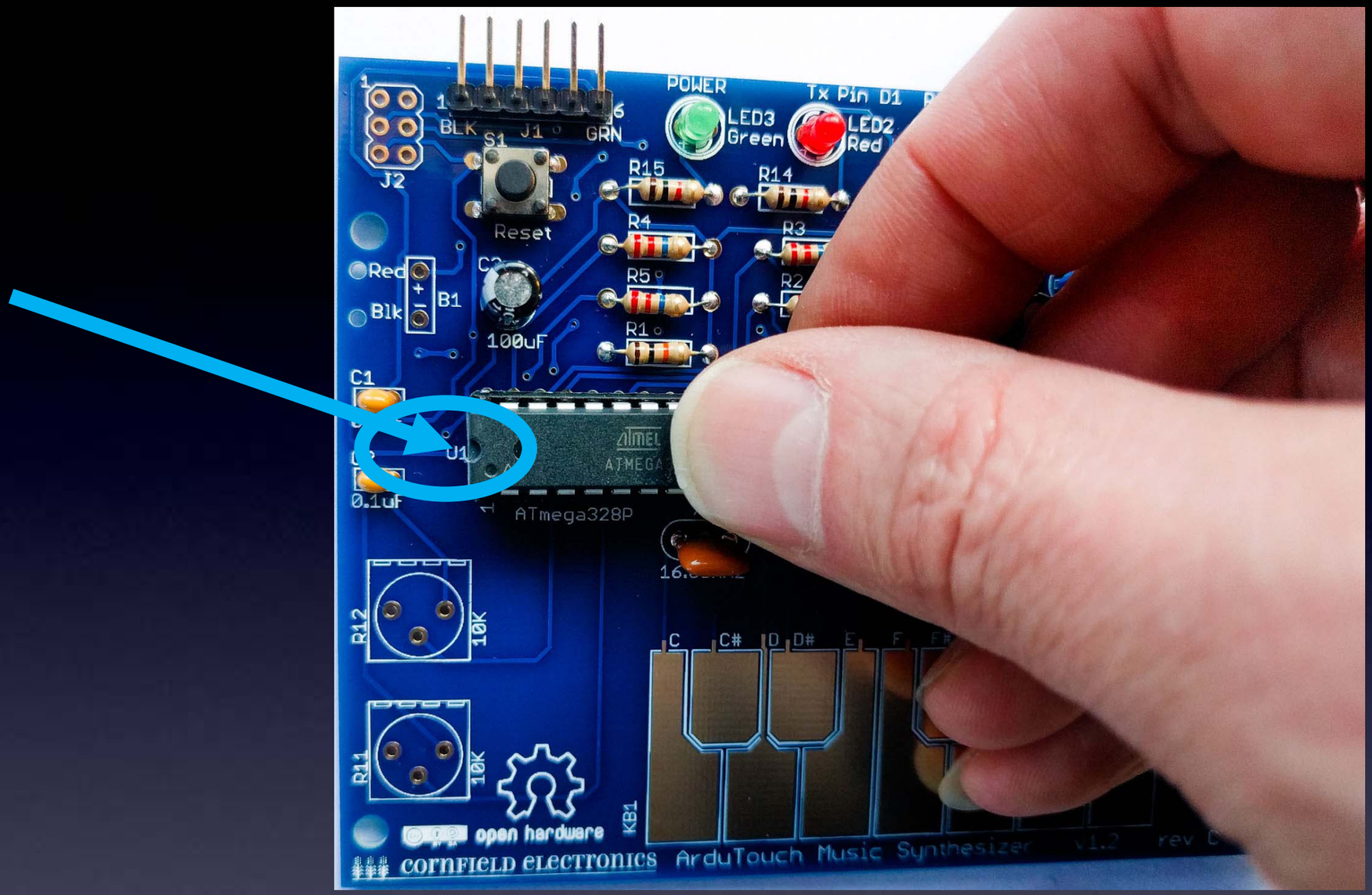


U1: microcontroller

These pins must be straight and parallel



U1: microcontroller



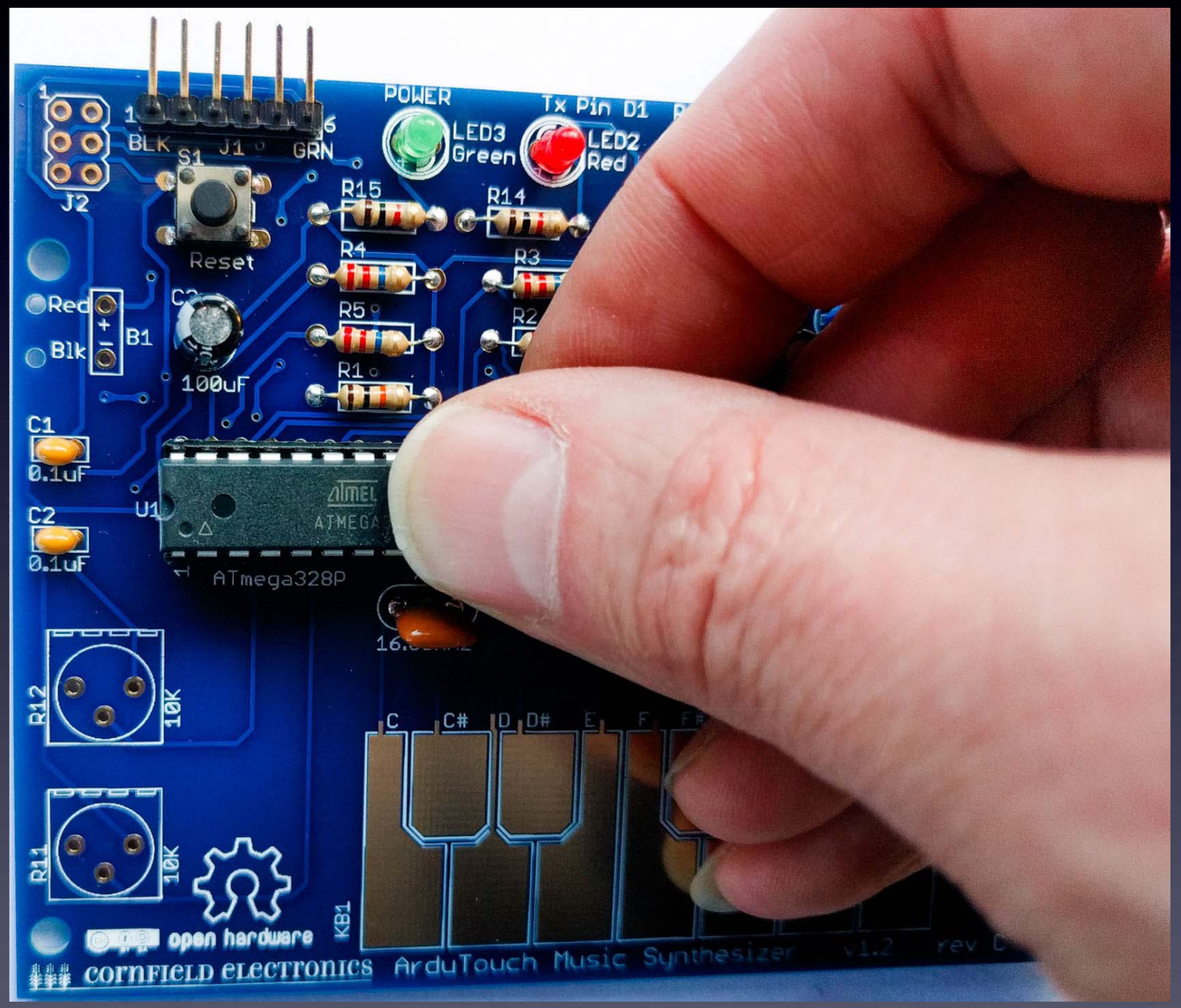
U1: microcontroller

make sure each pins rests in its hole in the socket
→ with the proper orientation

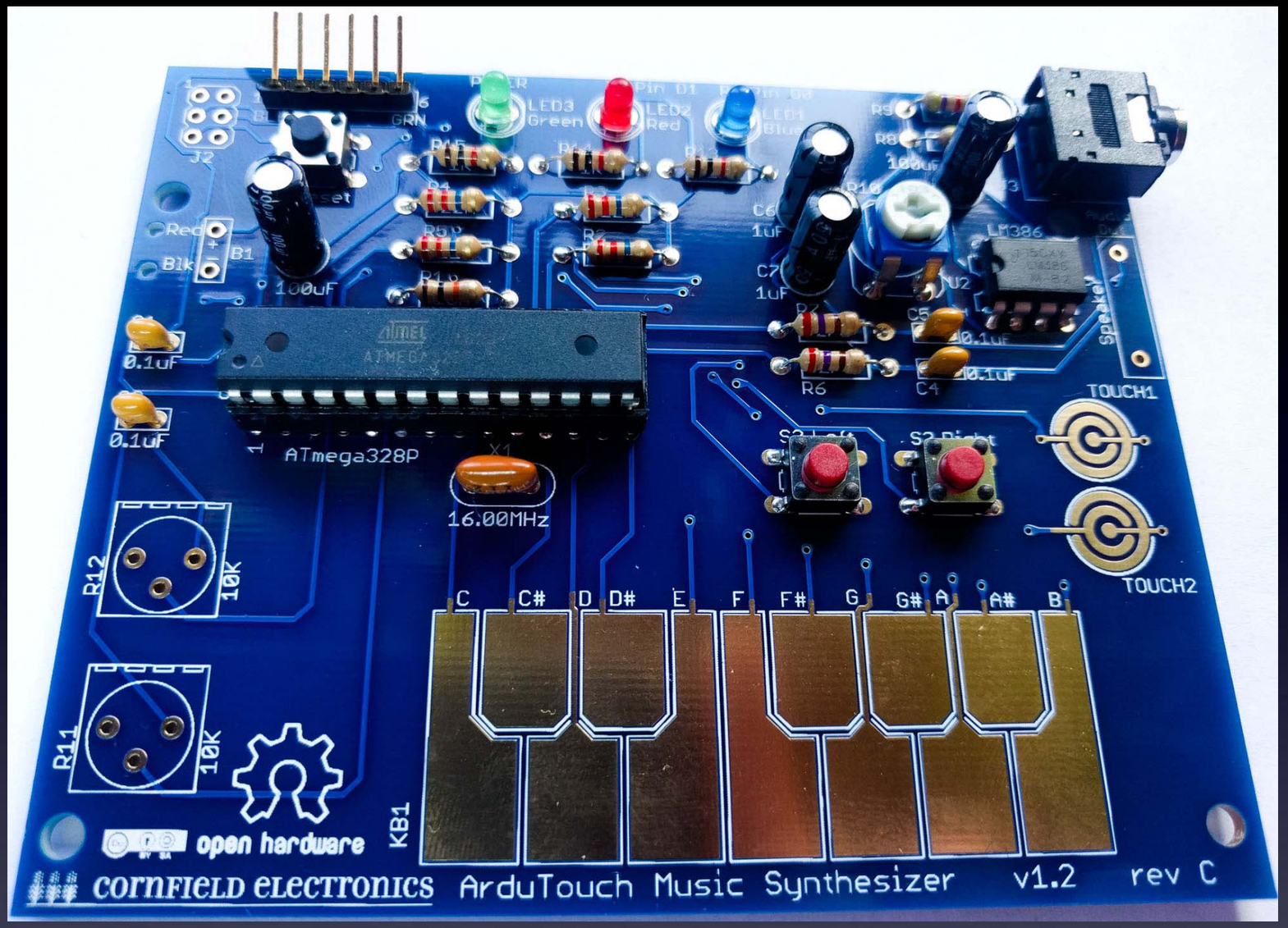
Use two thumbs to push microcontroller into the socket

Make sure all 28 pins are in place, and push it into its socket.

(This is actually way easier with 2 thumbs.)



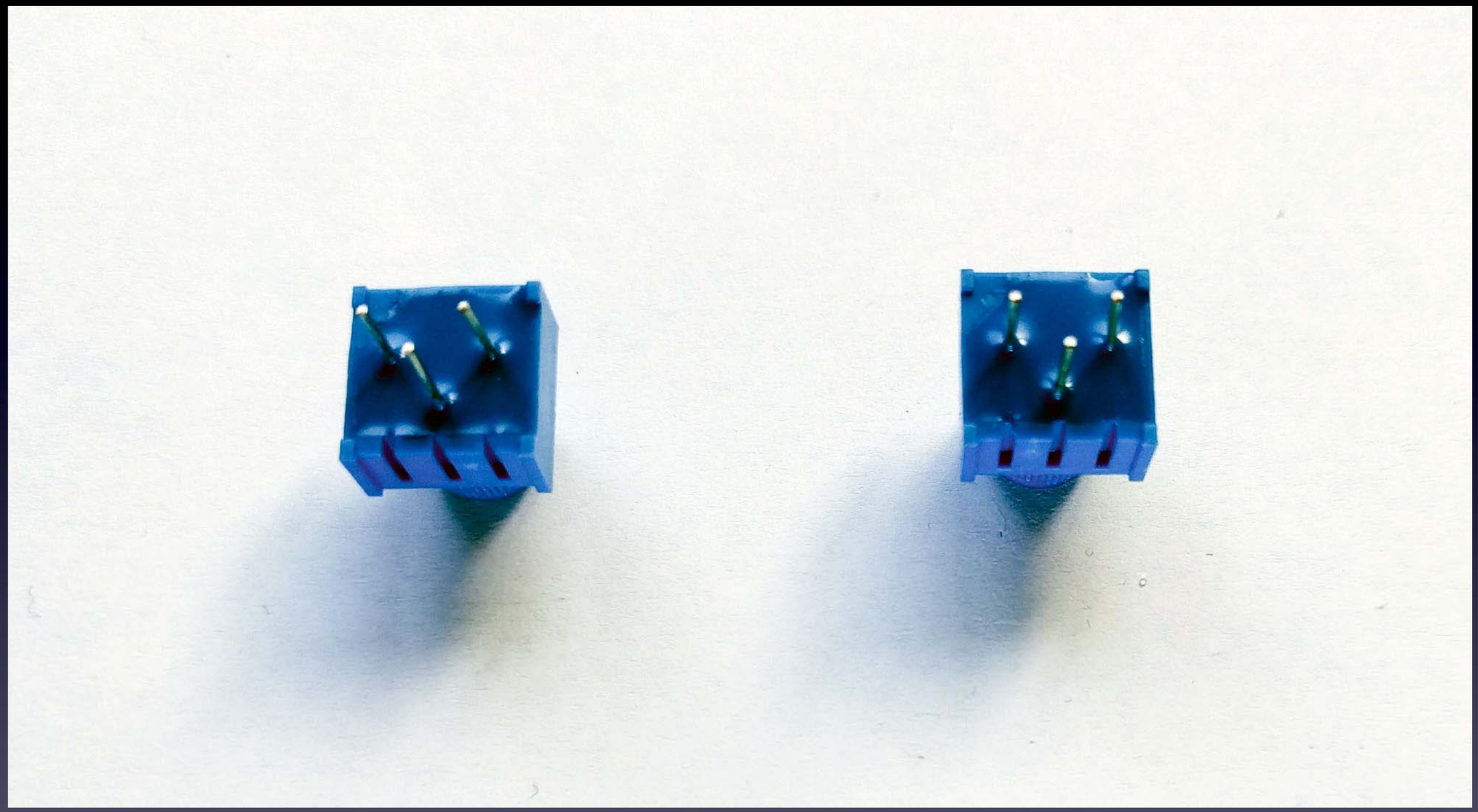
U1: microcontroller



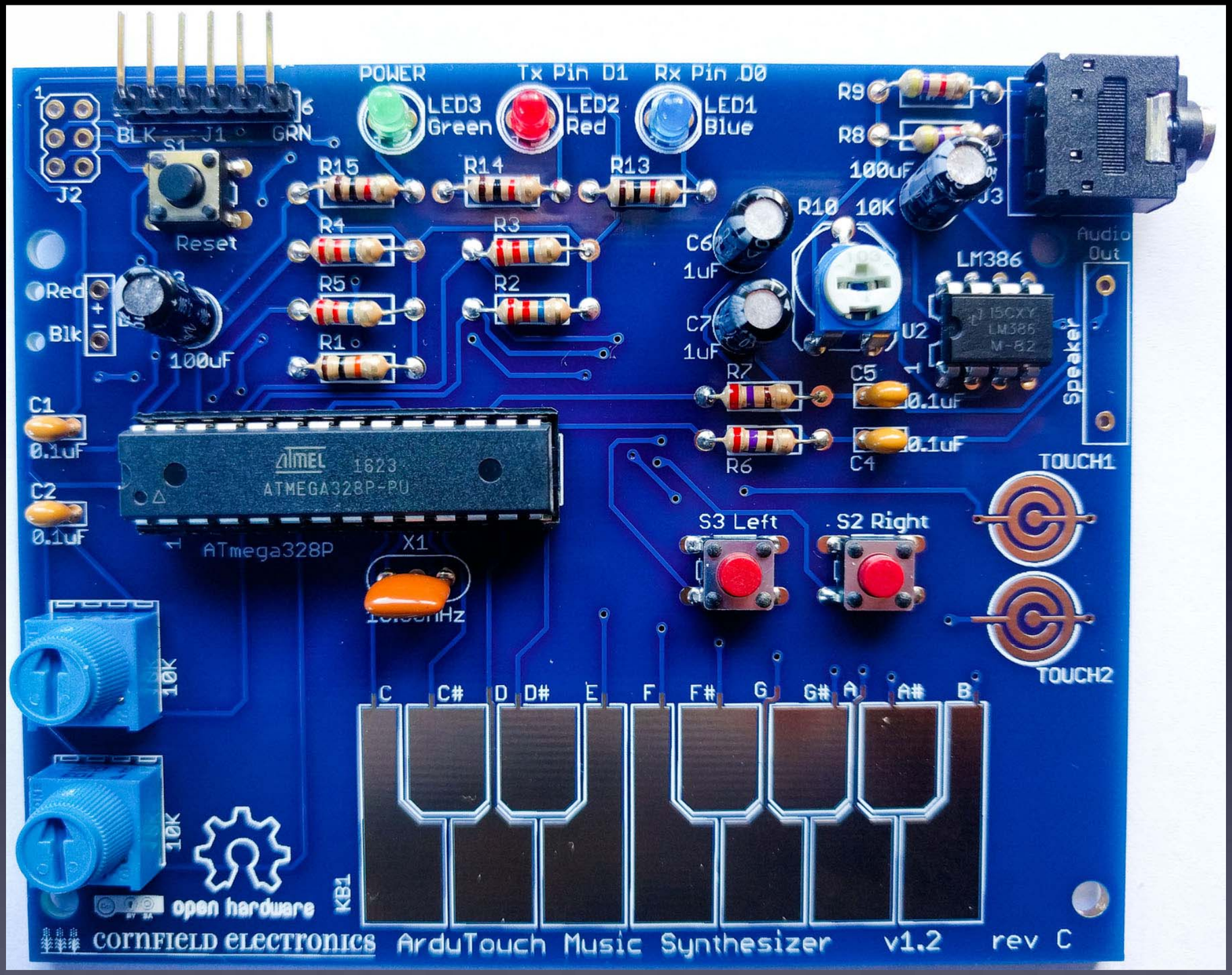
U1: microcontroller

Inspect all pins, and be sure each went into its hole in the socket – not bent.

If any pins are bent, (gently) pry out chip, straighten pins, and insert again.



R11 & R12: potentiometers



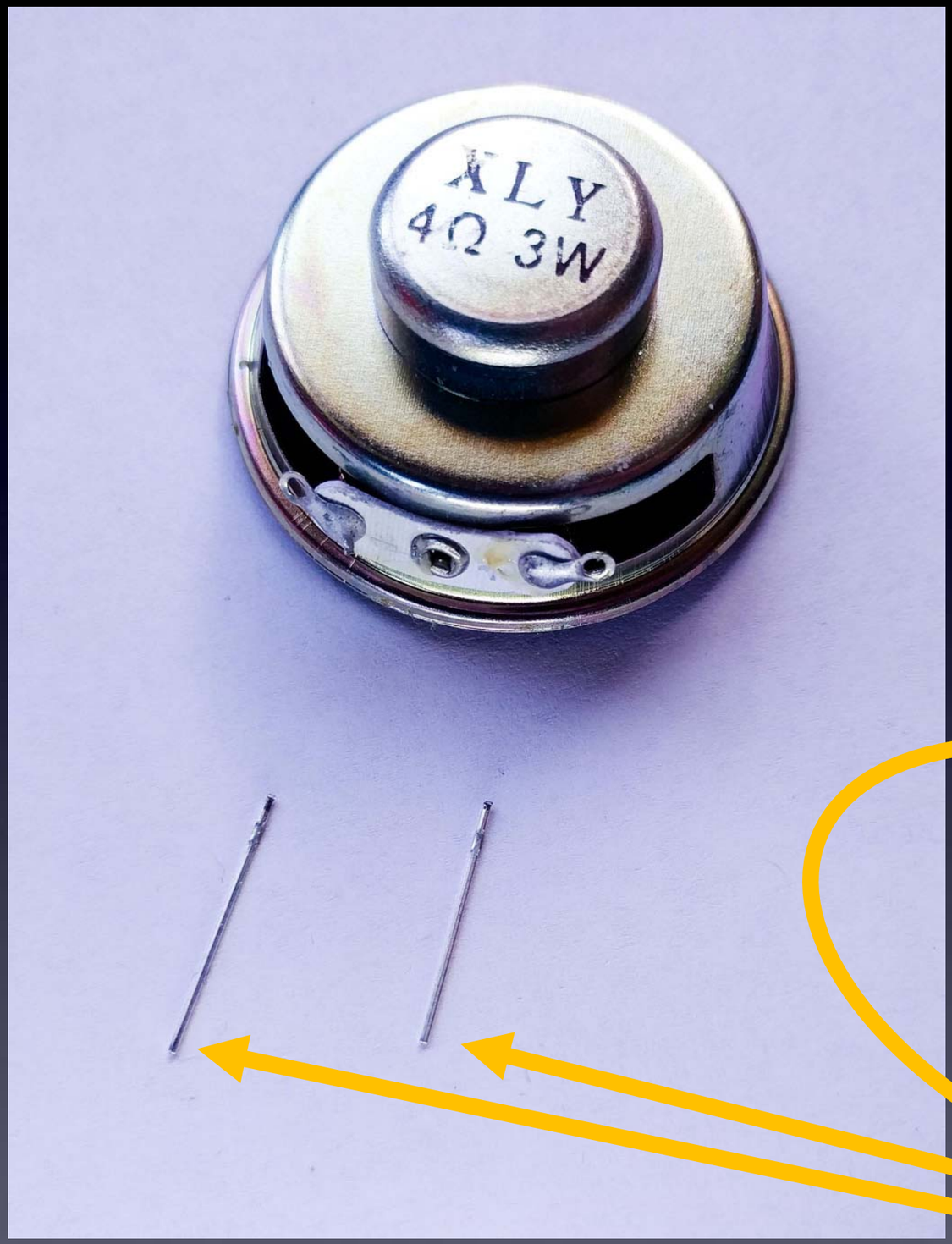
R11 & R12: potentiometers

Speaker

Some kits have a speaker that looks like this

Speaker

We'll add leads to the speaker



from the LEDs

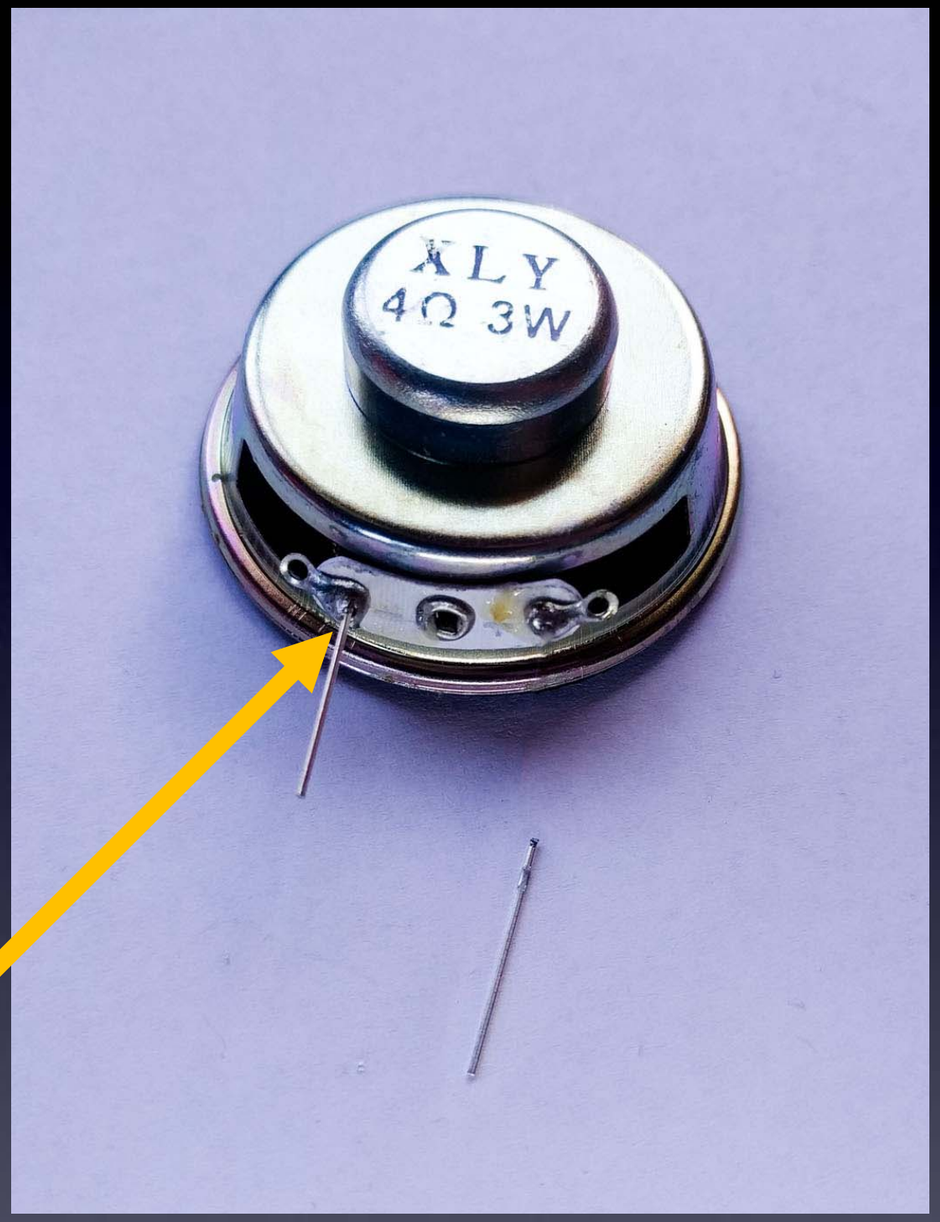
Speaker

Tin one side of each lead

(i.e., cover with thin film of melted solder)

Speaker

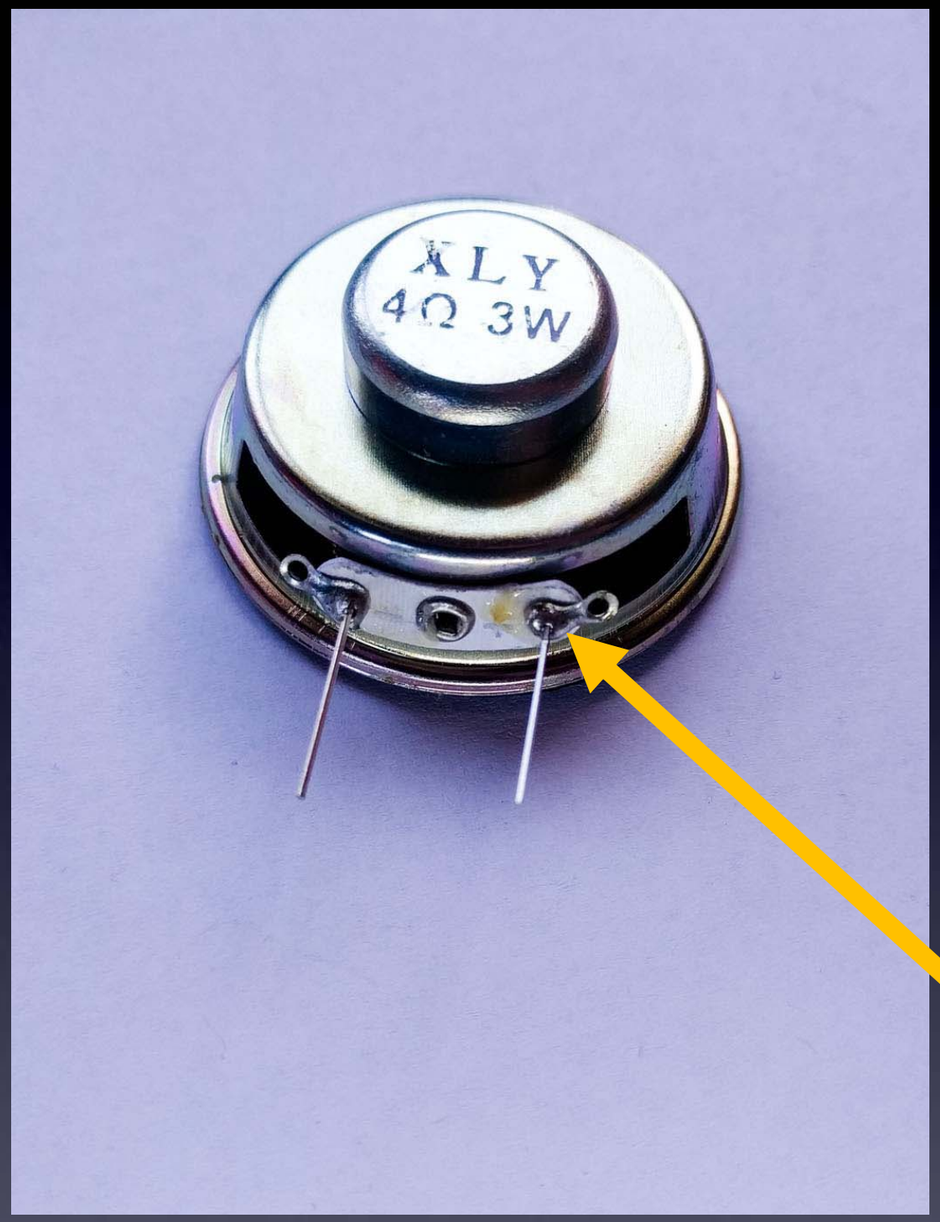
Solder one lead
to speaker



Notice the
correct place
to solder the wire

Speaker

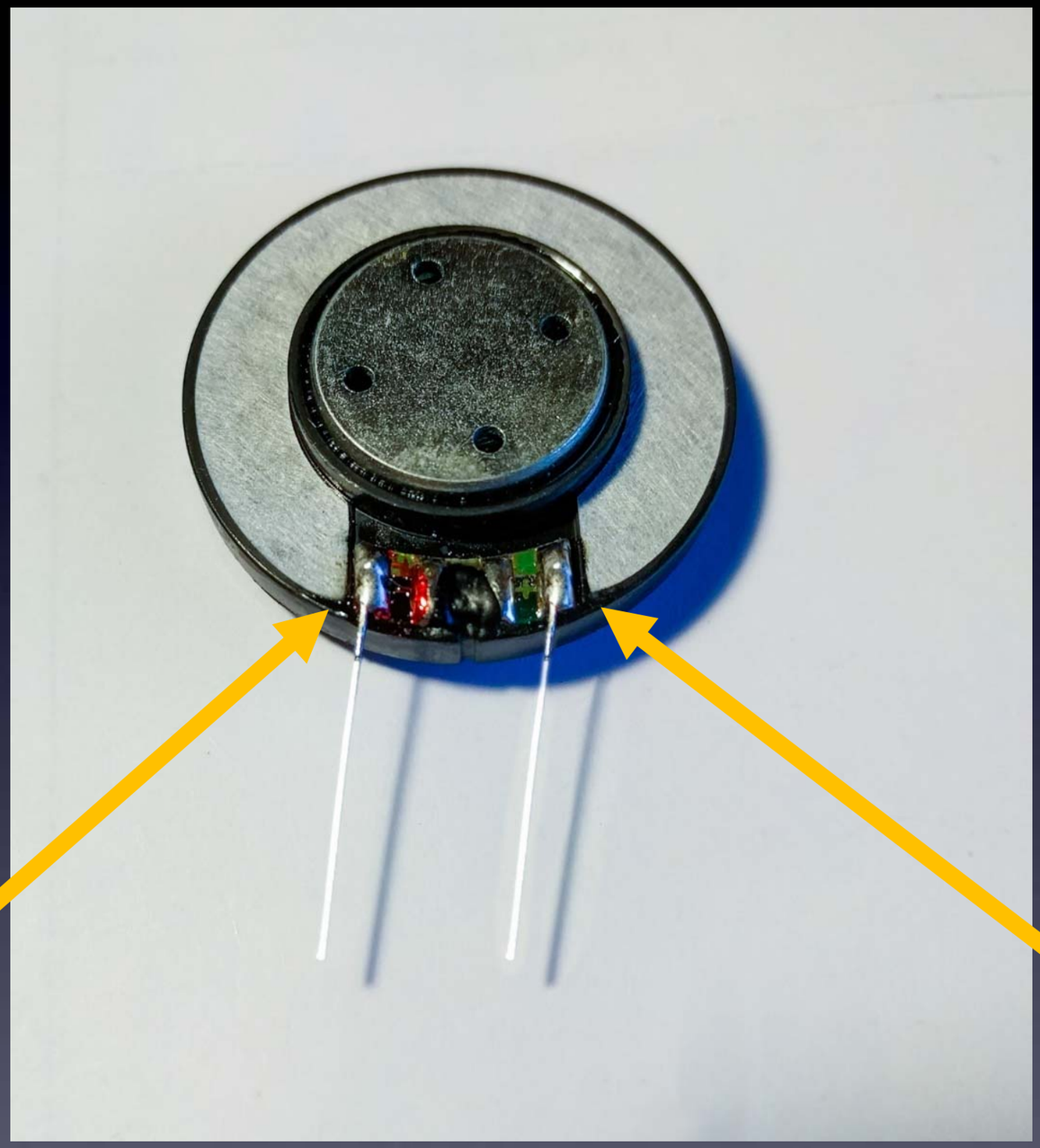
Solder next lead to speaker



Notice the correct place to solder the wire

Speaker

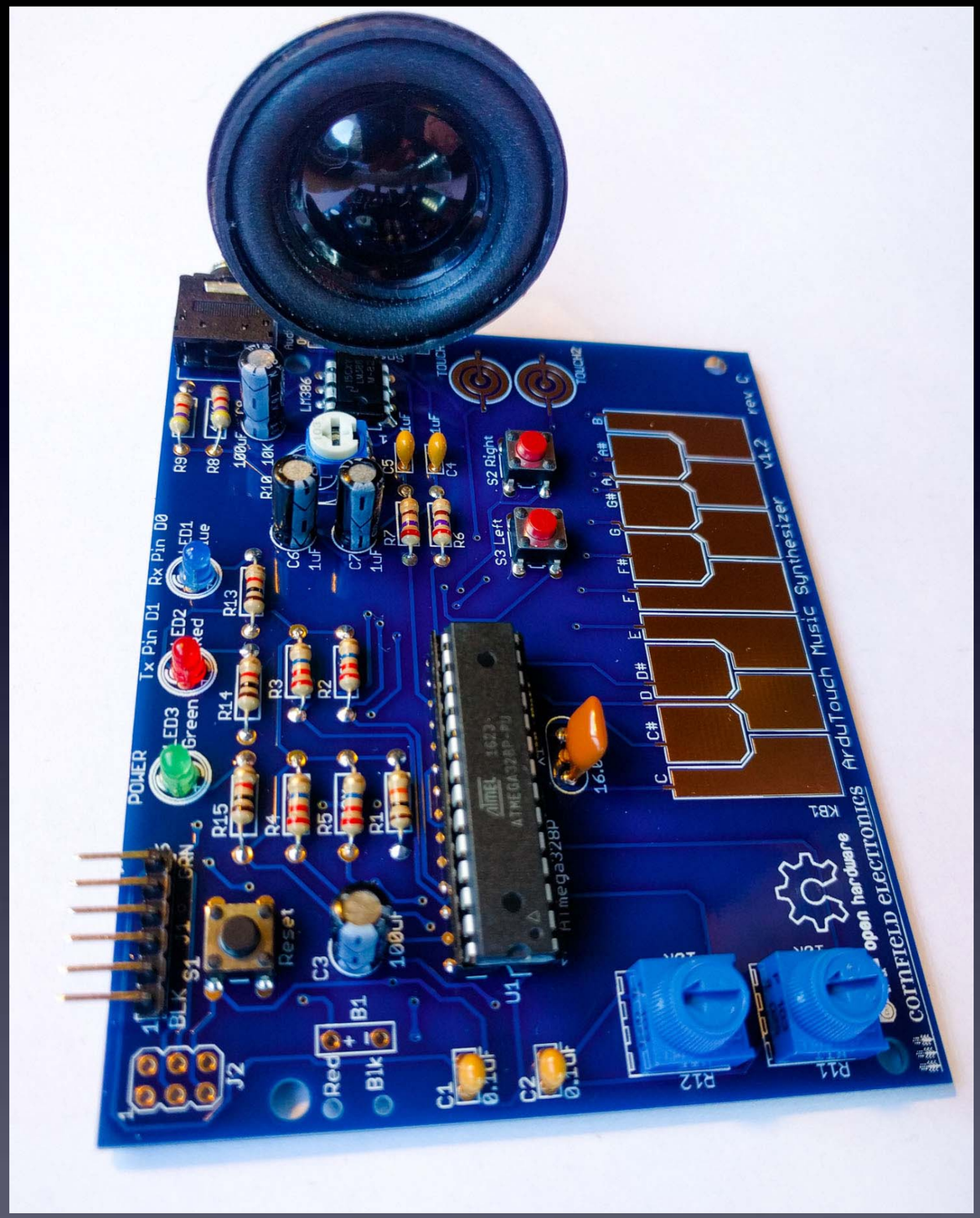
Some kits have a speaker that looks like this



Notice the correct place to solder the wires

Speaker

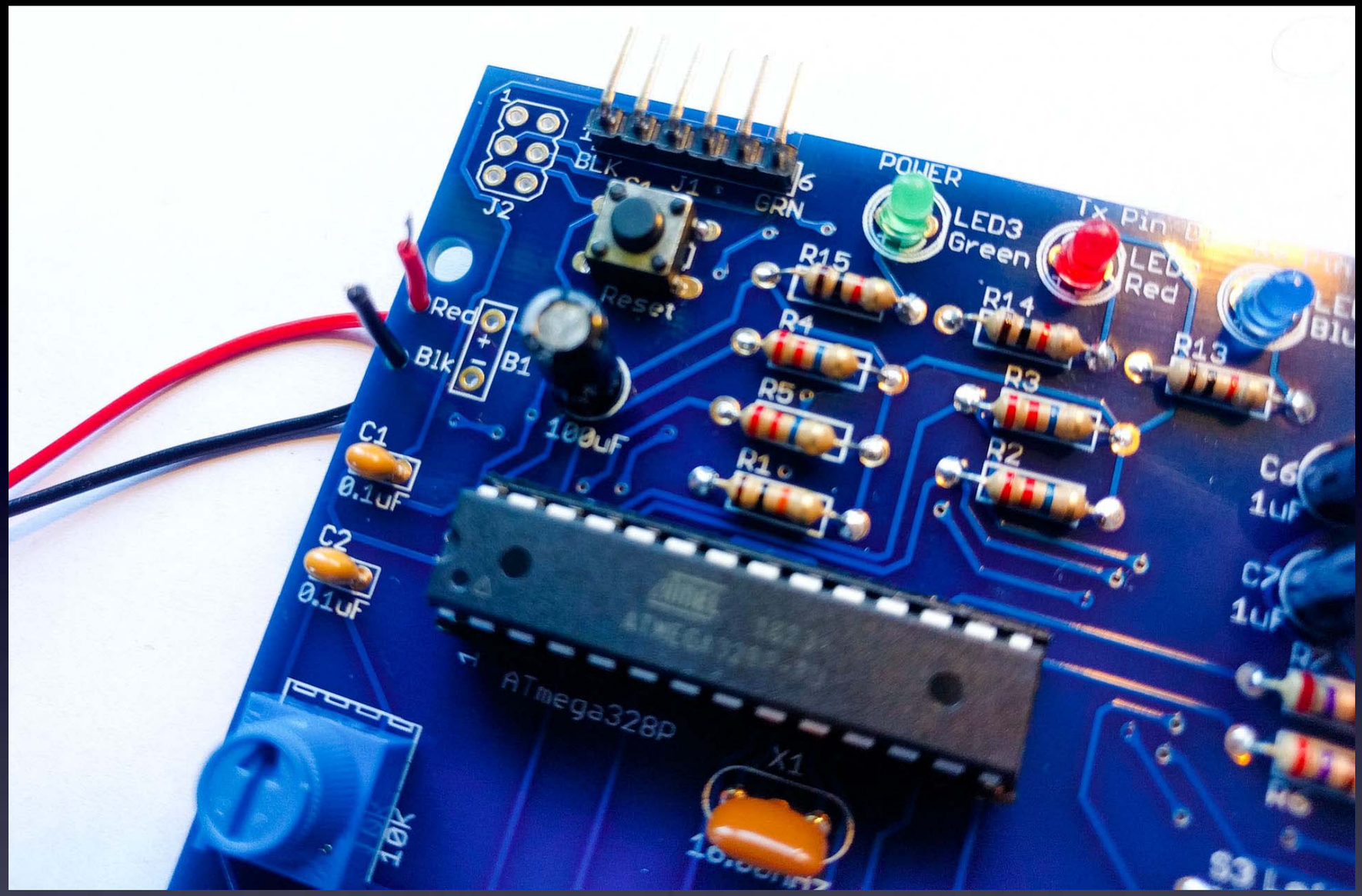
Insert speaker into board and solder both leads to board.



Speaker

Note: Some battery pack wires have thicker red and black plastic coatings.

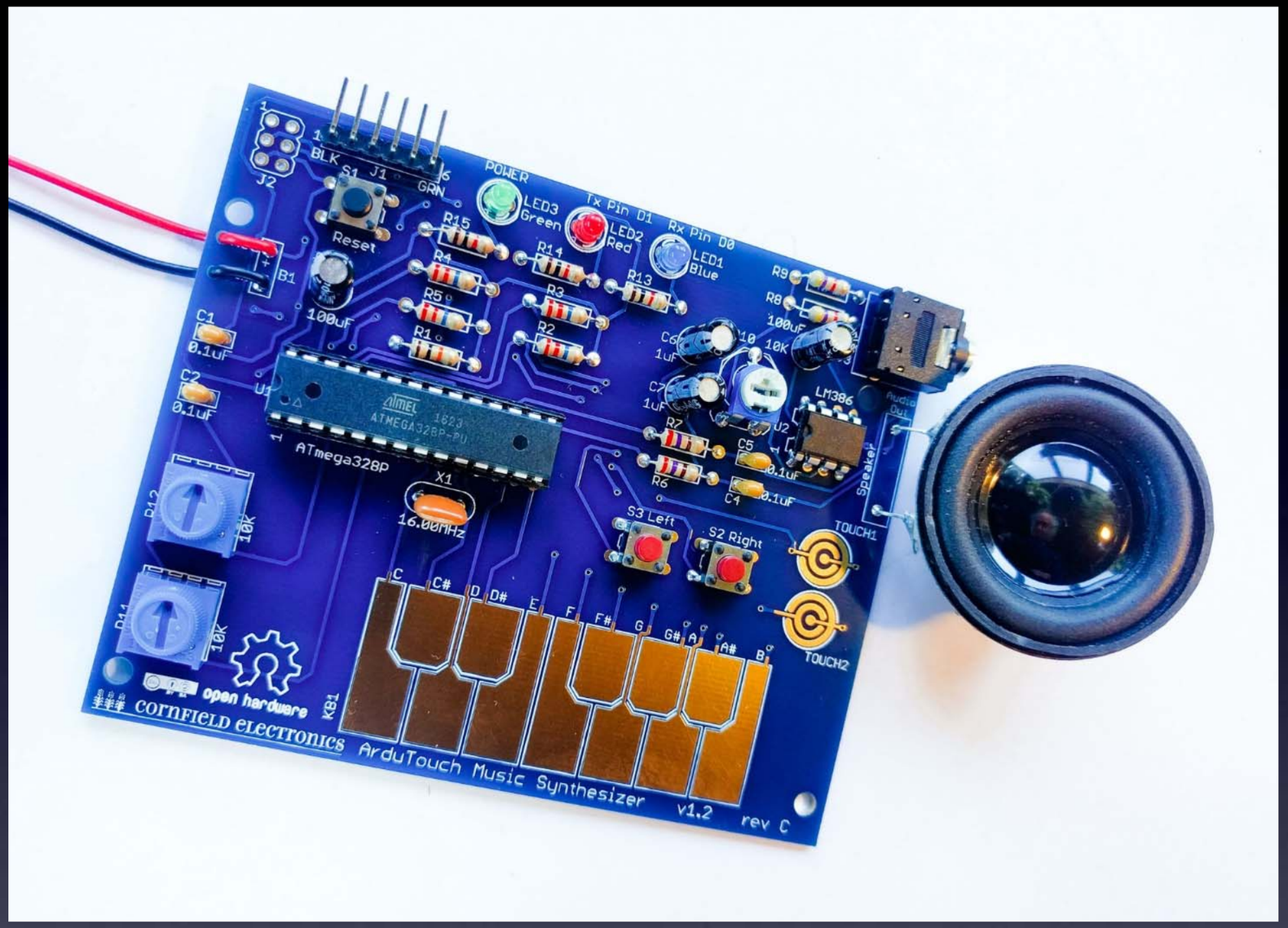
If so,
you can widen the these two holes by gently rotating a scissors or small knife or small Phillips screwdreiver on the top and bottom of these two holes.



Push battery pack leads through holes.

Make sure Red and Black go through their correct holes!

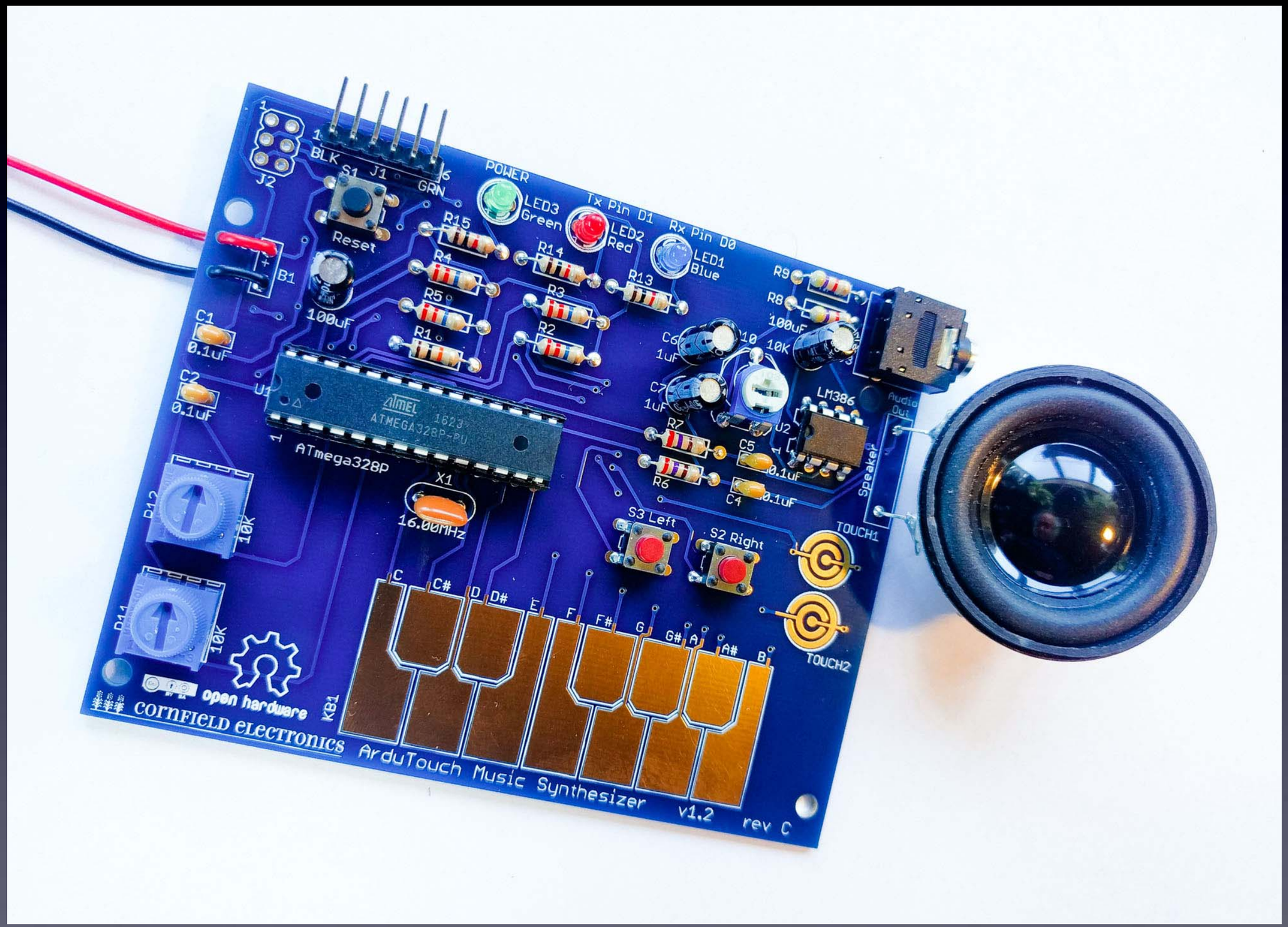
Battery pack



Loop one lead into its pad,
and solder.
Then loop the other lead into its pad,
and solder.

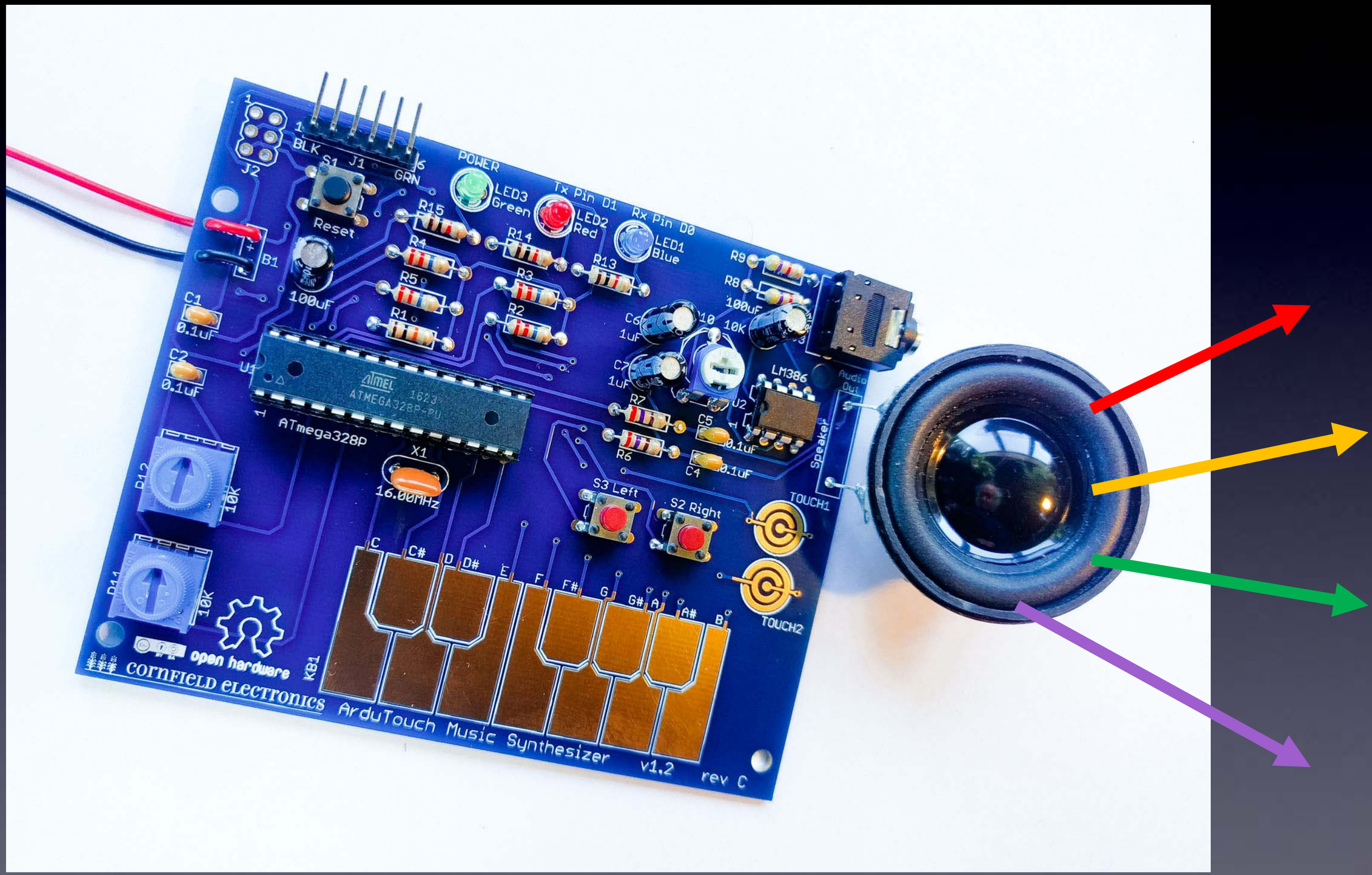
Battery pack

Done!



POWER
LED3 Green
Tx Pin D1
LED2 Red
Rx Pin D0
LED1 Blue
Reset
ATmega328P
16.00MHz
LM386
Speaker
S3 Left
S2 Right
TOUCH1
TOUCH2
open hardware
CORNFIELD ELECTRONICS
ArduTouch Music Synthesizer
v1.2
rev C

Let’s make noise!

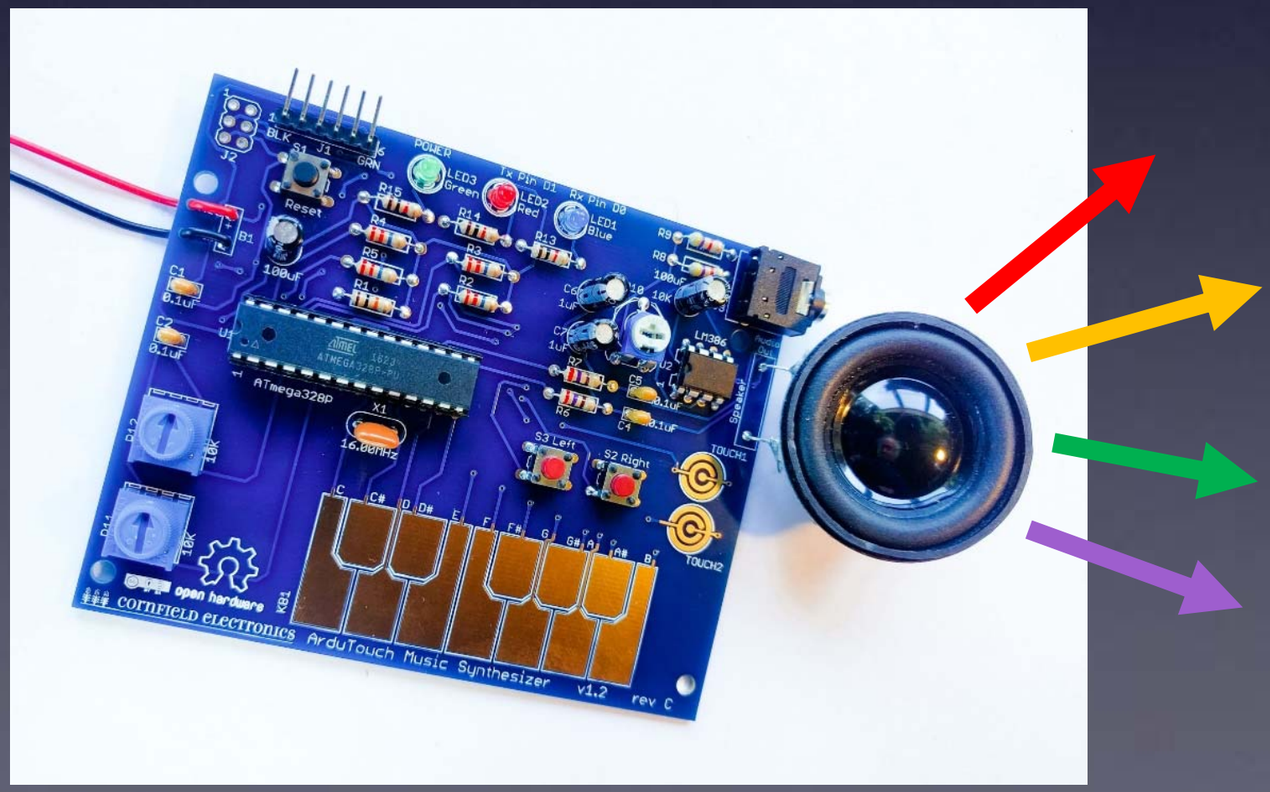


Let’s make noise!

Your ArduTouch comes pre-programmed with a really cool synthesizer, called “Thick”.

“Thick” plays 4 sawtooth waves at once.

- **the left and right buttons change octaves**
- **long press the left and right buttons to change sounds**
- **the Bottom knob controls the glide rate**
- **the Top knob controls how each of the 4 notes glide separately**
- **Try playing with these and see!**

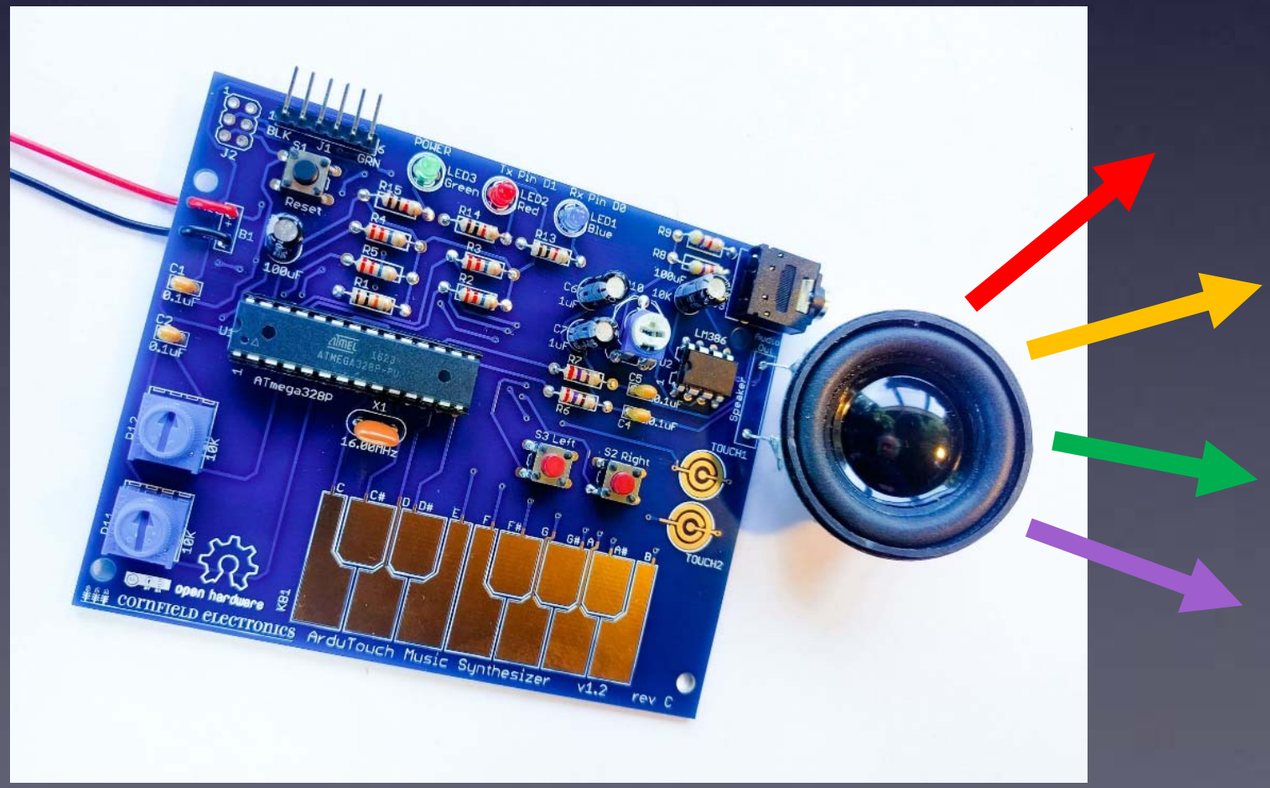


Let’s make noise!

Your ArduTouch comes pre-programmed with a really cool synthesizer, called “Thick”.

If you are happy playing with “Thick” then no need to re-program your ArduTouch.

But if you want to program other synths into your ArduTouch, the next pages show you how…

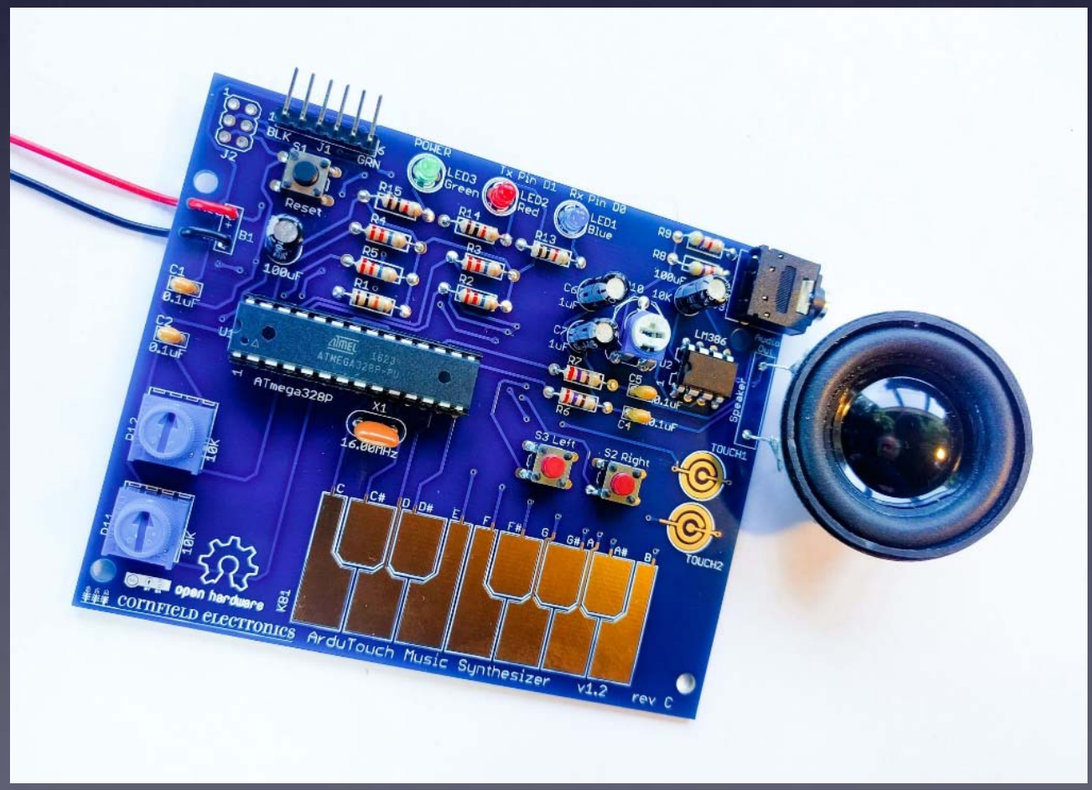


Re-programming the ArduTouch

We have written several way cool synthesizers for ArduTouch!
Each is unique, and each way different than the others.

<u>To program in a new synth in your ArduTouch, you will need</u>:

- the Arduino software <http://arduino.cc>
- a USB-Serial adapter cable (such as an FTDI, or equivalent)
  a nice one is available at
  <https://cornfieldelectronics.com/cfe/products/buy.php?productId=usbcable>
- a synth sketch and the ArduTouch Arduino library
  <http://cornfieldelectronics.com/cfe/projects.php#ardutouch>



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 >

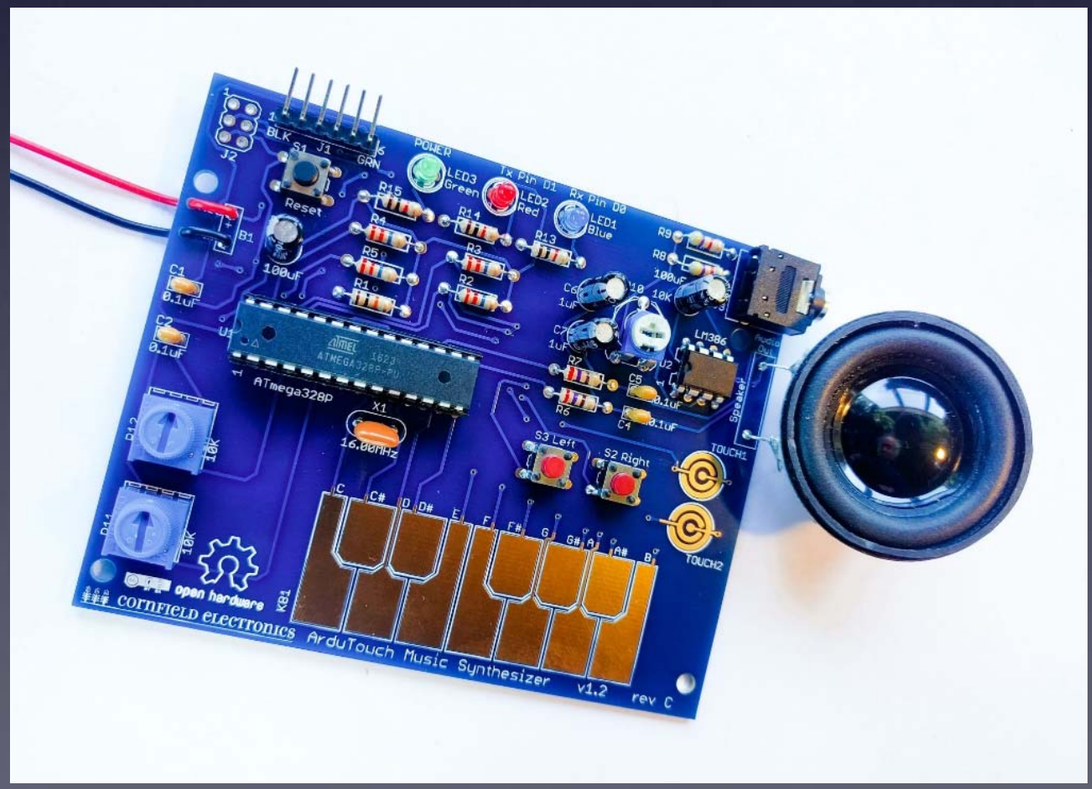
Any version is OK

Re-programming the ArduTouch

Second:

Download and install the ArduTouch Arduino library
<http://cornfieldelectronics.com/cfe/projects.php#ardutouch>

(details on this soon)



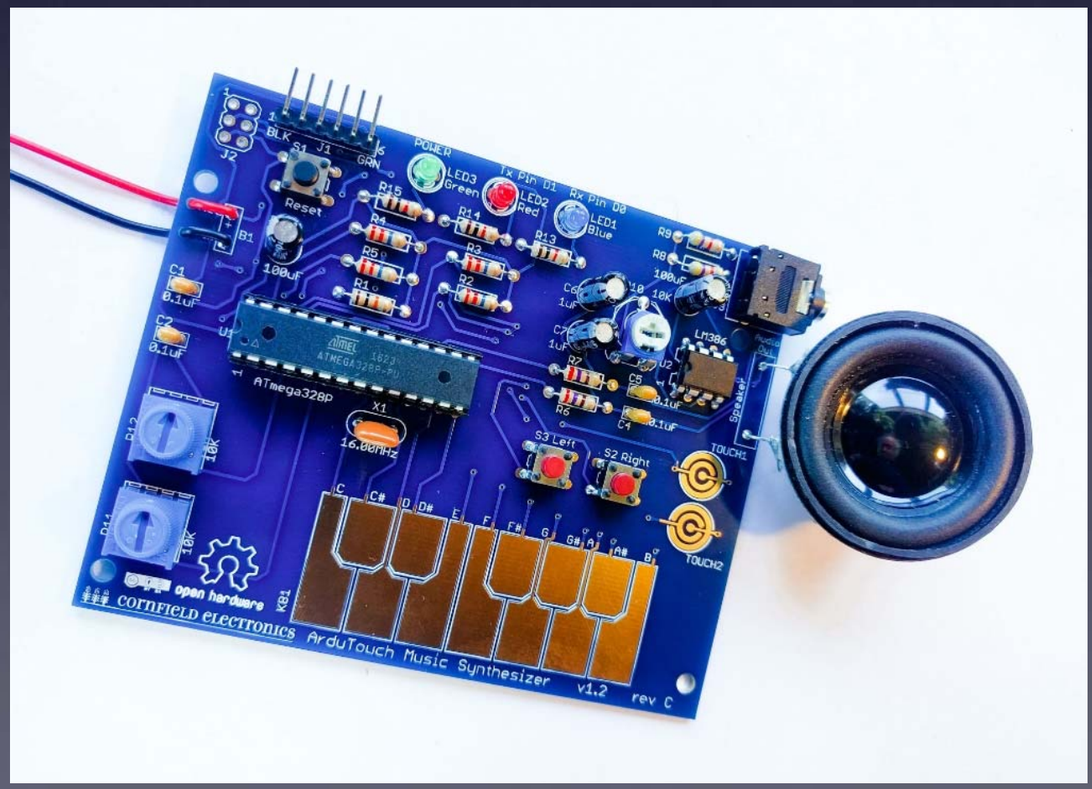
Re-programming the ArduTouch

Third:

Download ArduTouch synth sketches
<http://cornfieldelectronics.com/cfe/projects.php#ardutouch>

Store them on your computer anywhere you like.

(details on this soon)

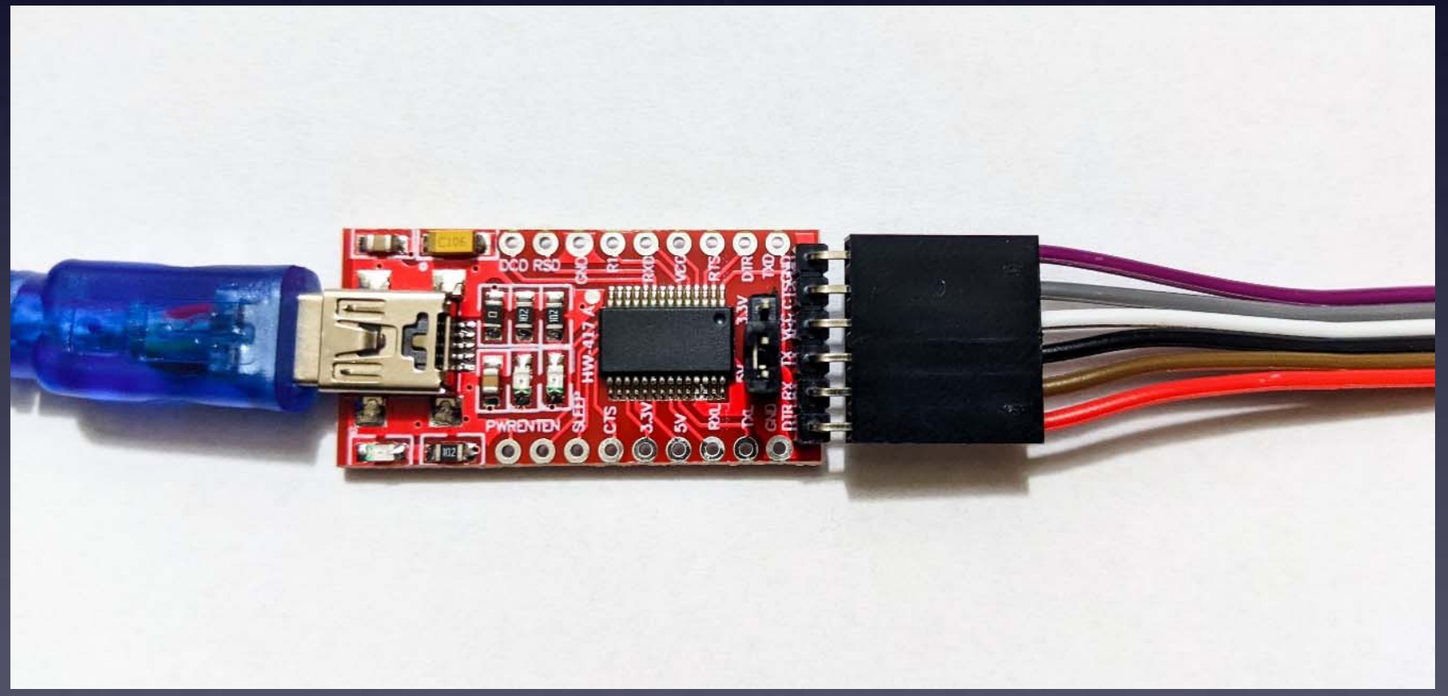


Connecting your ArduTouch to your computer

USB-Serial adapter cable

Ones available from Cornfield Electronics look like this:

<https://cornfieldelectronics.com/cfe/products/buy.php?productId=usbcable>

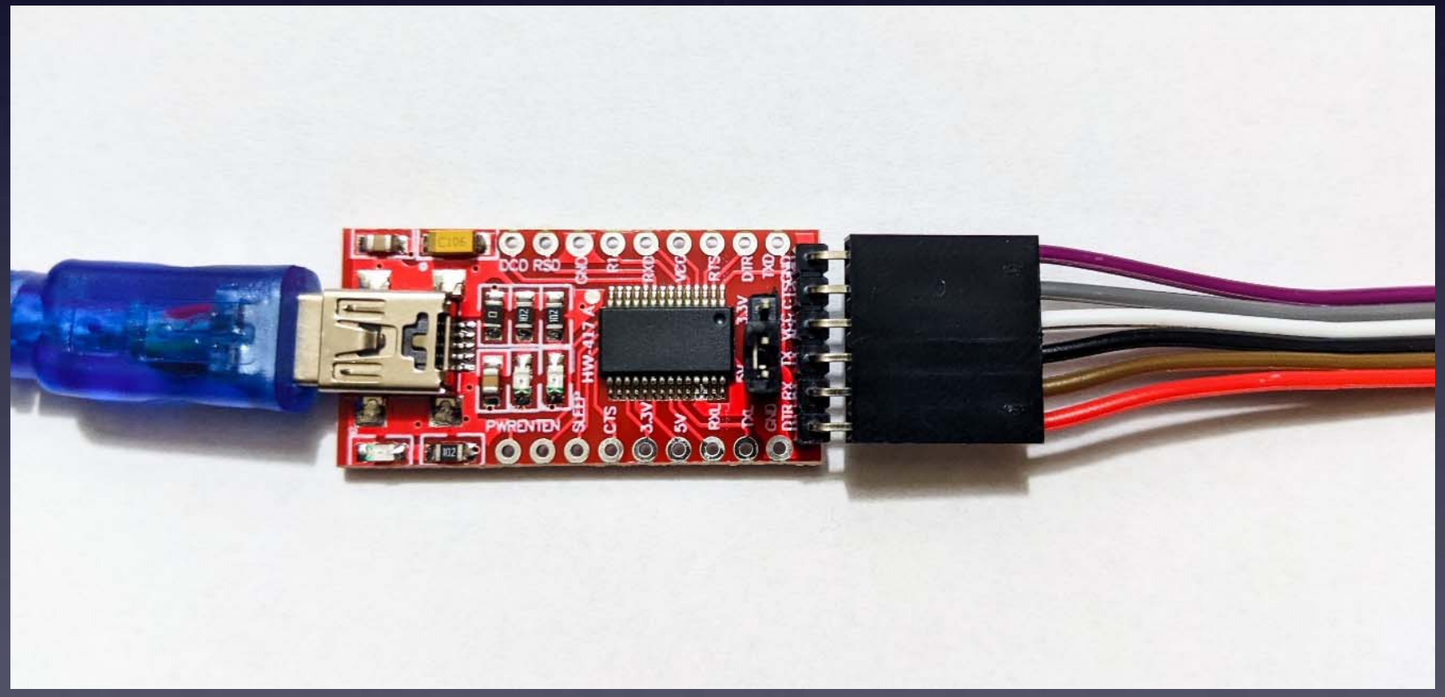


Connecting your ArduTouch to your computer

USB-Serial adapter cable

Ones available from Cornfield Electronics look like this:

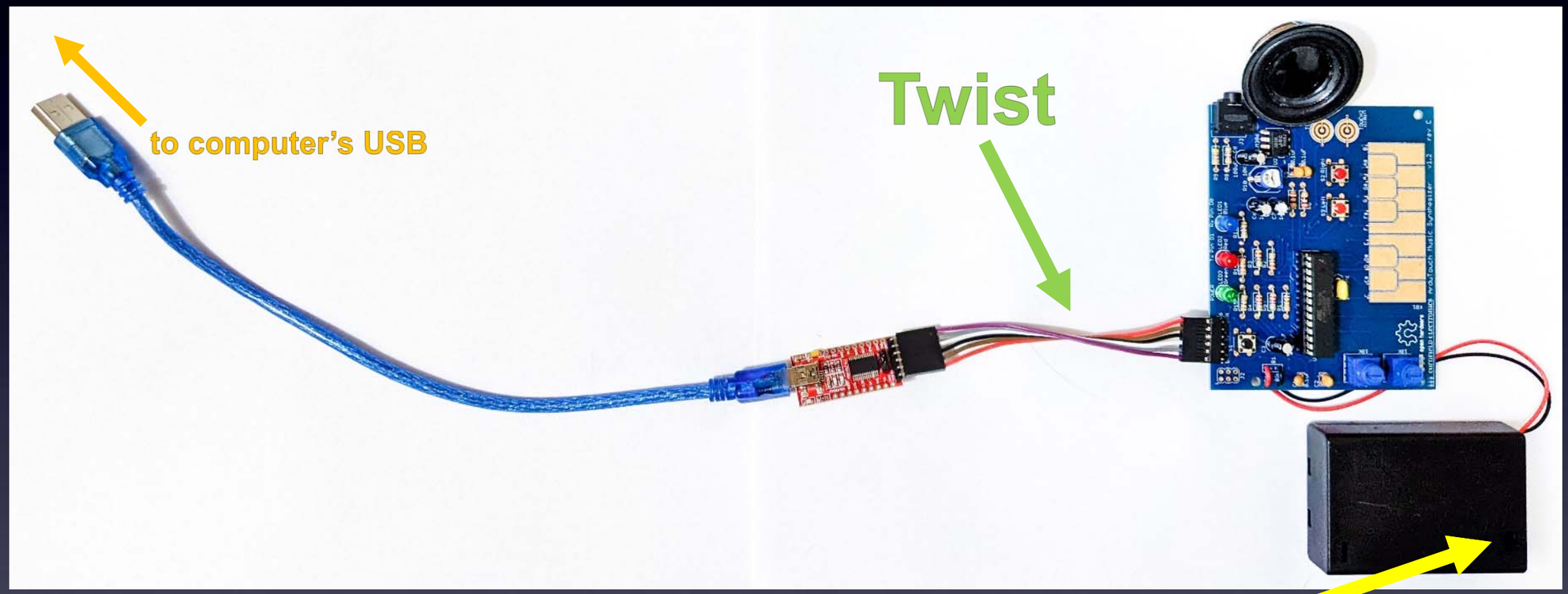
<https://cornfieldelectronics.com/cfe/products/buy.php?productId=usbcable>



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

<https://ftdichip.com/drivers/vcp-drivers/>

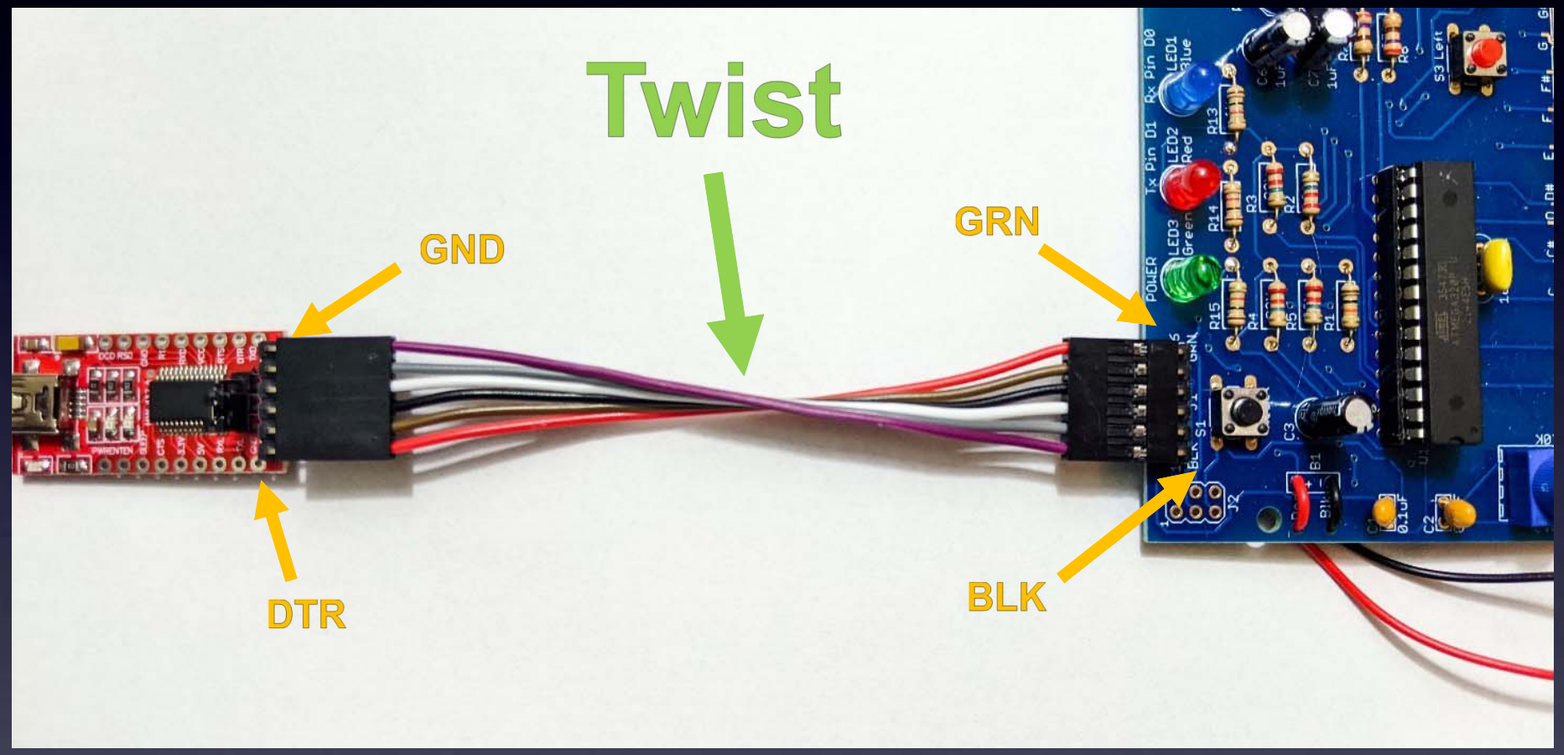
Connecting your ArduTouch to your computer



<u>IMPORTANT</u>:
Make sure the battery pack on your ArduTouch is OFF

Connecting your ArduTouch to your computer

This shows a few more details:

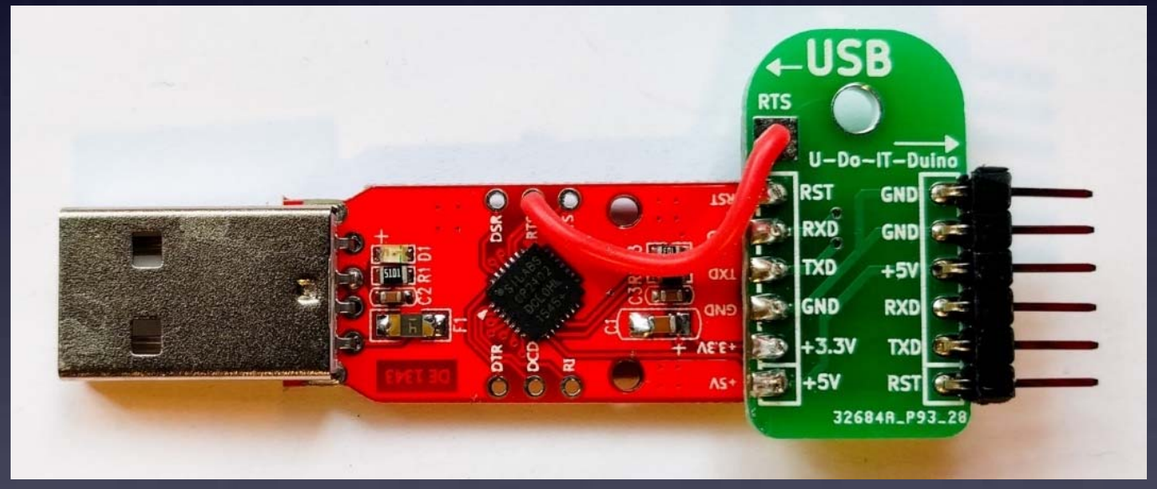


<u>IMPORTANT</u>: Make sure the battery pack on your ArduTouch is OFF

Connecting your ArduTouch to your computer

USB-Serial adapter cable

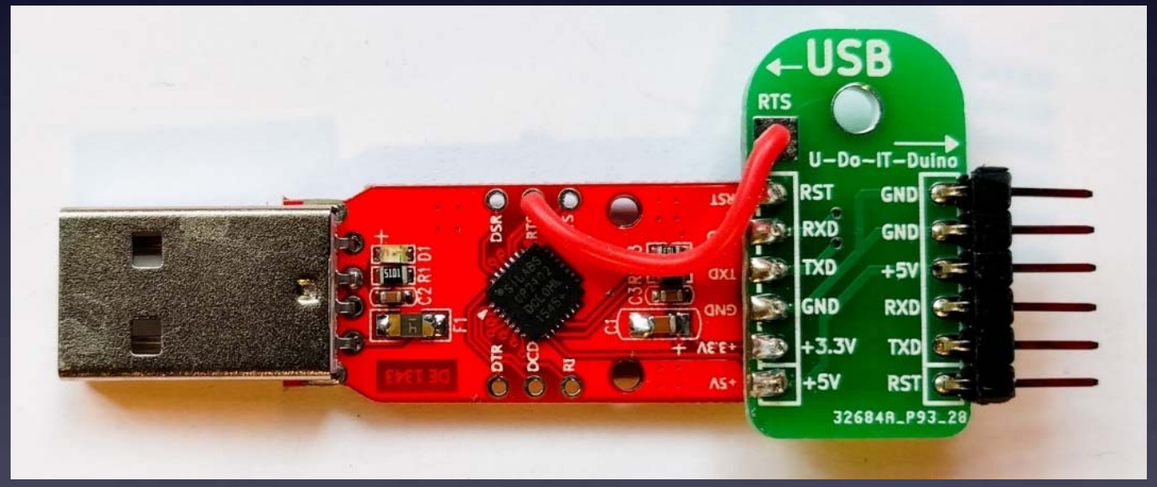
Old ones from Cornfield Electronics looked like this:



Connecting your ArduTouch to your computer

USB-Serial adapter cable

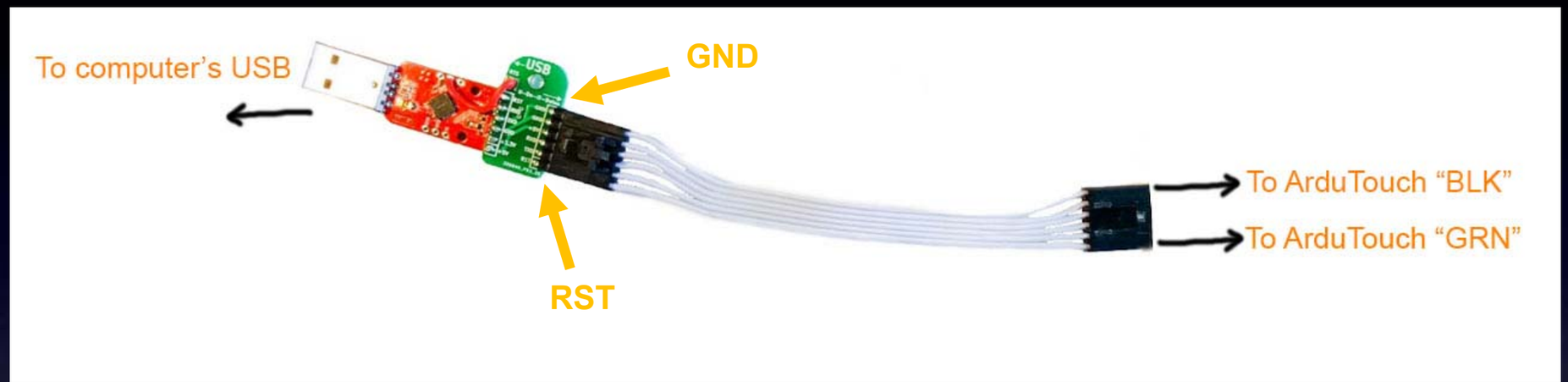
Old ones from Cornfield Electronics looked like this:



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

<https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>

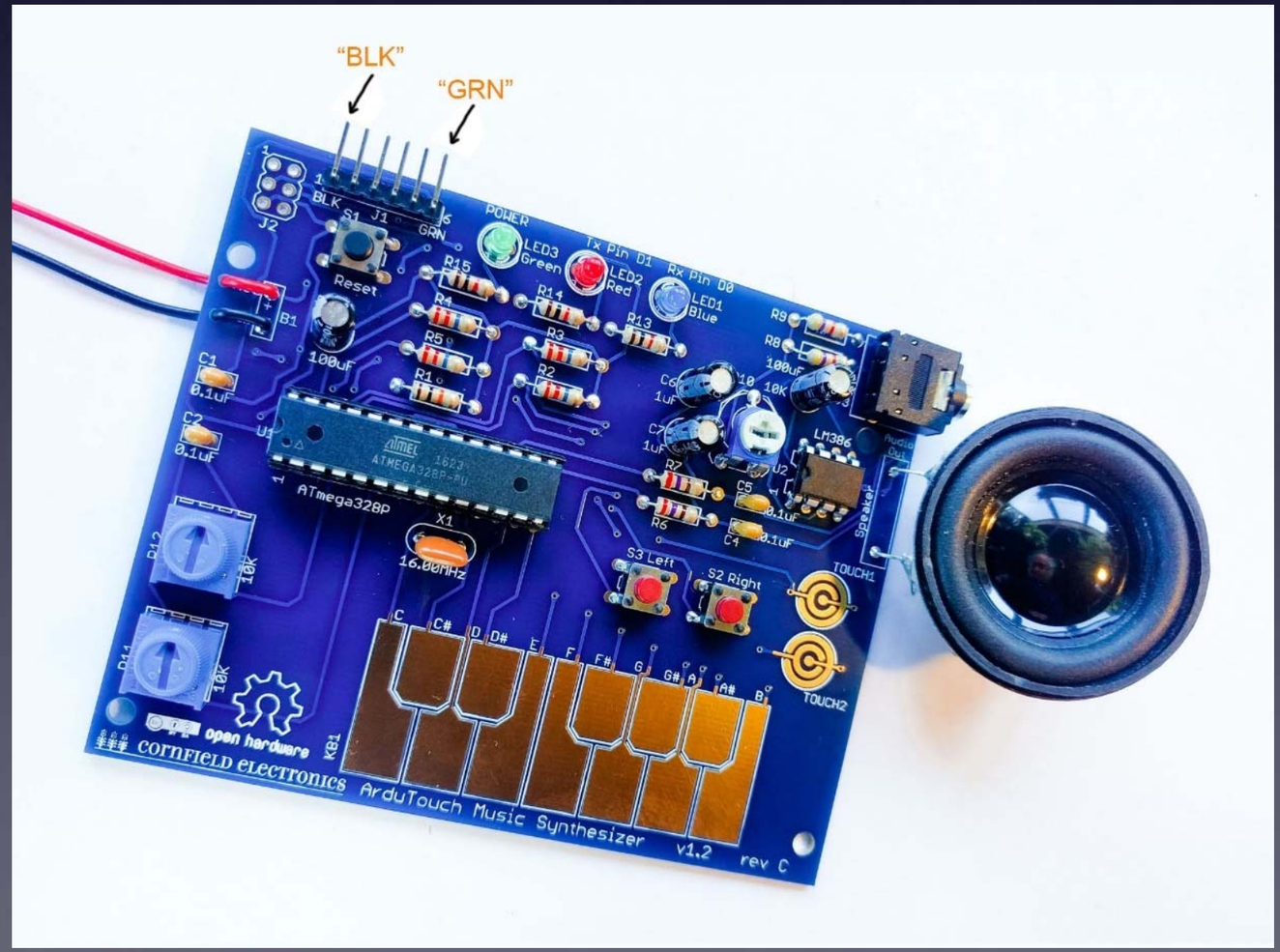
Connecting your ArduTouch to your computer



(Old ones)

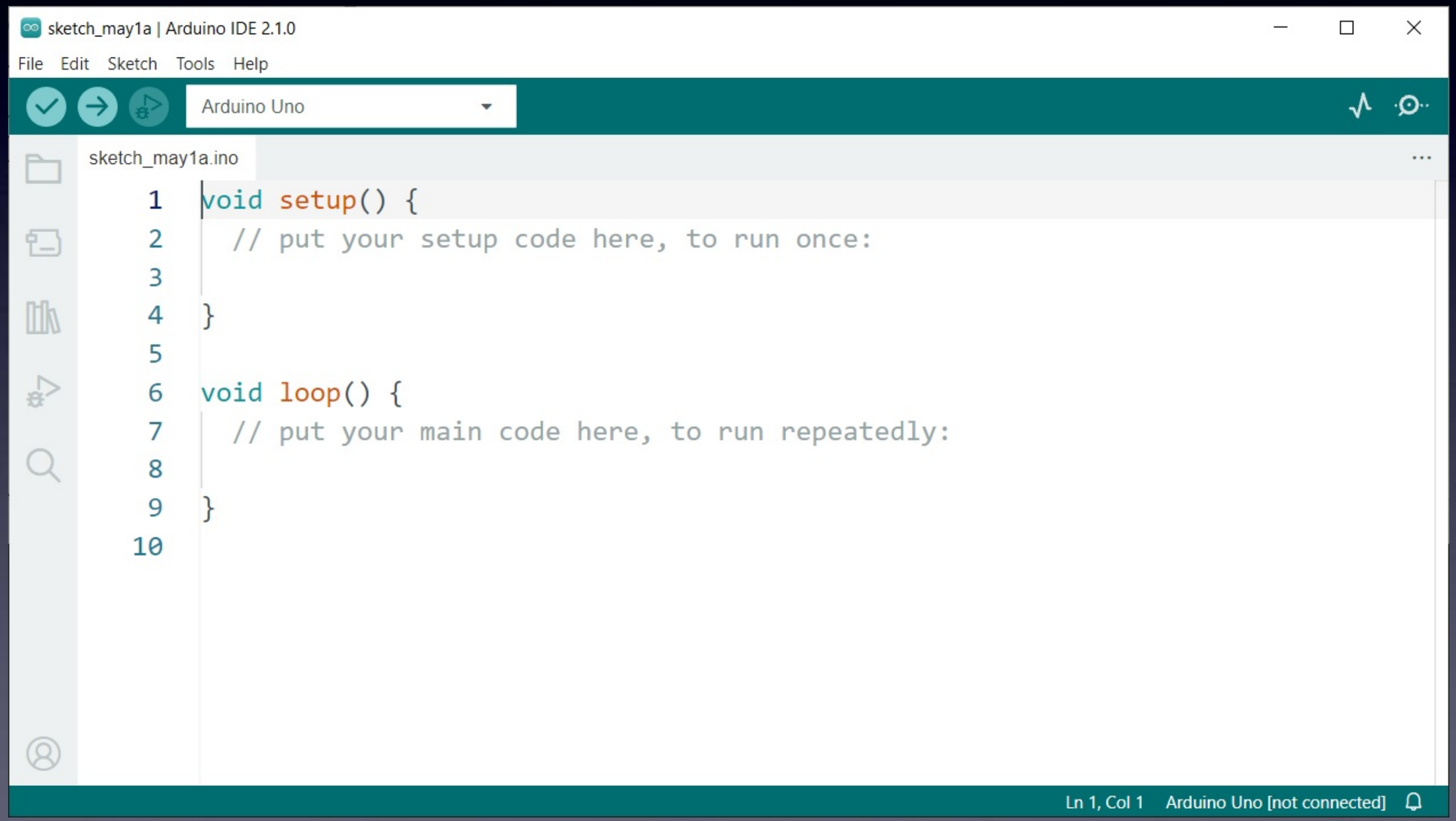
IMPORTANT:

Make sure the battery pack on your ArduTouch is OFF



Arduino

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

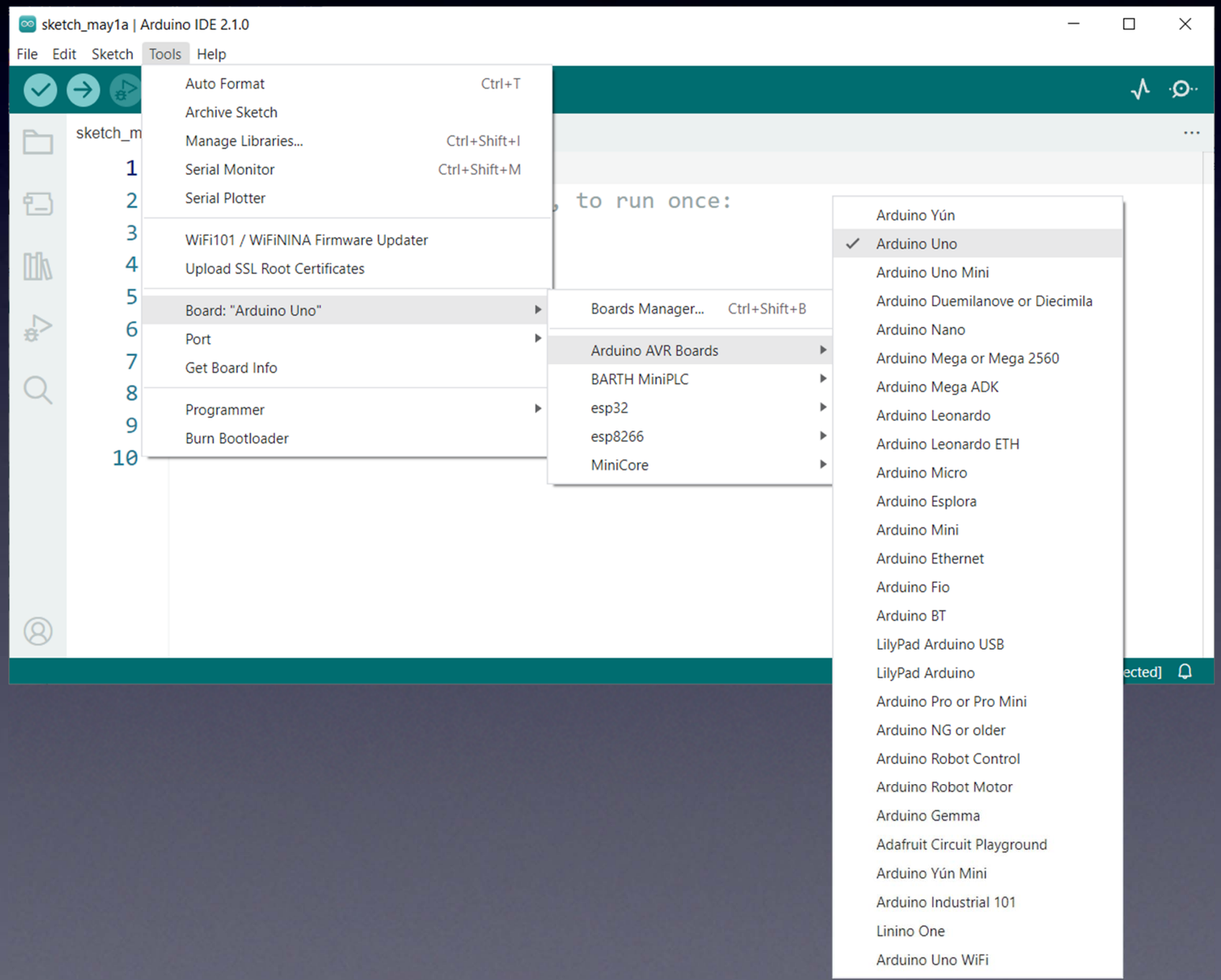


Arduino

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

(1)
Choose “Uno” as the Board

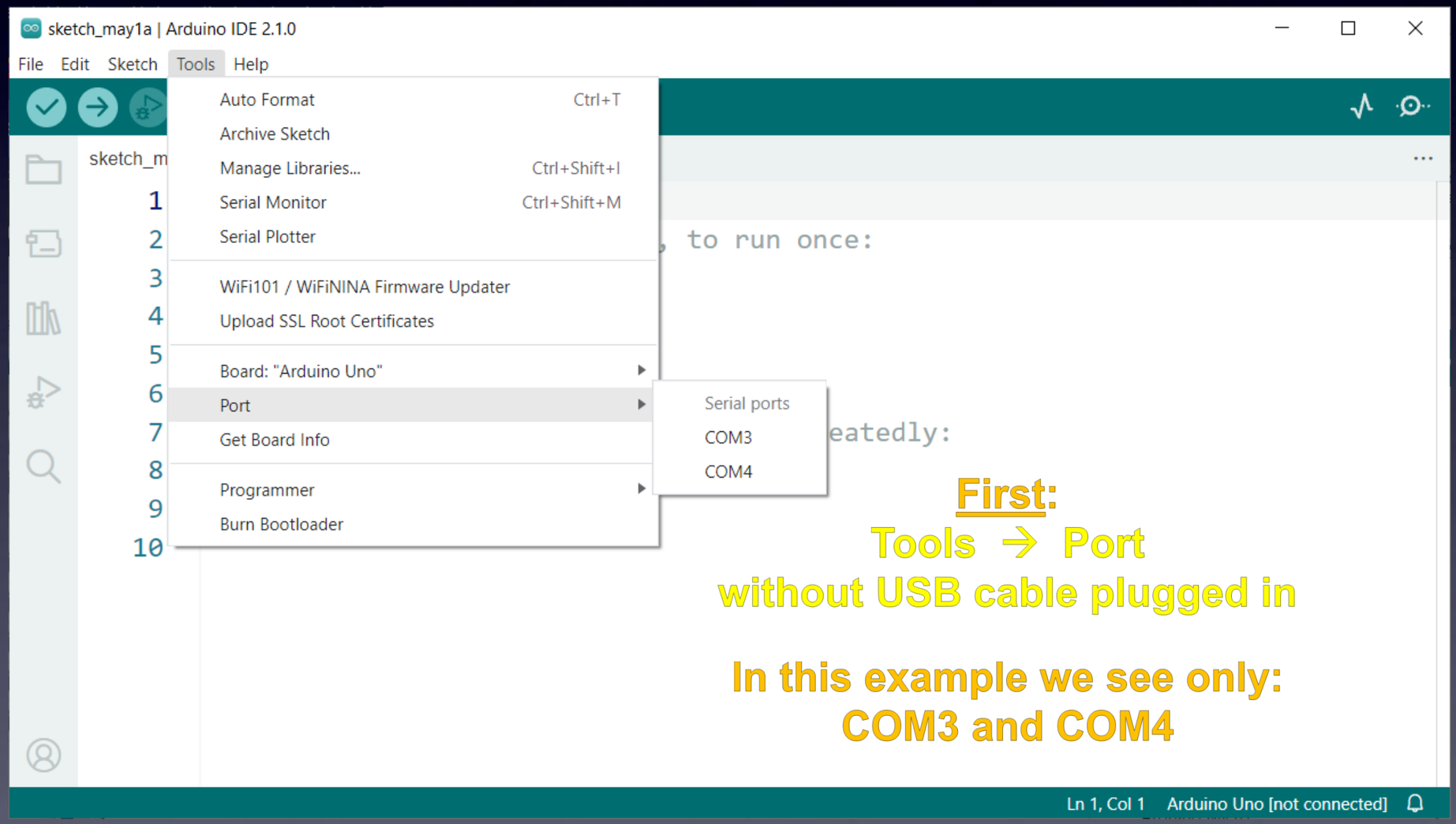
(Your ArduTouch board acts just like an Arduino Uno board)



Arduino

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

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

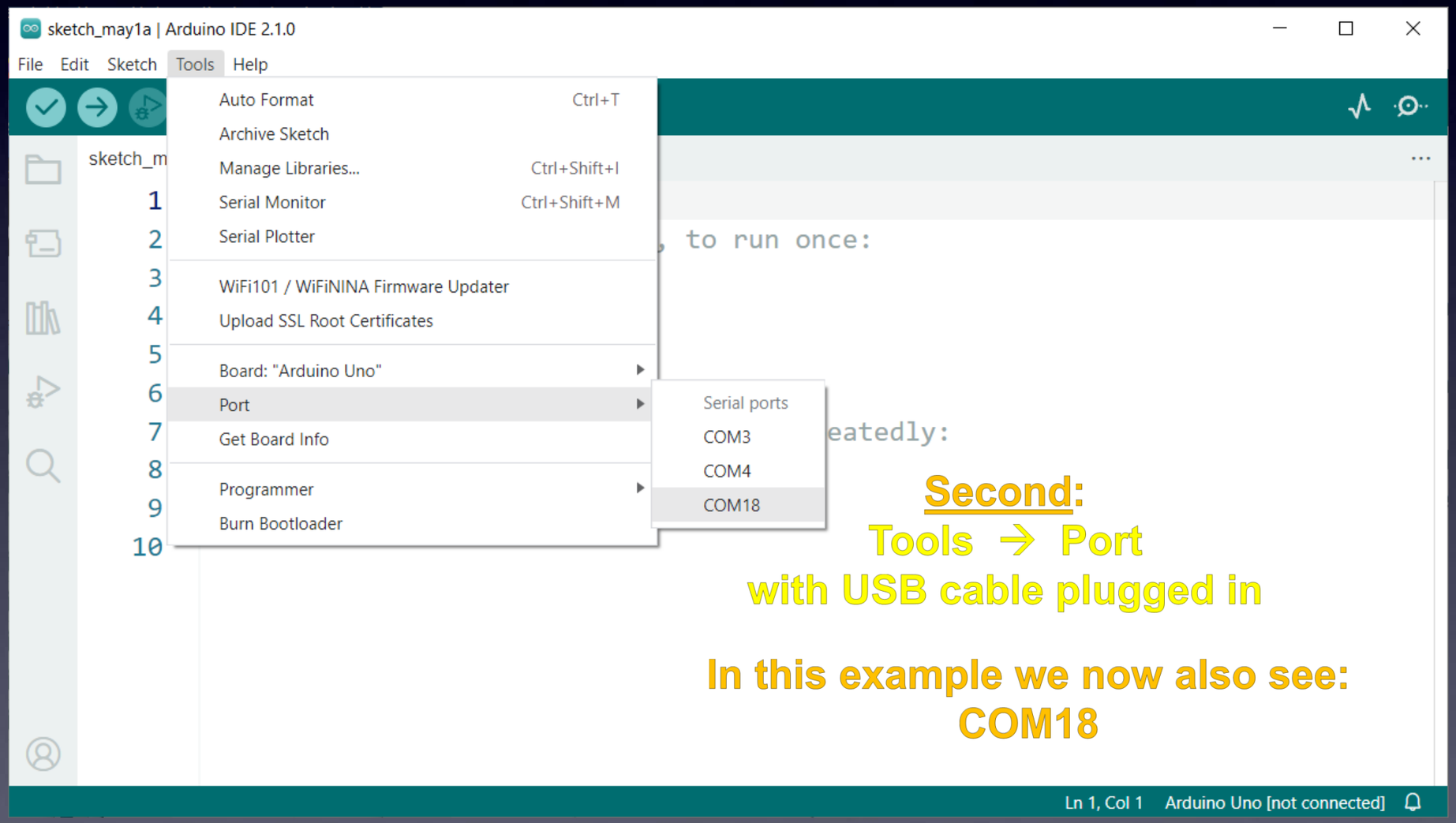


Arduino

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

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

(After installing the driver for your USB-Serial cable and plugging it in your operating system will see a serial port and it appears here.)

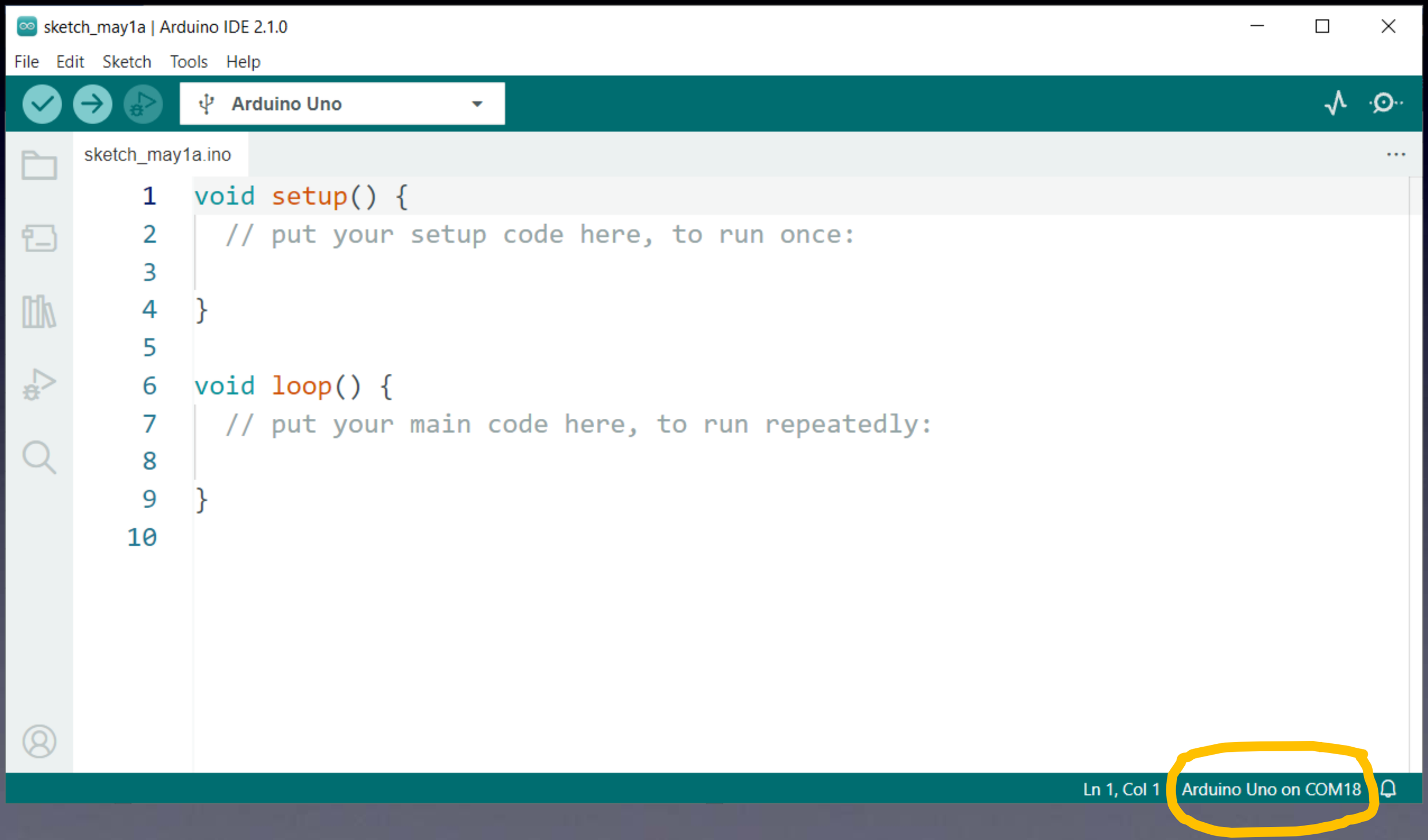


Second:
Tools → Port
with USB cable plugged in

In this example we now also see: COM18

Arduino

Your Arduino software is almost ready



Arduino

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

(3) Install the ArduTouch library

Arduino

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

(3) Install the ArduTouch library

Arduino

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

(3) Install the ArduTouch library

Arduino

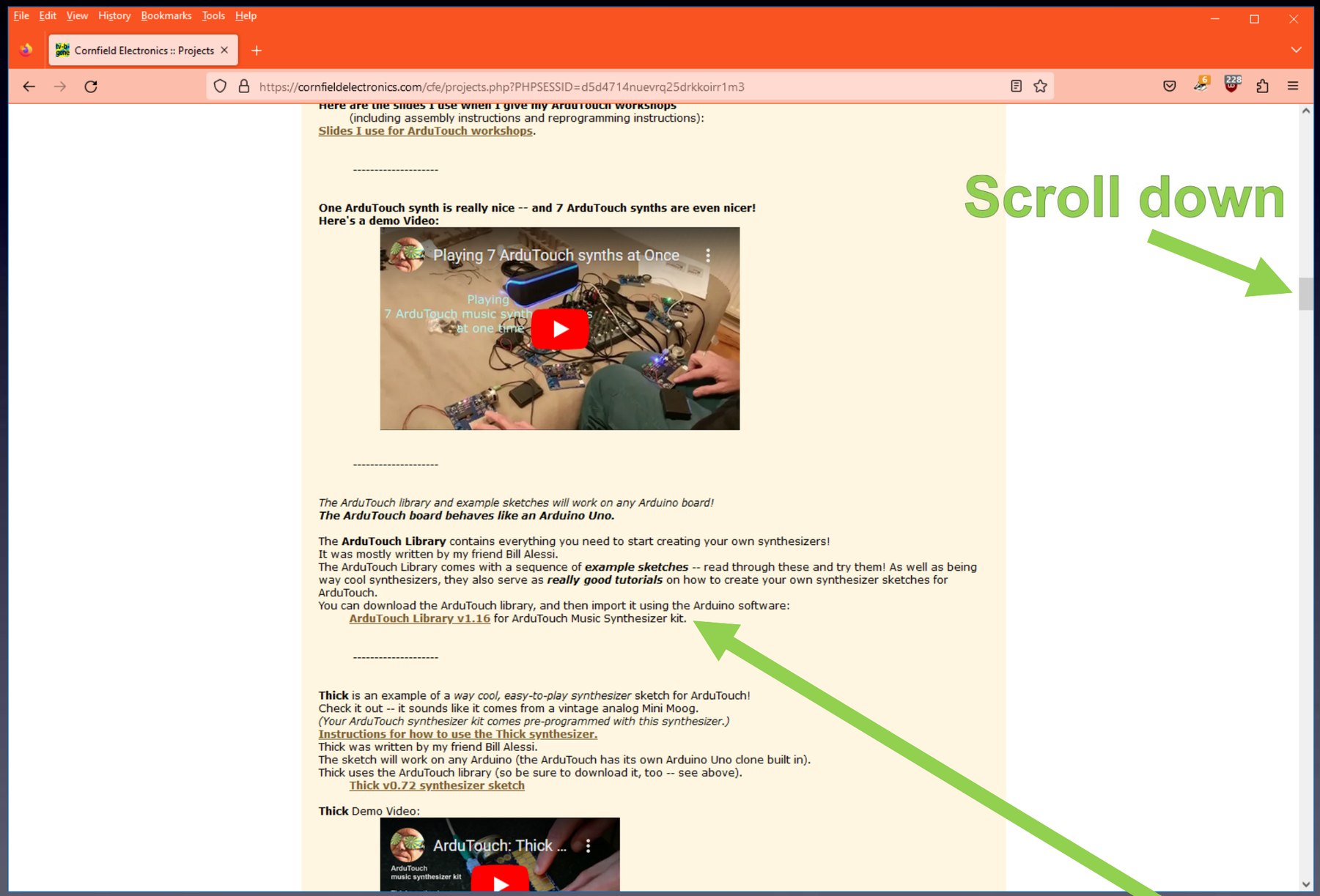
The first time you start your Arduino software you need to set things up

(3) Install the ArduTouch library

Arduino

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

(3) Install the ArduTouch library



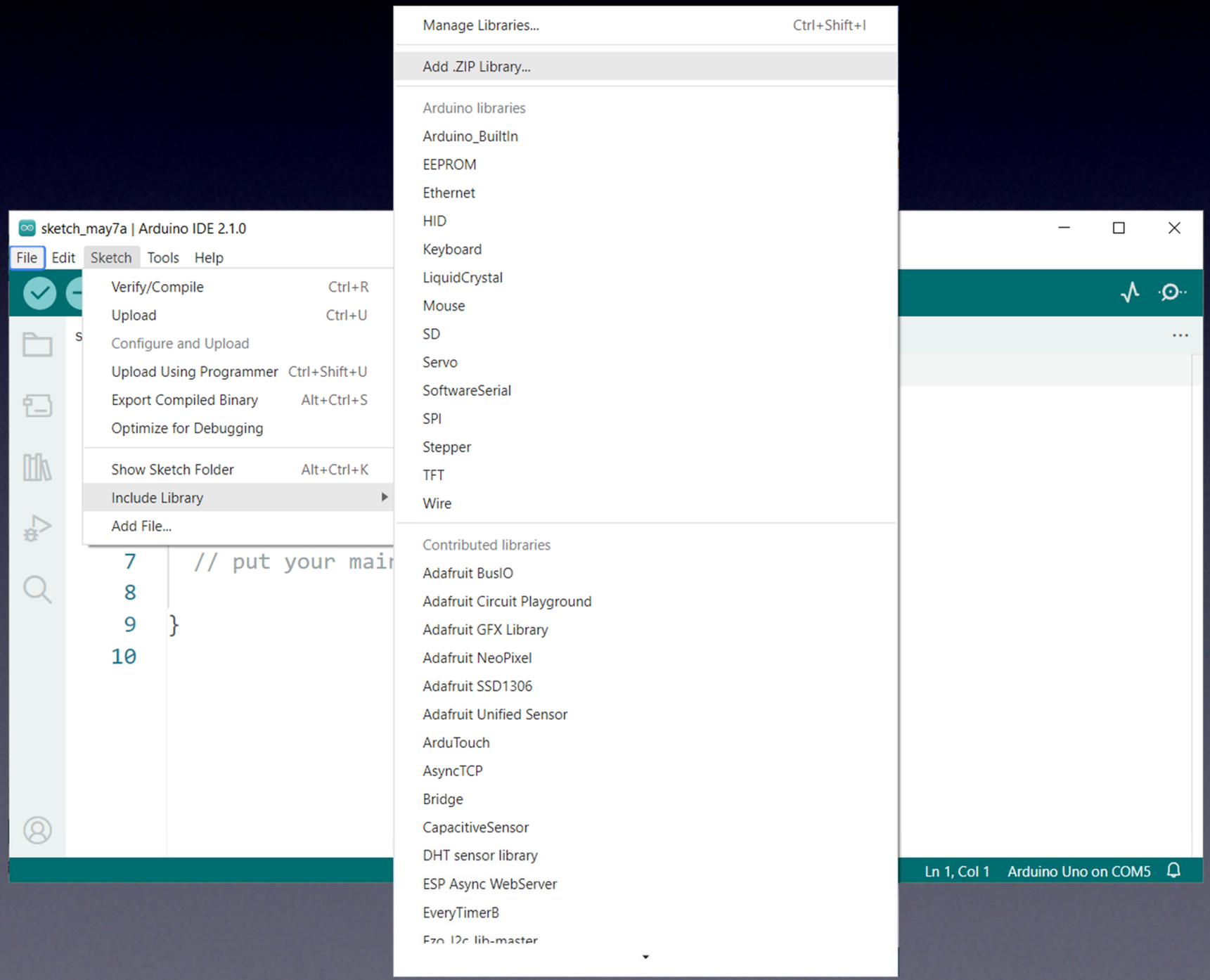
Scroll down

click this link to download the ArduTouch library

Arduino

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

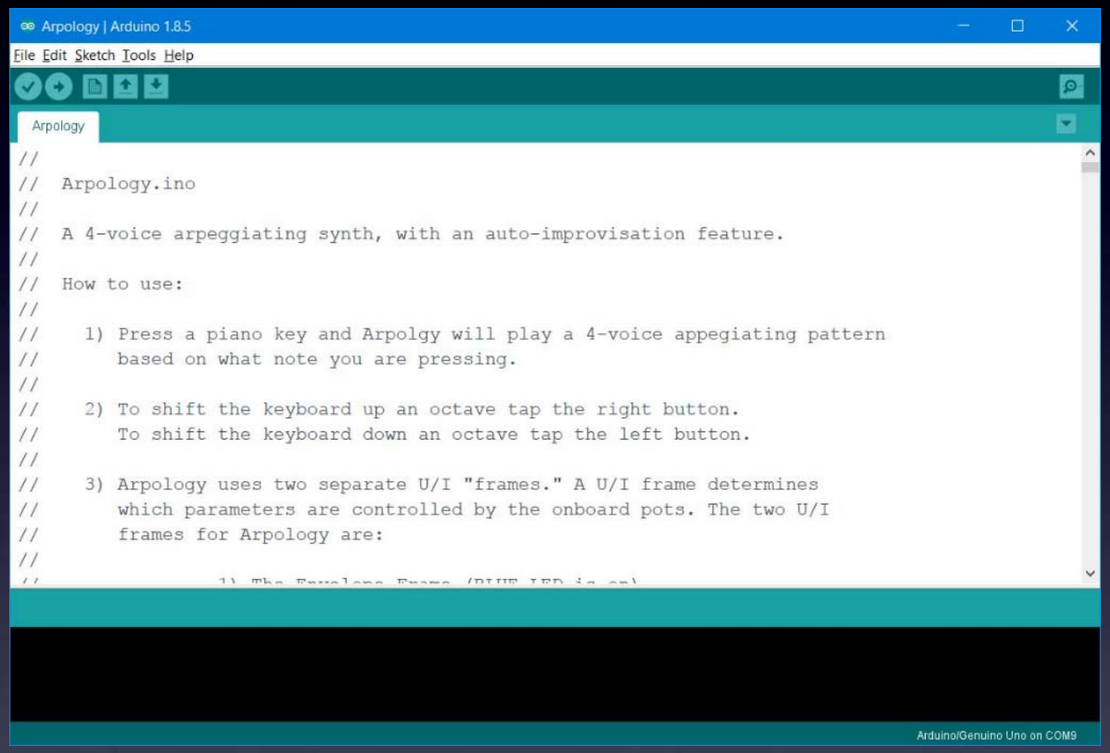
(3) Install the ArduTouch library



Arduino

Designed for non-geeky artists

(4) Download an ArduTouch “sketch”



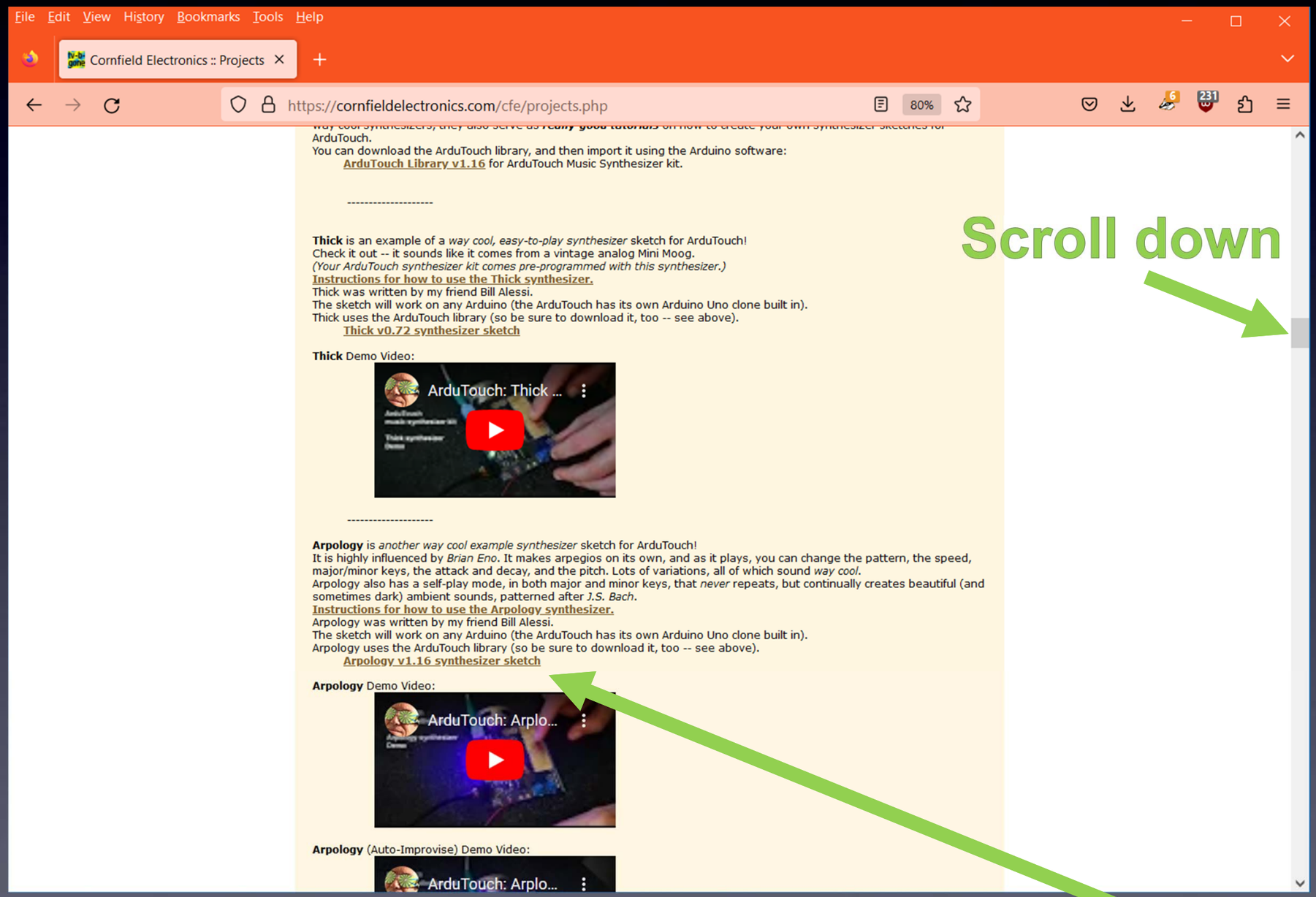
“Sketch” :

an Arduino program

Arduino

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

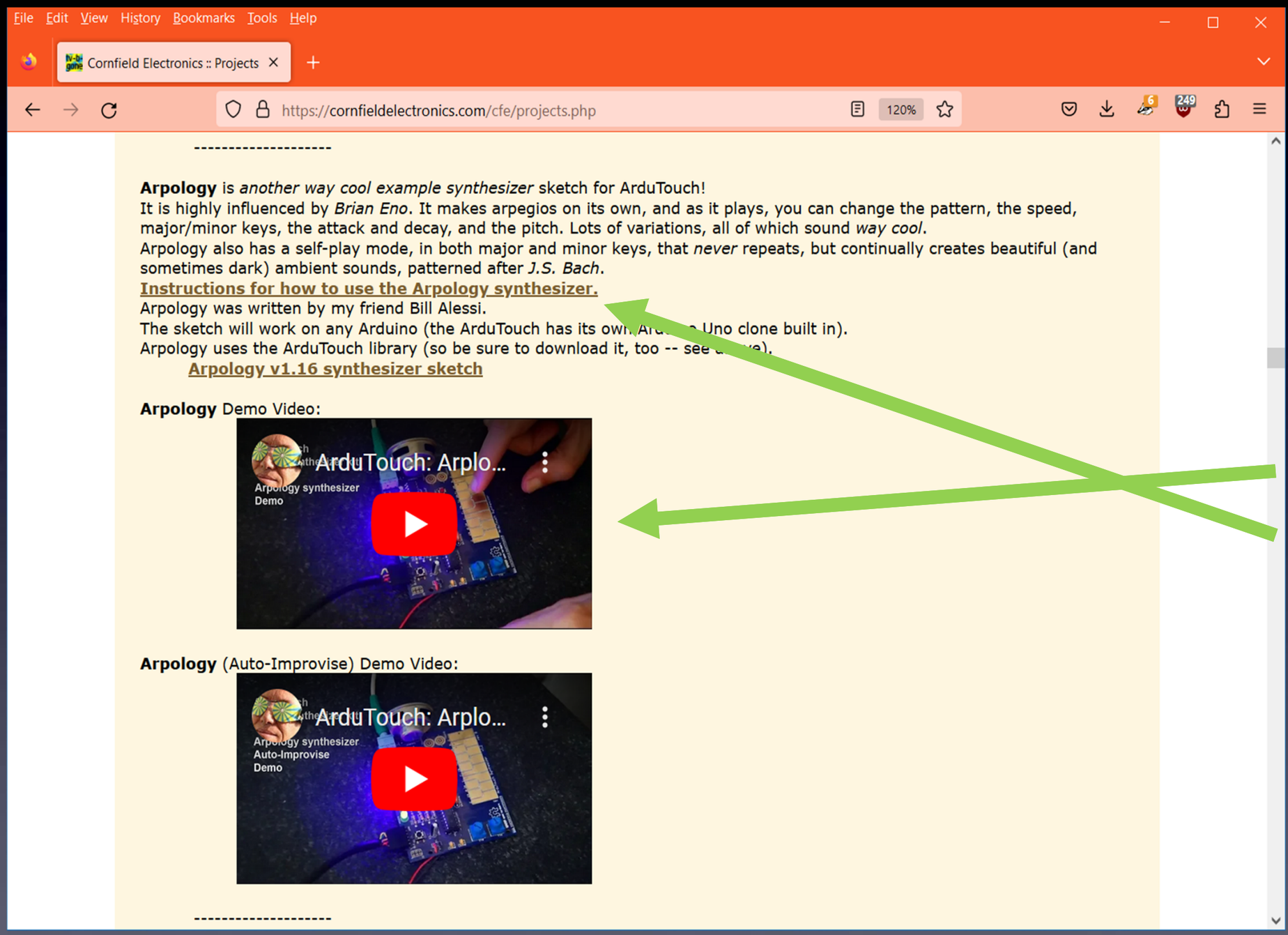
(4) Download an ArduTouch “sketch”



Scroll down

click link to download a synth “sketch”

Arduino



Check it out!

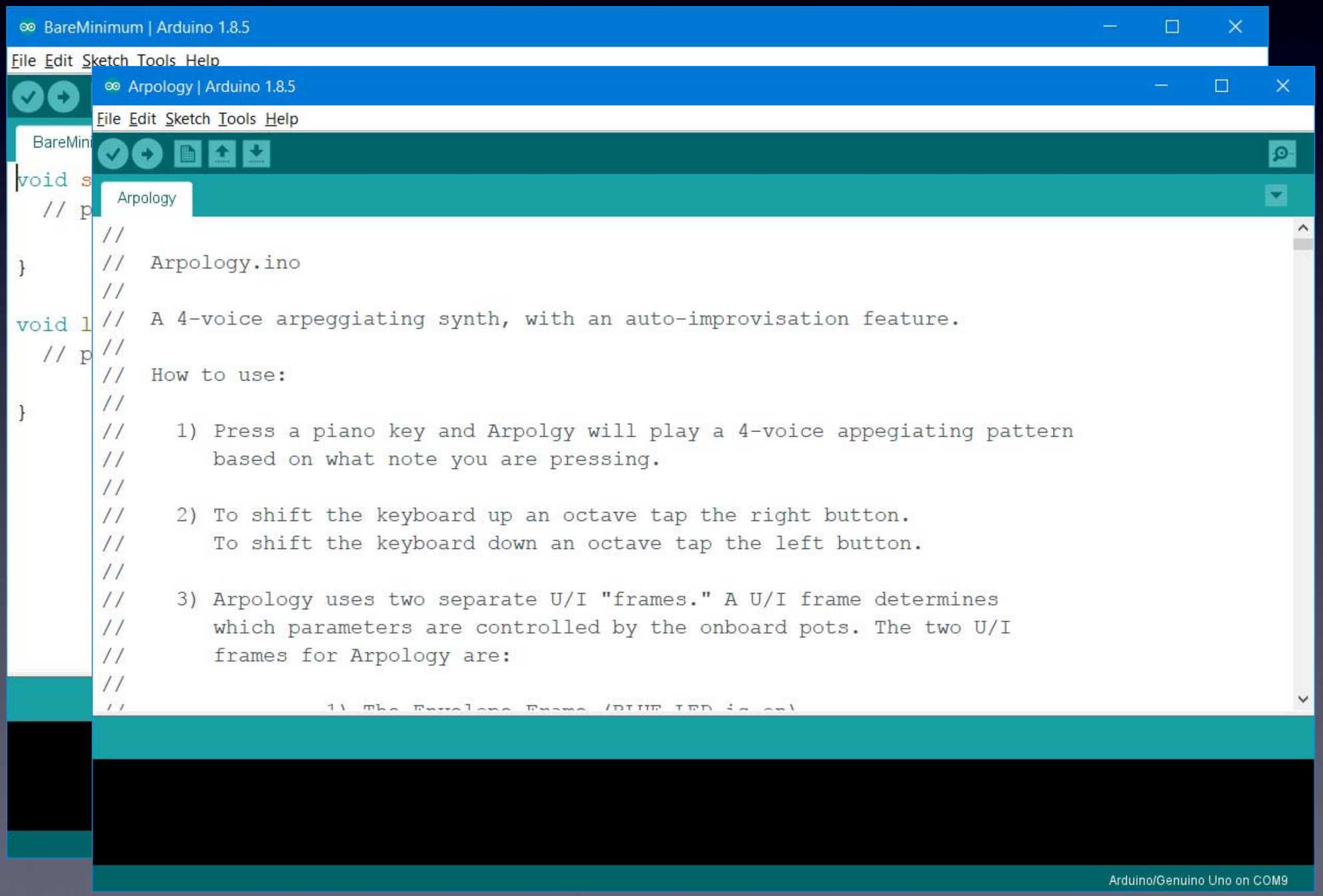
Also available for each synth:

- Demo Videos
- Instructions

Arduino

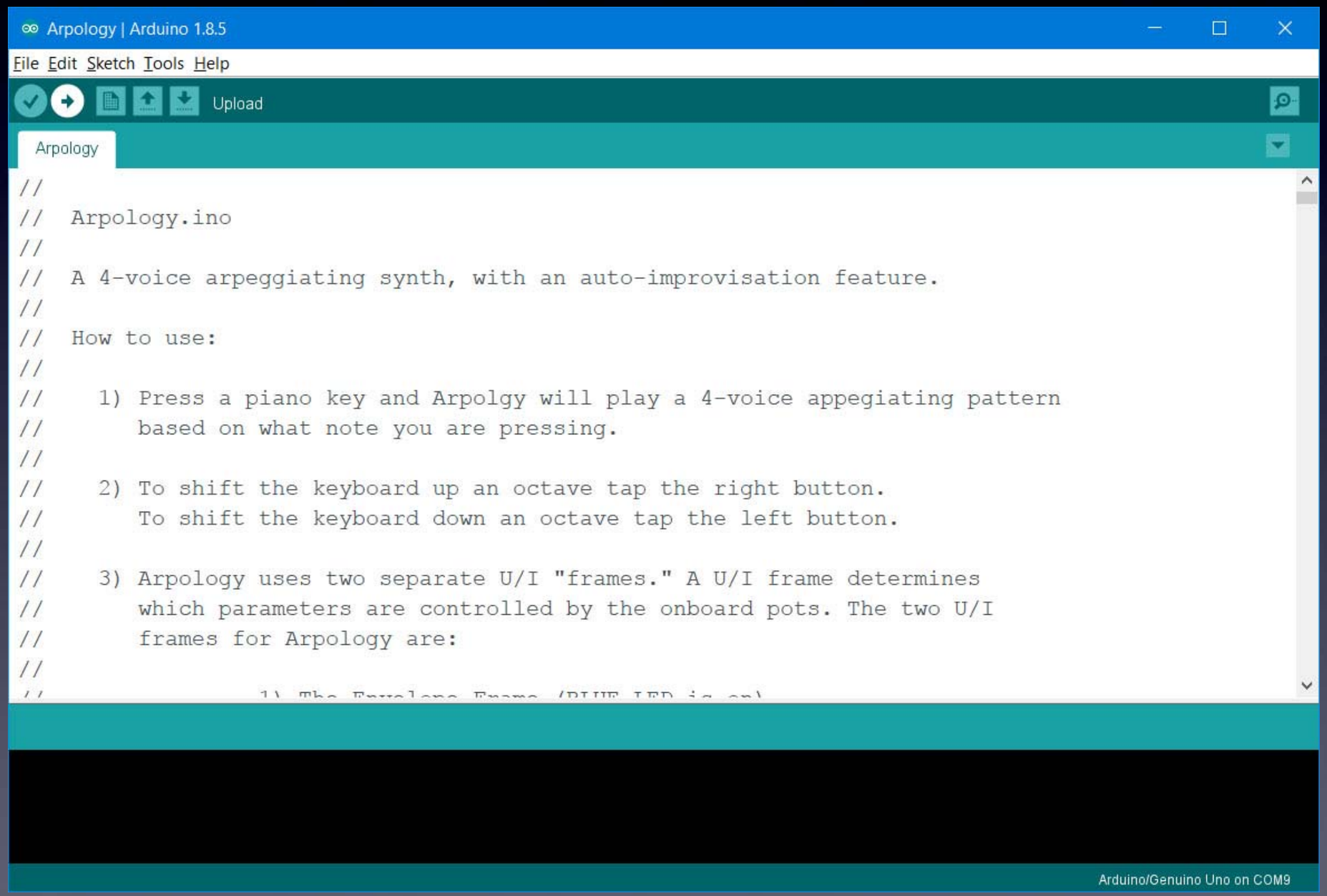
You can open an ArduTouch synth sketch from:
File → Open…

(I opened “Arpology here)



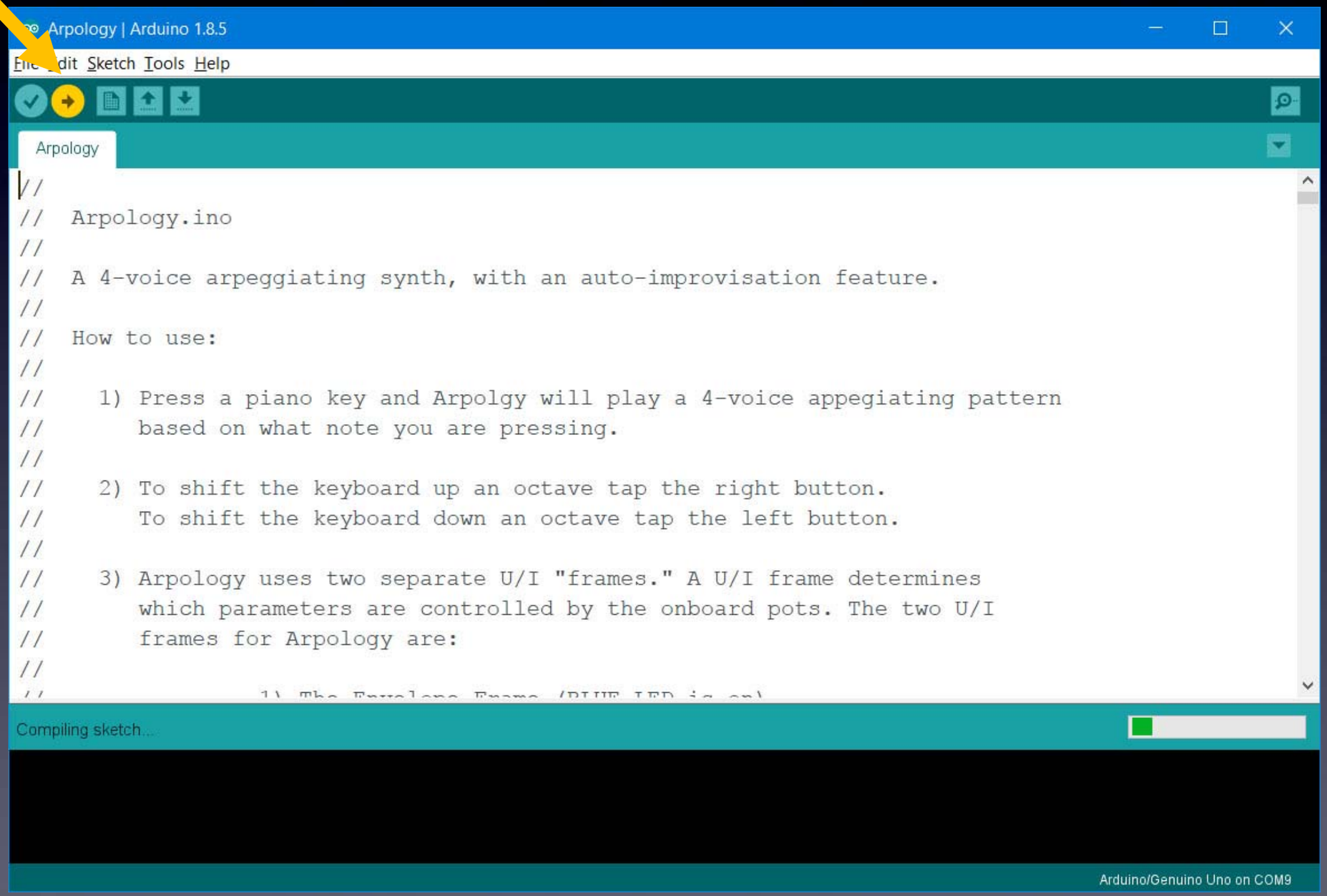
Arduino

Your Arduino software is now ready to program your ArduTouch !



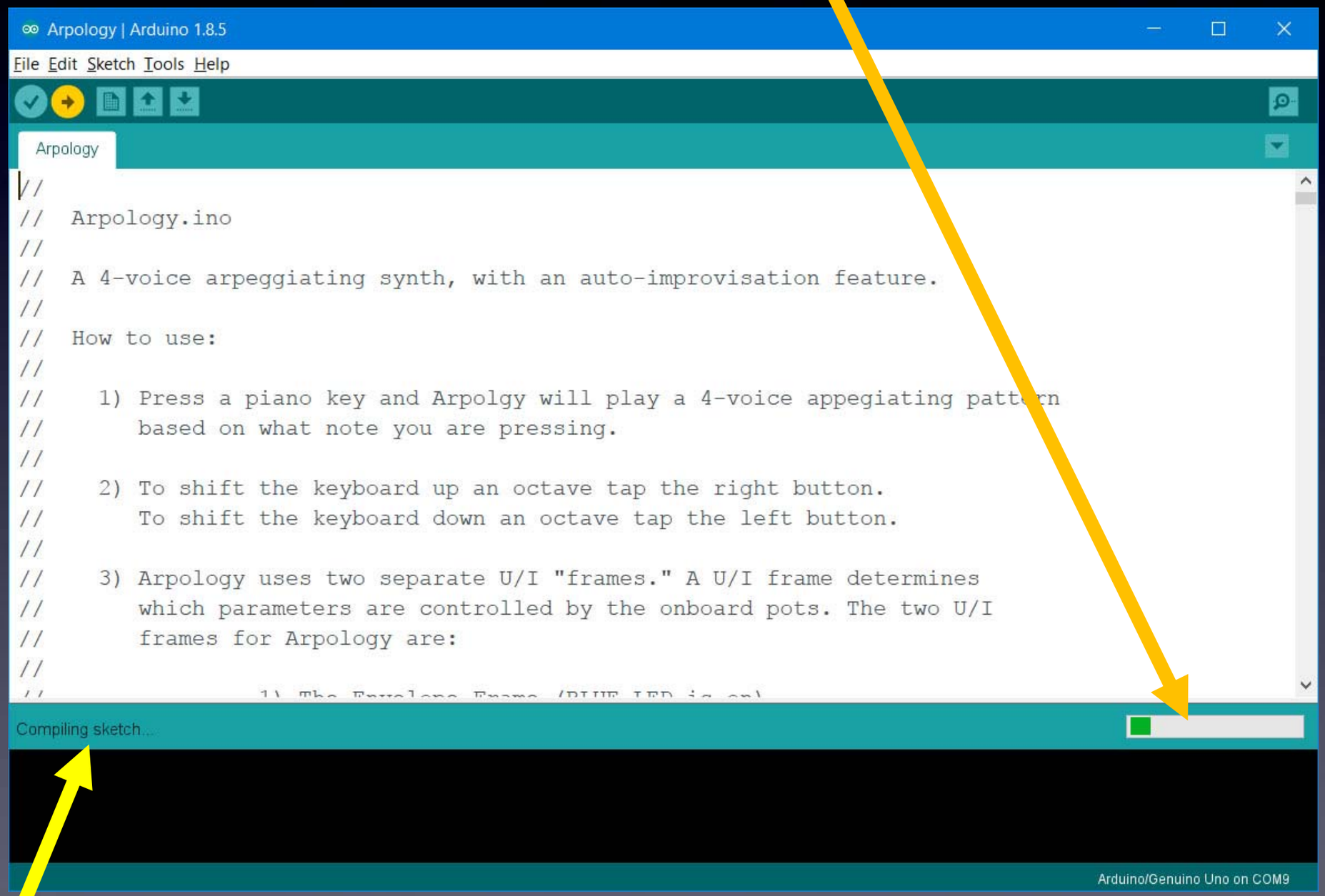
Arduino

With the USB-Serial cable connected to your ArduTouch board press the Upload button



Arduino

While uploading, you will see a progress bar…

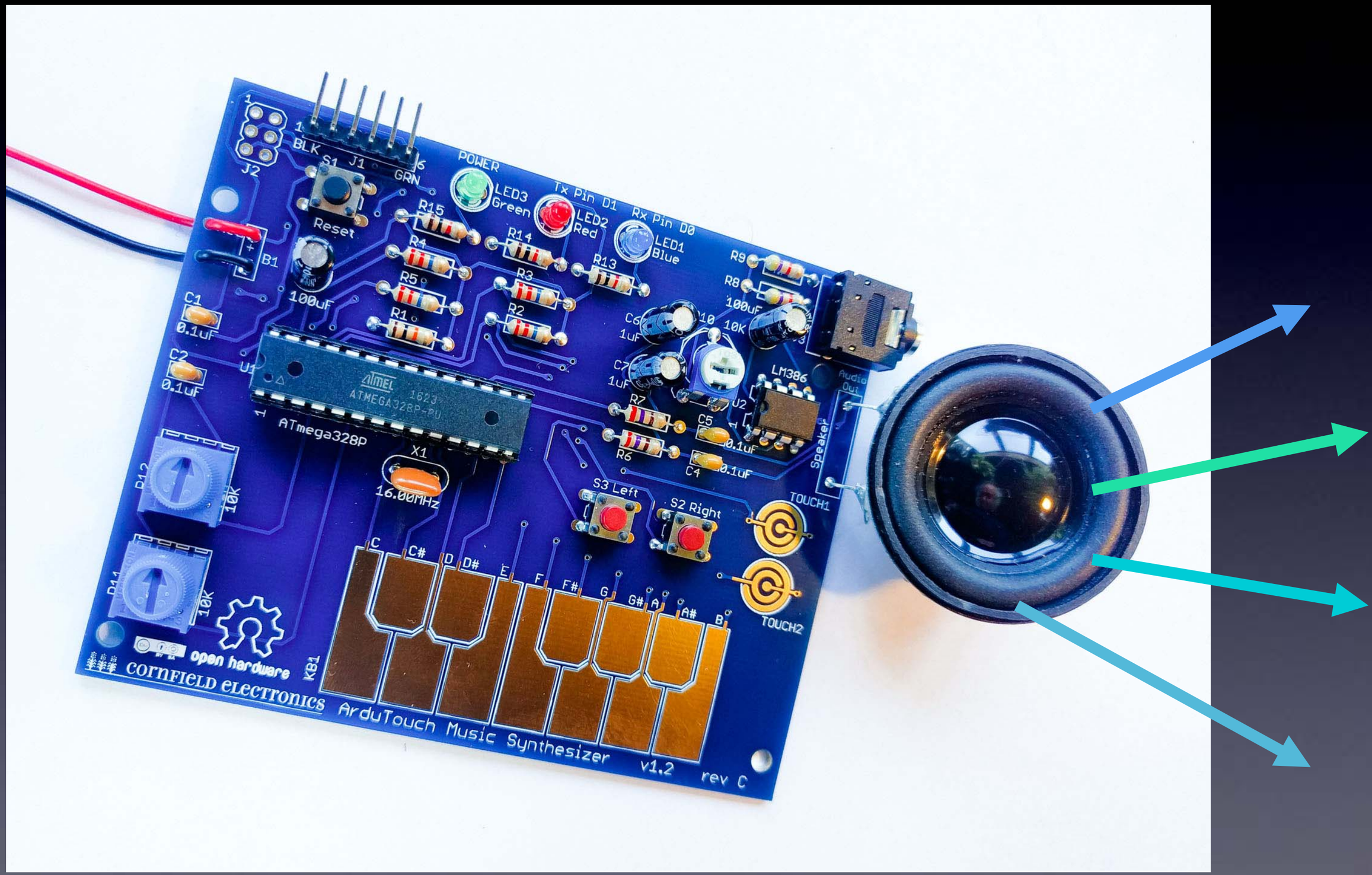


…and when it's completed successfully, it says: "Upload done"

ArduTouch

Disconnect your ArduTouch board
from the USB-Serial cable,

turn on your battery pack,

And...

Let’s make new noise!