



Make your own



Mitch Altman

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Inventor of **TV-B-Gone** universal remote controls

Co-founder of **3Ware** (successful Silicon Valley startup)

Pioneer of **VR** (in the mid-1980s)

Founding mentor at **HAX** (1st and biggest hardware accelerator)

Co-founder of **Noisebridge** (San Francisco hackerspace)

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Patreon: [mitchaltman](#)



TV B GONE®

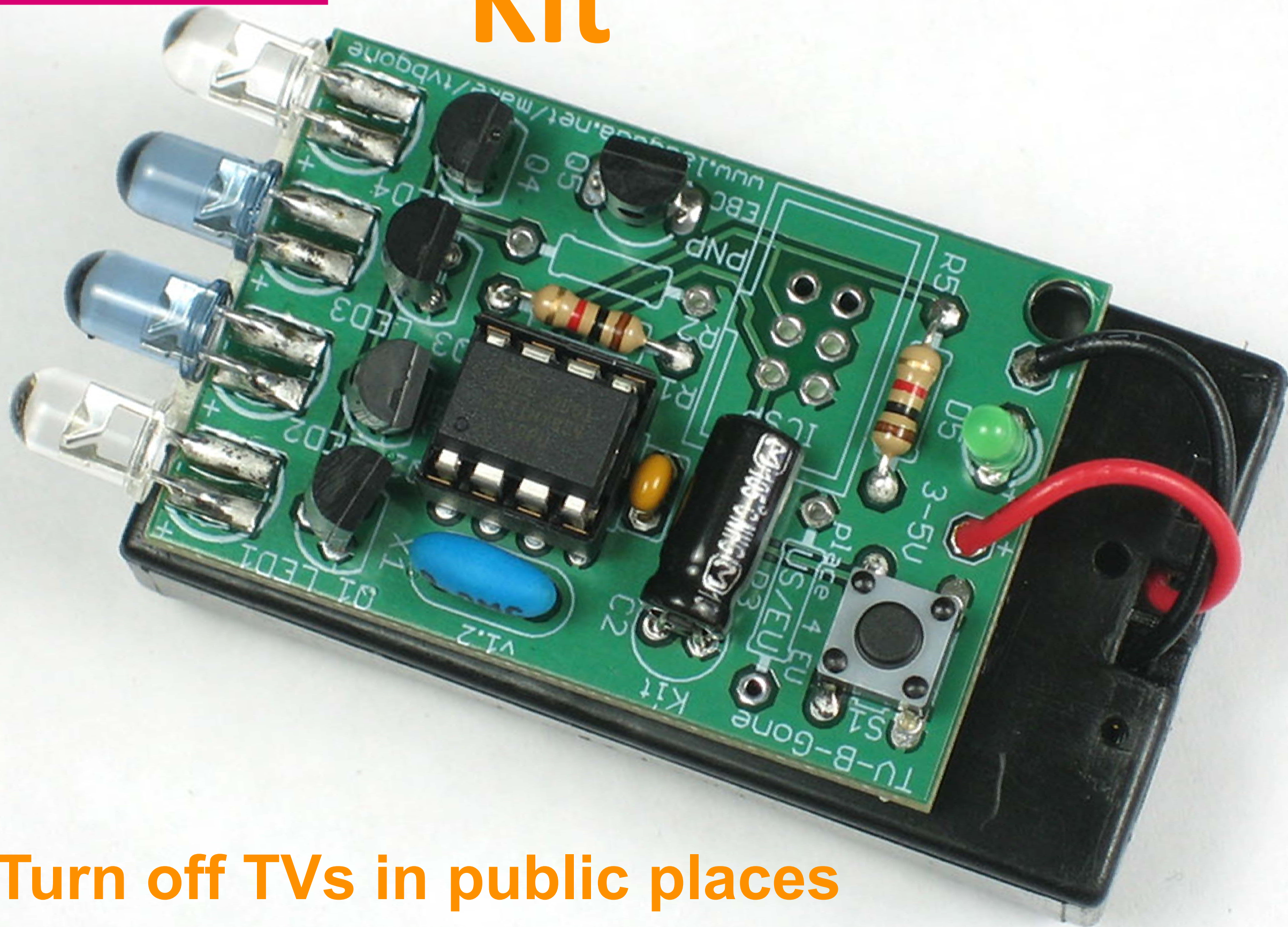


TV-B-Gone
Just a remote control,
but only one button:
OFF !



TV B GONE®

Kit



**Turn off TVs in public places
from 50 meters away!**



Kit: in a jacket



forbes.com – Turning Off Any TV You Want - Without Getting Caught



Kit: in a hat



makezine.com – TV-B-Gone Hat



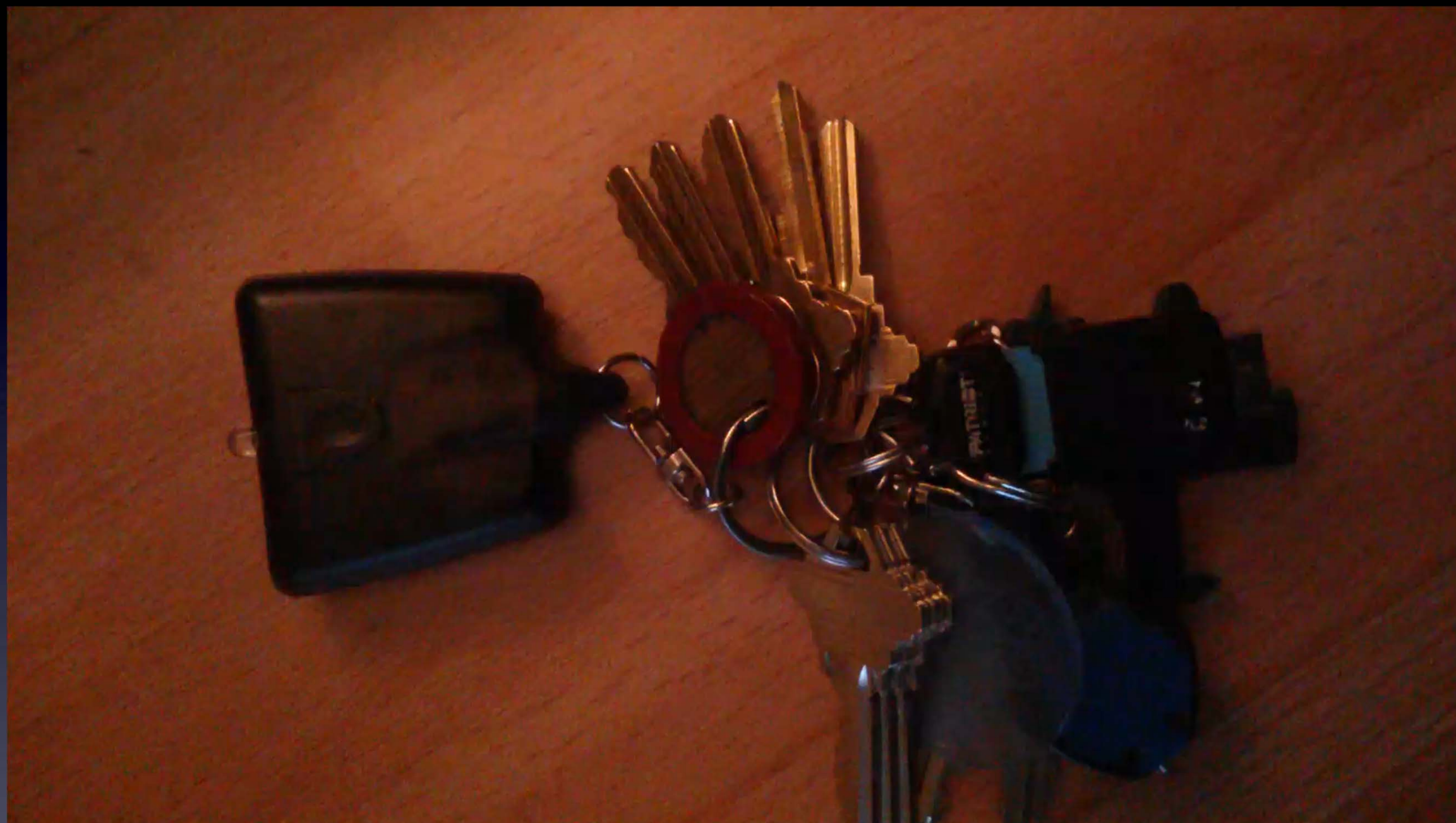
Kit: Sonic Screwdriver



hackaday.com – Sonic Screwdriver Meets TV-B-Gone



Takes about 60 seconds



About 150 IR "OFF" codes (one per blink)

TV-B-Gone universal remote control

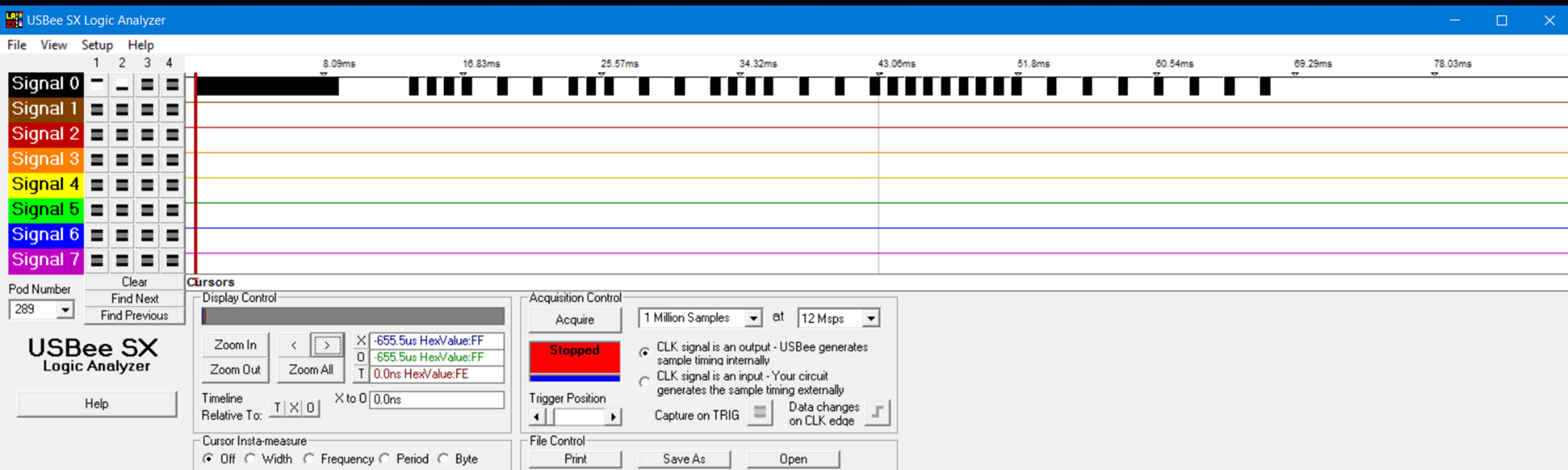
IR Remote control codes



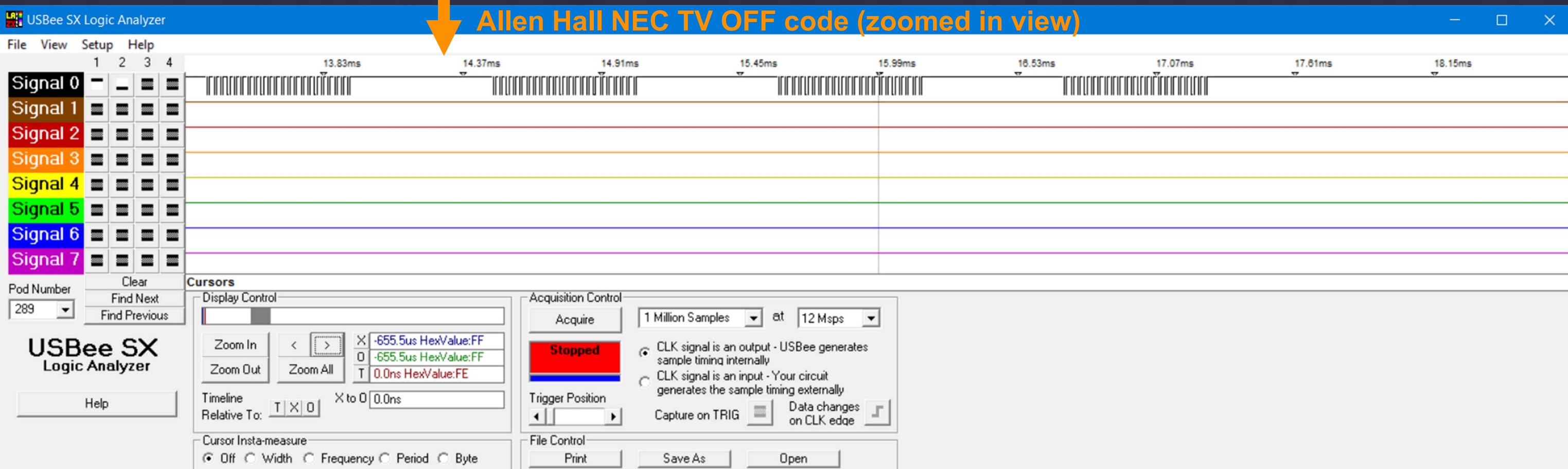
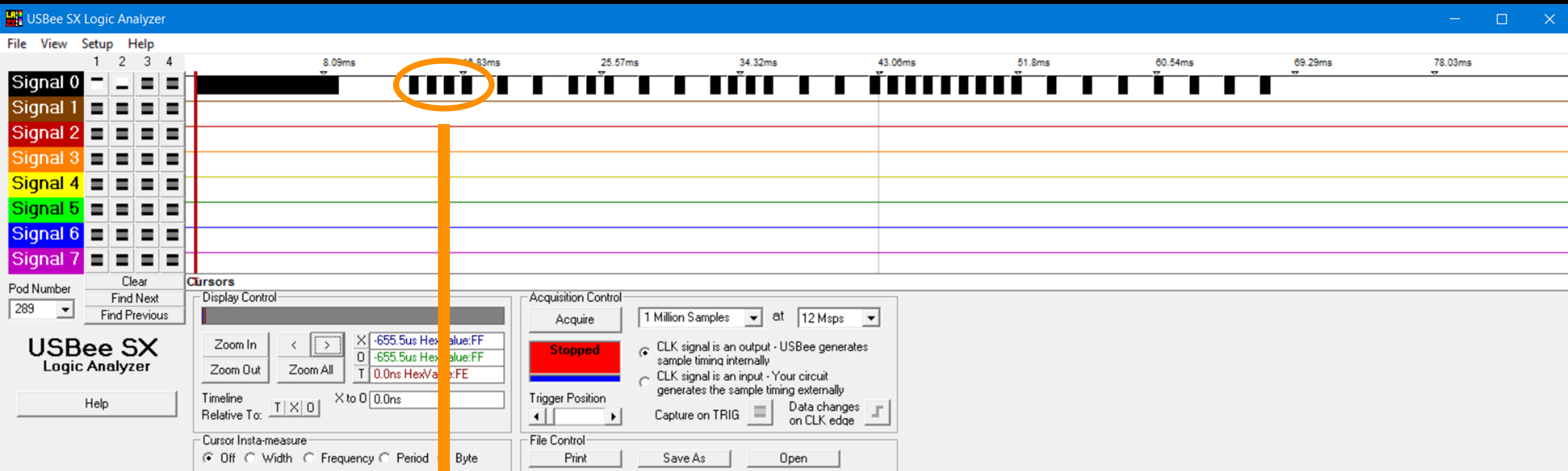
Allen Hall

NEC TV remote control

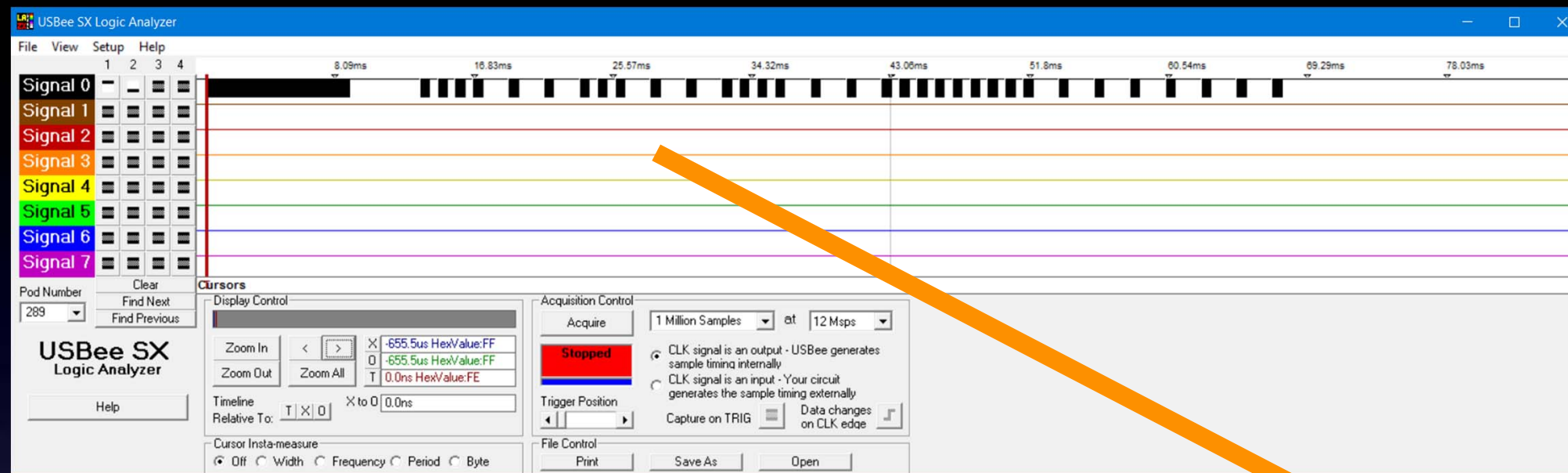
Allen Hall NEC TV OFF code



Allen Hall NEC TV OFF code

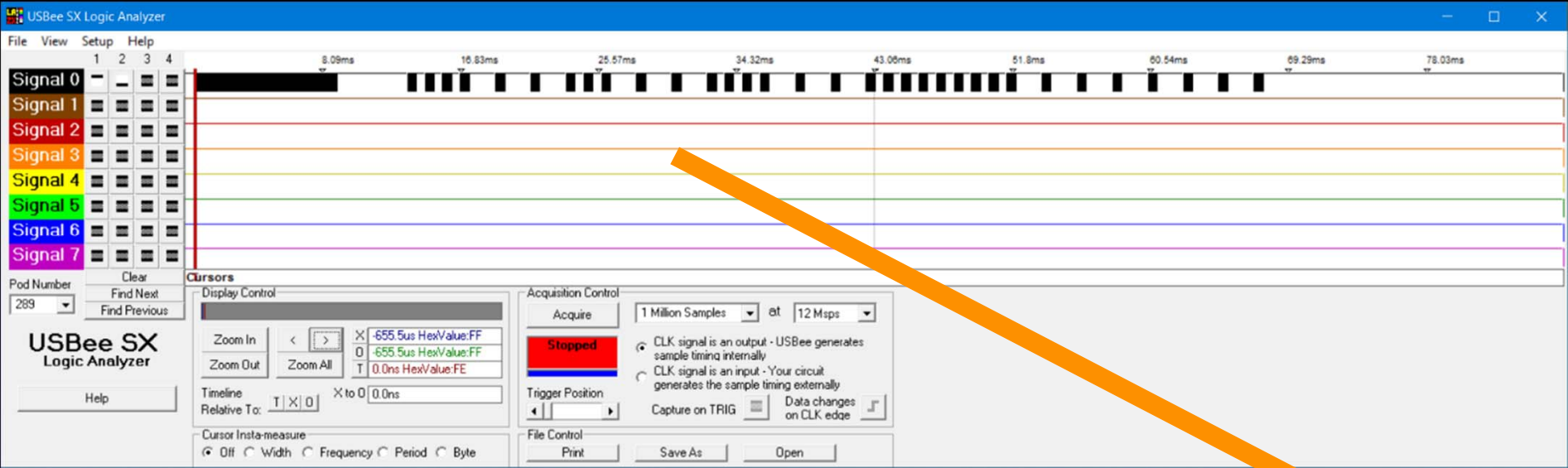


Allen Hall NEC TV OFF code



pair #	on-time	off-time
1	8,920 usec	4,450 usec
2	560 usec	560 usec
3	560 usec	560 usec
4	560 usec	560 usec
5	560 usec	1,680 usec
6	560 usec	1,680 usec
7	560 usec	1,680 usec
8	560 usec	560 usec
9	560 usec	560 usec
10	560 usec	1,680 usec
11	560 usec	1,680 usec
12	560 usec	1,680 usec
13	560 usec	560 usec
14	560 usec	560 usec
15	560 usec	560 usec
16	560 usec	560 usec
17	560 usec	1,680 usec
18	560 usec	1,680 usec
19	560 usec	560 usec
20	560 usec	560 usec
21	560 usec	560 usec
22	560 usec	560 usec
23	560 usec	560 usec
24	560 usec	560 usec
25	560 usec	560 usec
26	560 usec	560 usec
27	560 usec	1,680 usec
28	560 usec	1,680 usec
29	560 usec	1,680 usec
30	560 usec	1,680 usec
31	560 usec	1,680 usec
32	560 usec	1,680 usec
33	560 usec	1,680 usec
34	560 usec	560 usec

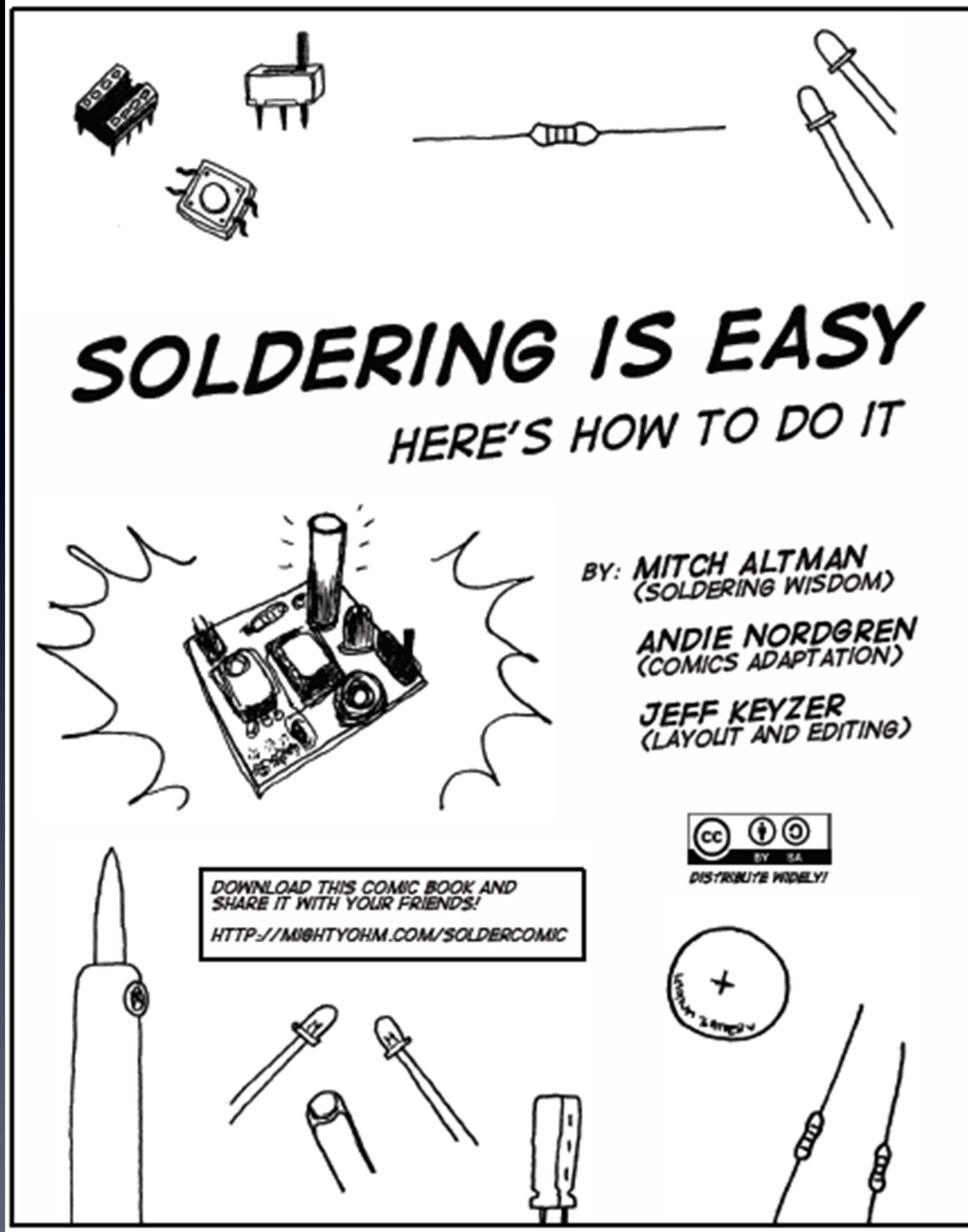
Allen Hall NEC TV OFF code



pair #	on-time	off-time	index
1	8,920 usec	4,450 usec	0
2	560 usec	560 usec	1
3	560 usec	560 usec	1
4	560 usec	560 usec	1
5	560 usec	1,680 usec	2
6	560 usec	1,680 usec	2
7	560 usec	1,680 usec	2
8	560 usec	560 usec	1
9	560 usec	560 usec	1
10	560 usec	1,680 usec	2
11	560 usec	1,680 usec	2
12	560 usec	1,680 usec	2
13	560 usec	560 usec	1
14	560 usec	560 usec	1
15	560 usec	560 usec	1
16	560 usec	560 usec	1
17	560 usec	1,680 usec	2
18	560 usec	1,680 usec	2
19	560 usec	560 usec	1
20	560 usec	560 usec	1
21	560 usec	560 usec	1
22	560 usec	560 usec	1
23	560 usec	560 usec	1
24	560 usec	560 usec	1
25	560 usec	560 usec	1
26	560 usec	560 usec	1
27	560 usec	1,680 usec	2
28	560 usec	1,680 usec	2
29	560 usec	1,680 usec	2
30	560 usec	1,680 usec	2
31	560 usec	1,680 usec	2
32	560 usec	1,680 usec	2
33	560 usec	1,680 usec	2
34	560 usec	560 usec	1

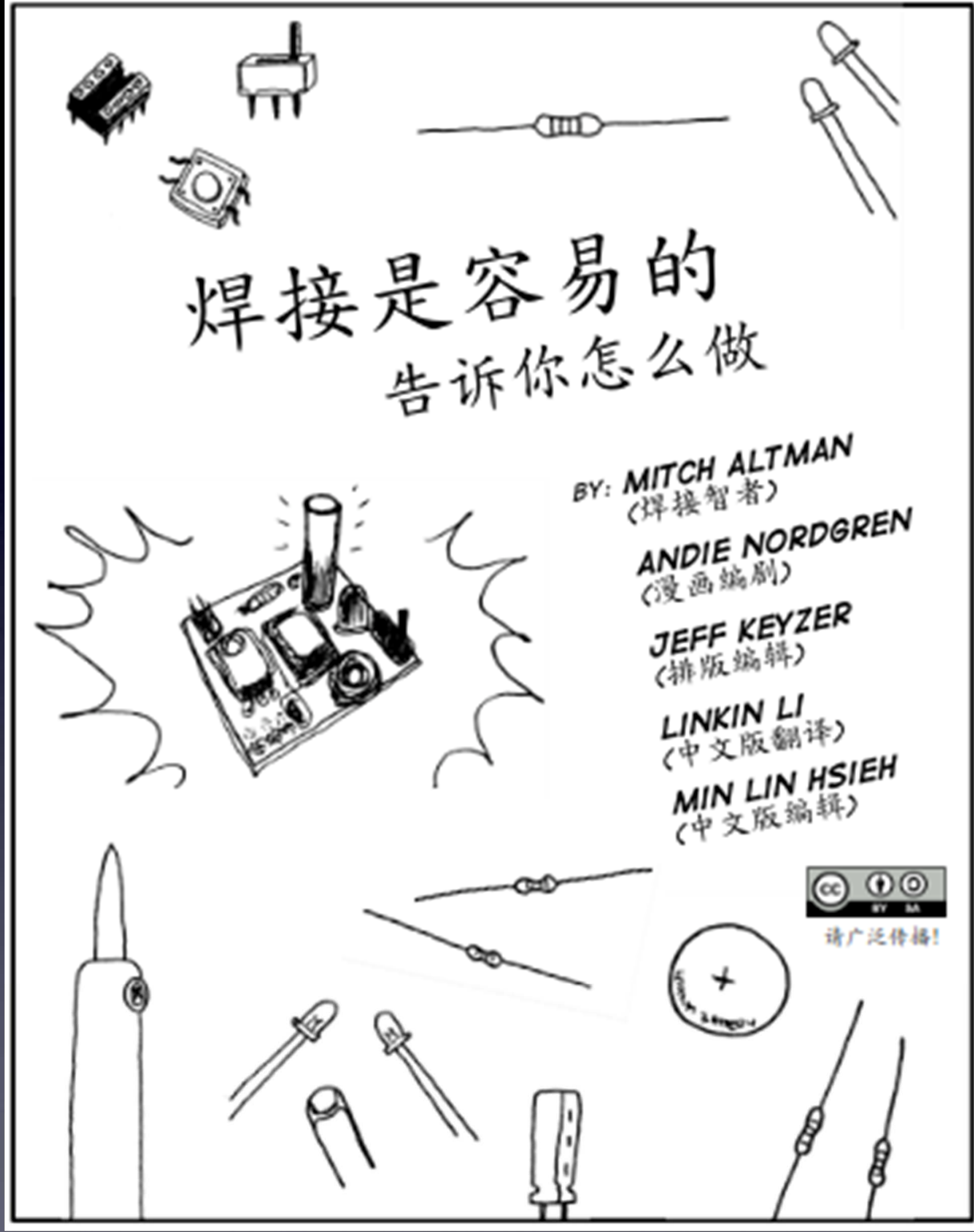
index
0 1 1 1
2 2 2 1
1 2 2 2
1 1 1 1
2 2 1 1
1 1 1 1
1 1 2 2
2 2 2 2
2 1

Learn To Solder



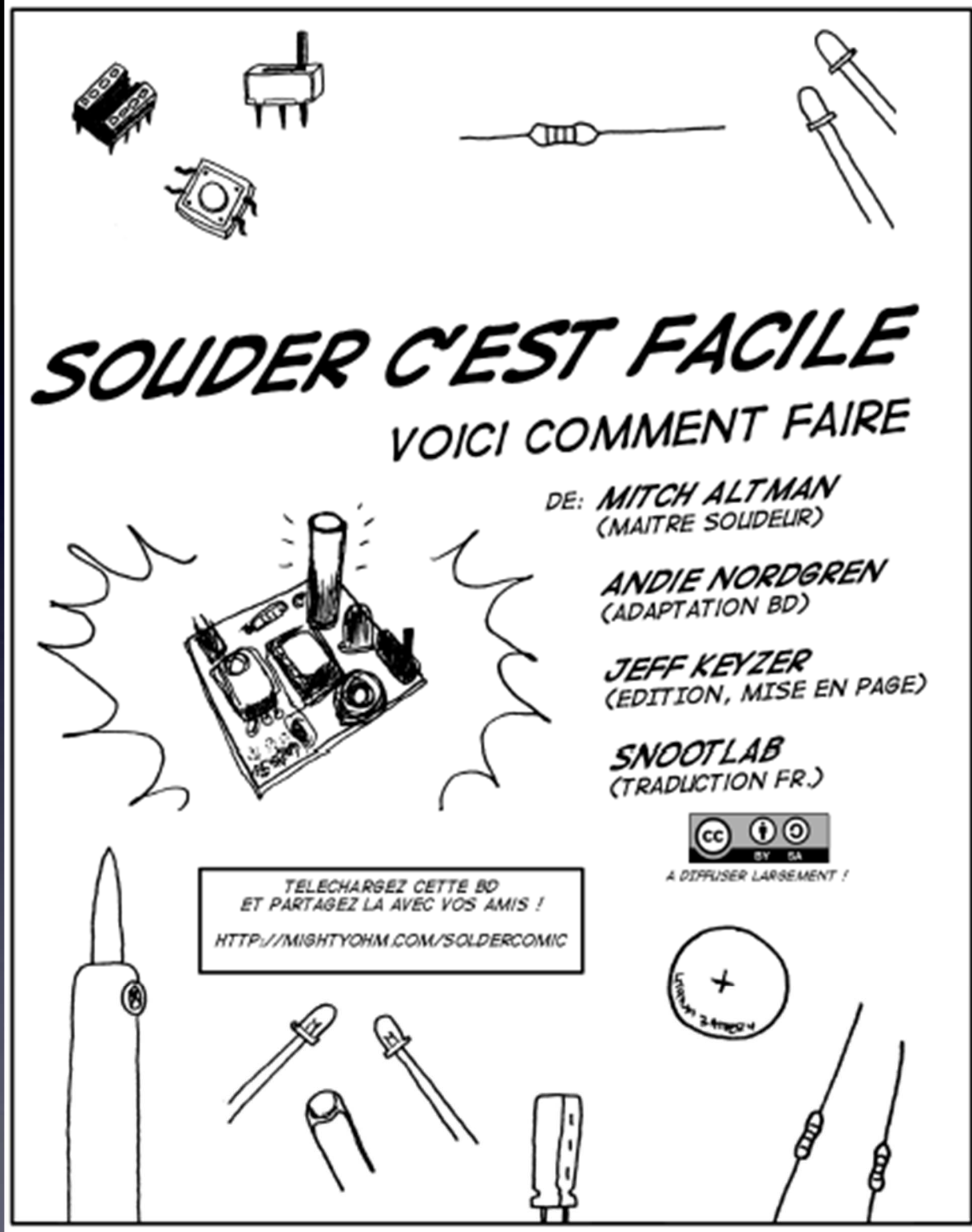
download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Learn To Solder



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(In many different languages.)

Learn To Solder



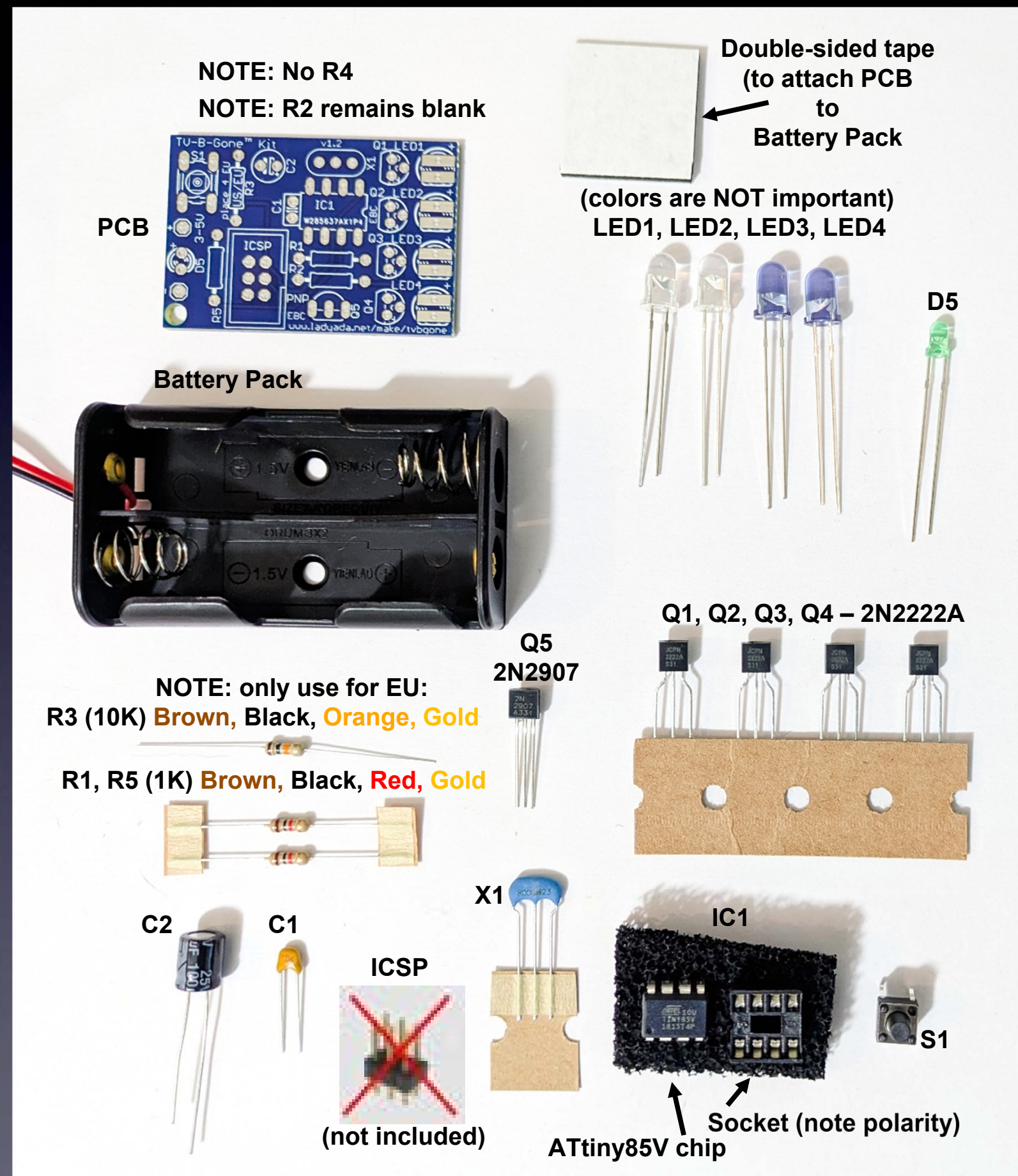
download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Learn To Solder

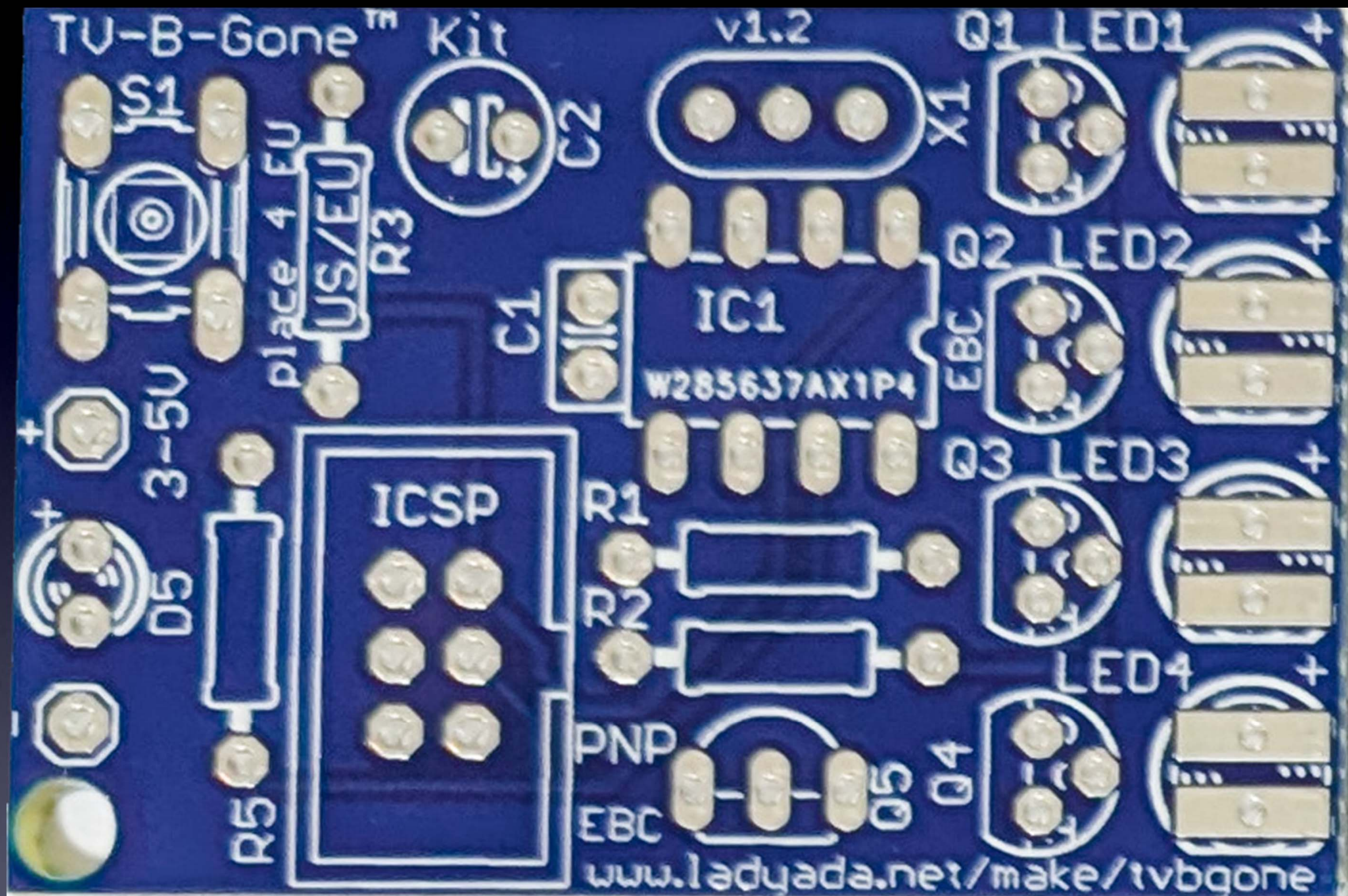


download for free at:
<http://mightyohm.com/soldercomic>
(In many different languages.)

Parts



All of the parts



The board we'll solder the parts to



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



3 Resistors in the kit

R3

NOTE:

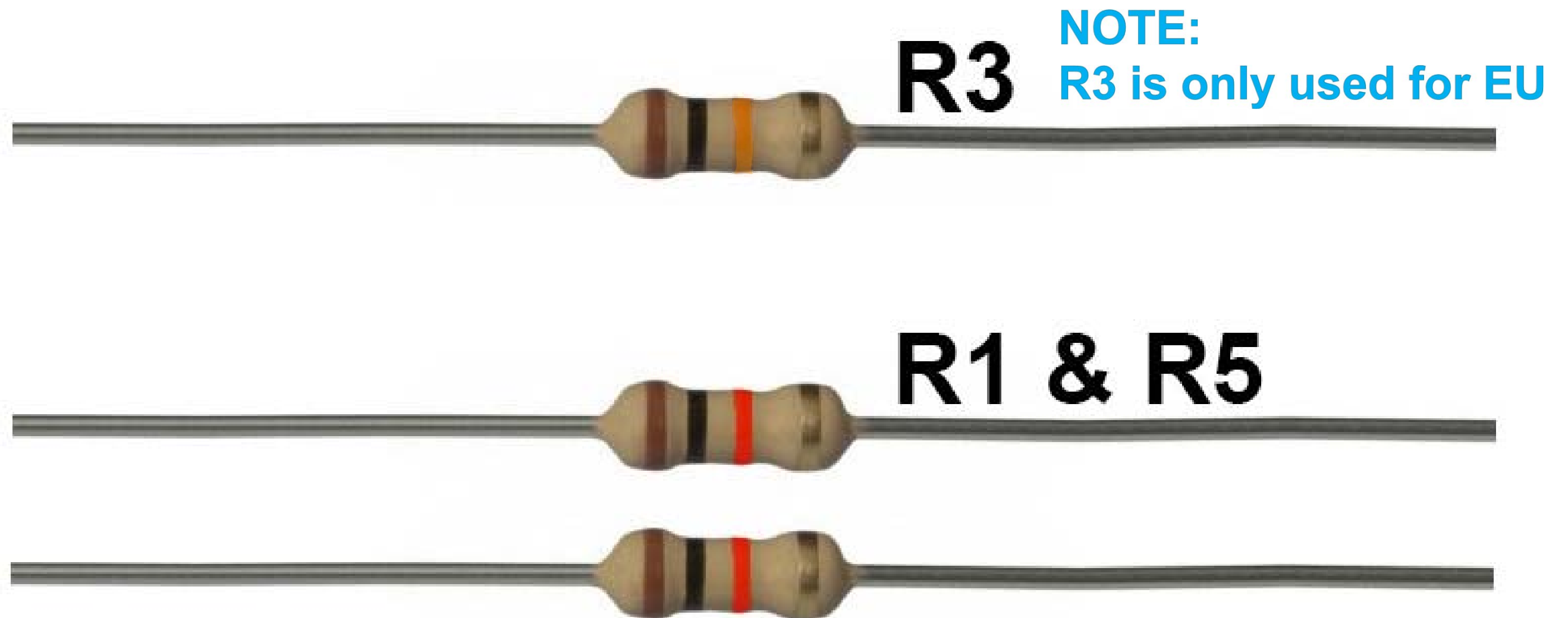
R3 is only used for EU

Brown, Black, Orange

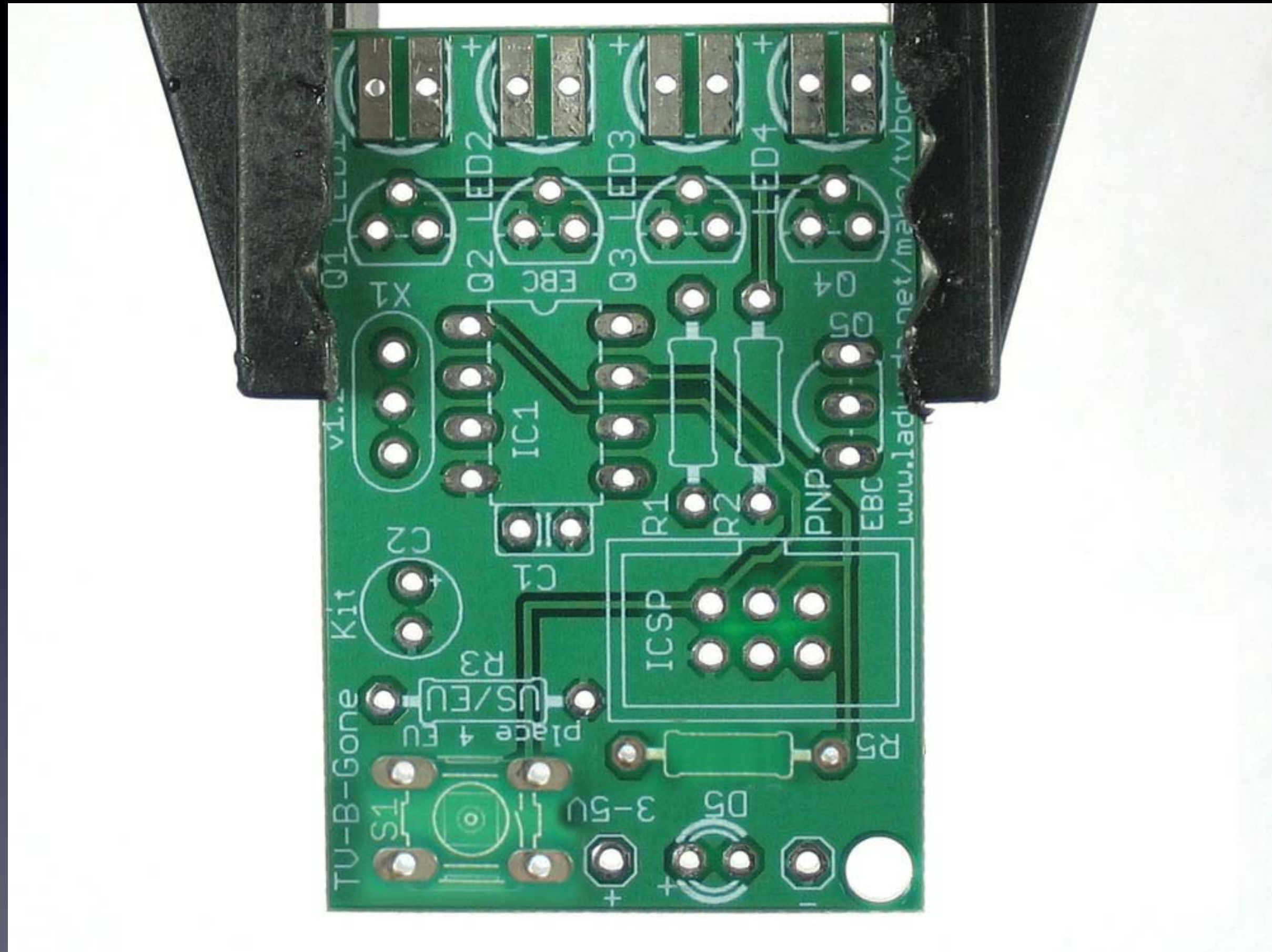
R1 & R5

Brown, Black, Red

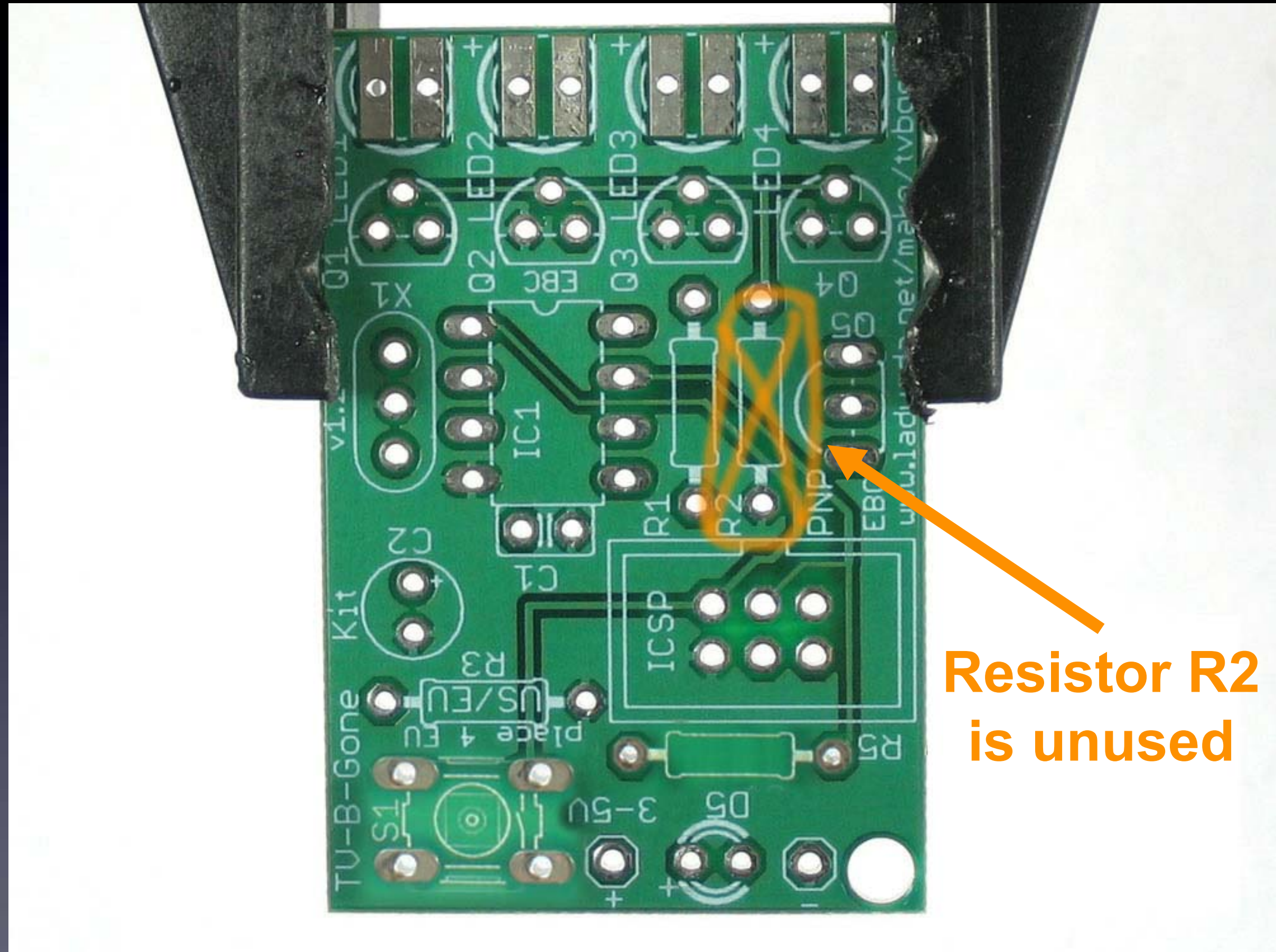
Look at the shape of these parts



See the same shapes on the PCB

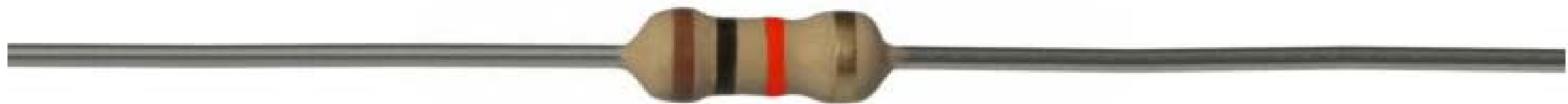


Do NOT put anything in R2



We will start with Resistors R1 & R5

R1 & R5



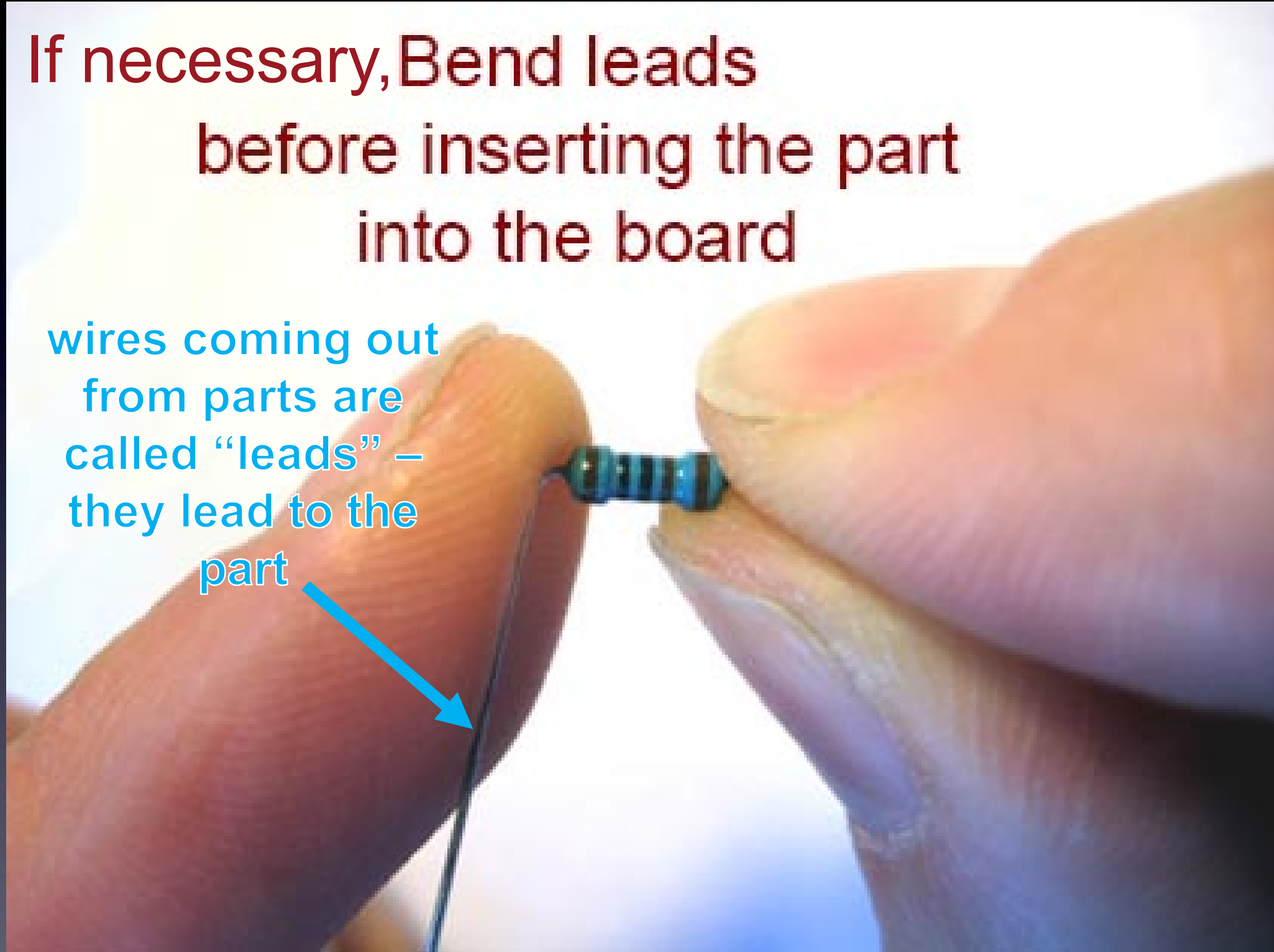
1K Ohm: Brown, Black, Red

NOTE: Do NOT use the ~~[Brown, Black, Orange]~~ resistor !

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

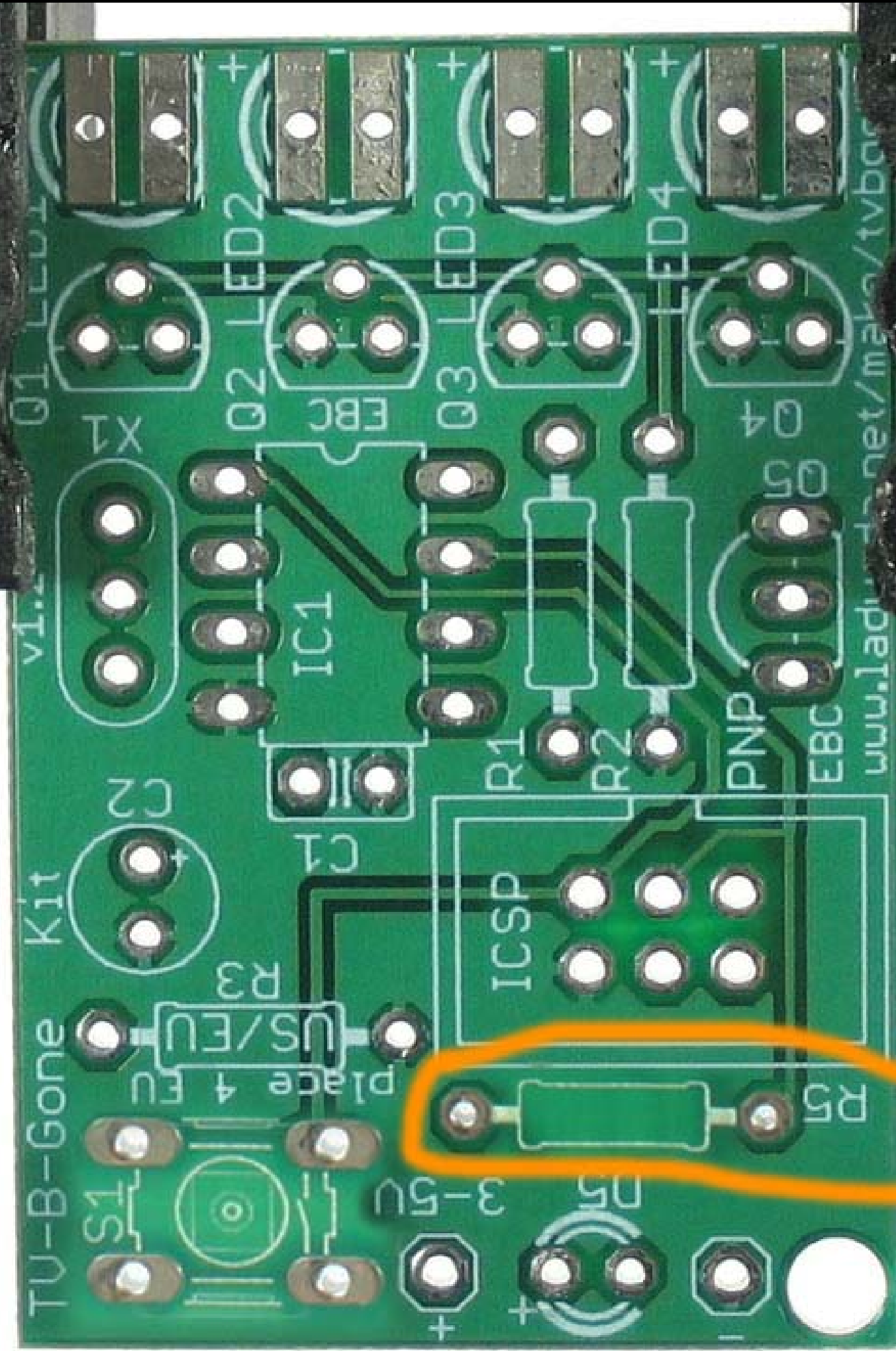
If necessary, Bend leads
before inserting the part
into the board

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





**R5 – this is how it will look before
inserting it into the board**

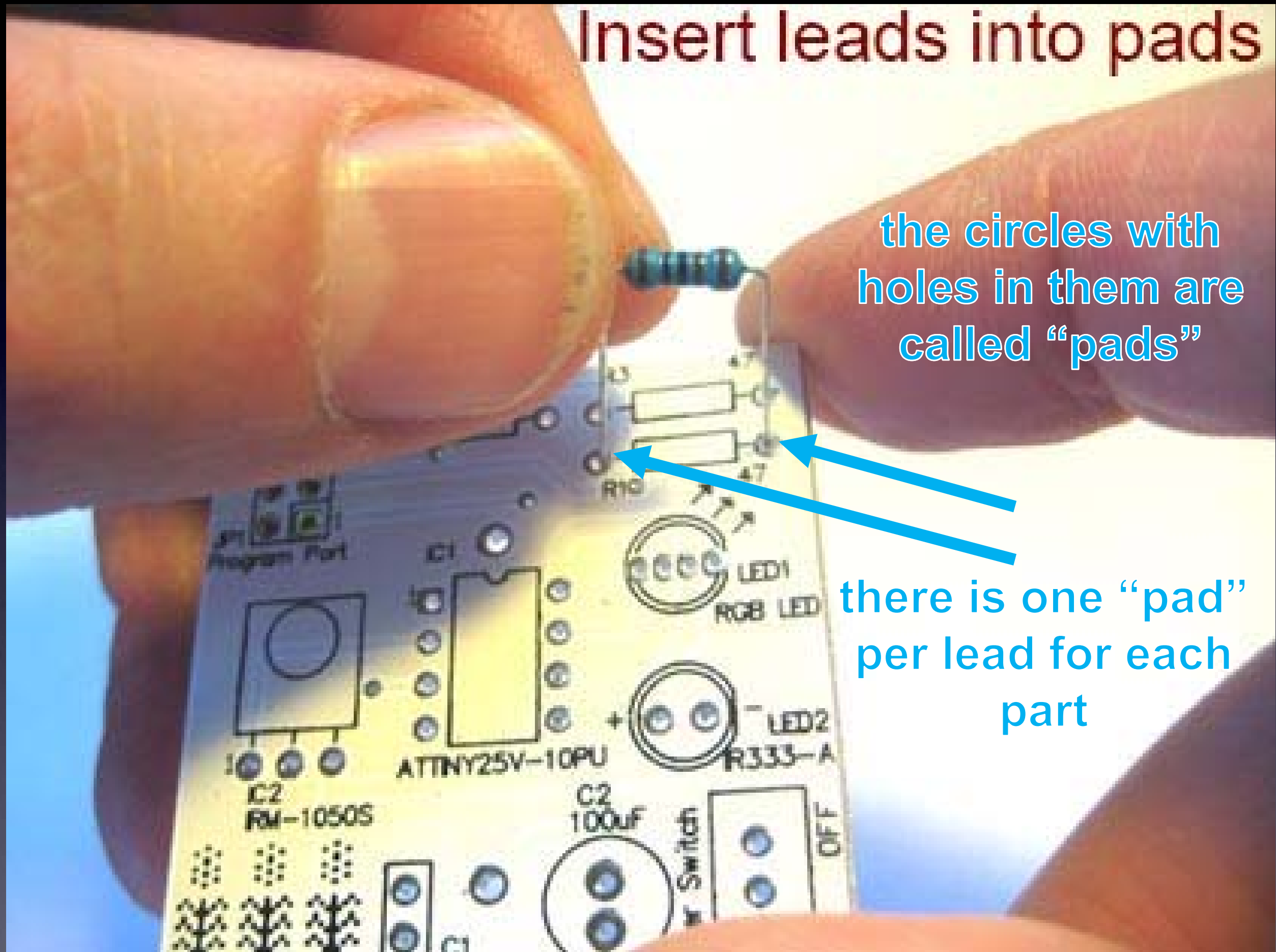


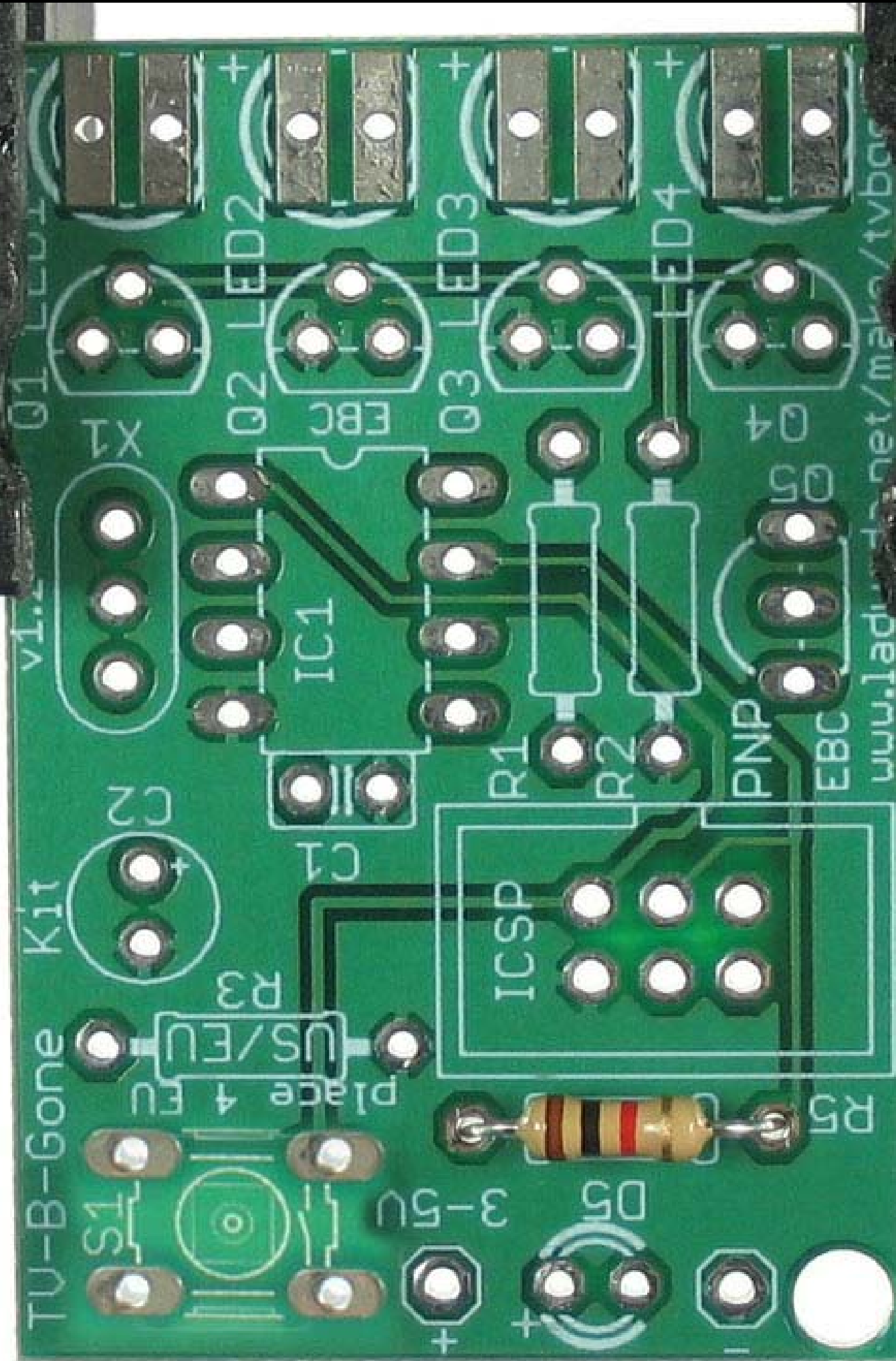
Resistor R5

Insert leads into pads

the circles with
holes in them are
called "pads"

there is one "pad"
per lead for each
part





**Resistor R5
inserted**

**R5: leads inserted
into their pads**



R5: board upside down



Bend leads
half way out

(only half way) like a “V”

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

R5: board upside down



Bend leads
half way out

(only half way) like a “V”

Ready to Solder !



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)*

3 Safety Tips...

Safety Tip #1:

Hot !!

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

Safety Tip #2:

Soldering chemicals
are toxic

But they easily wash off your hands
with soap and water

Safety Tip #3:

(coming soon)

2 secrets
to good soldering...

Secret #1:

Clean the tip!

(before every solder connection)

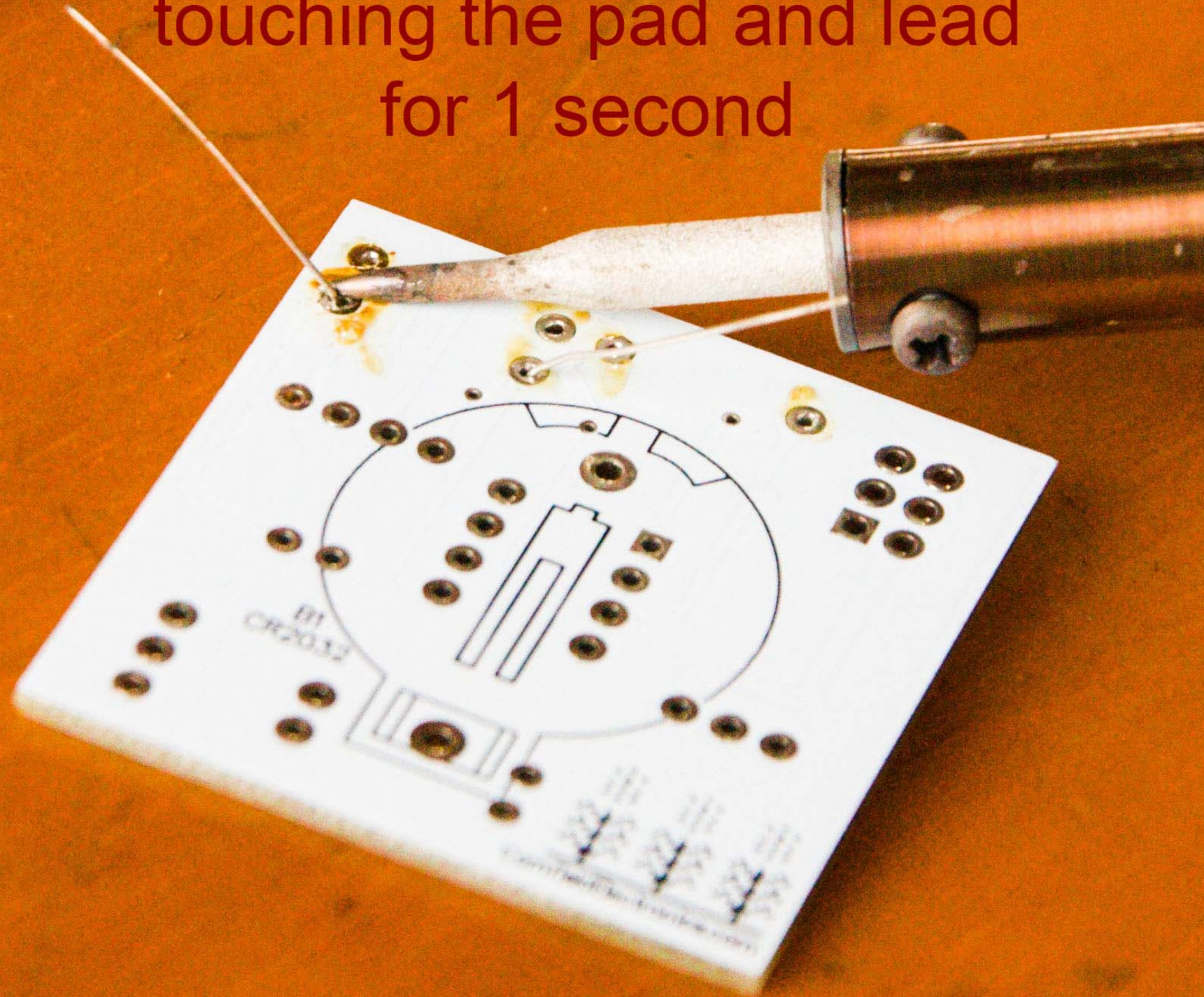
Bang (lightly) 3 times,

Swipe, Rotate, Swipe (on the sponge):

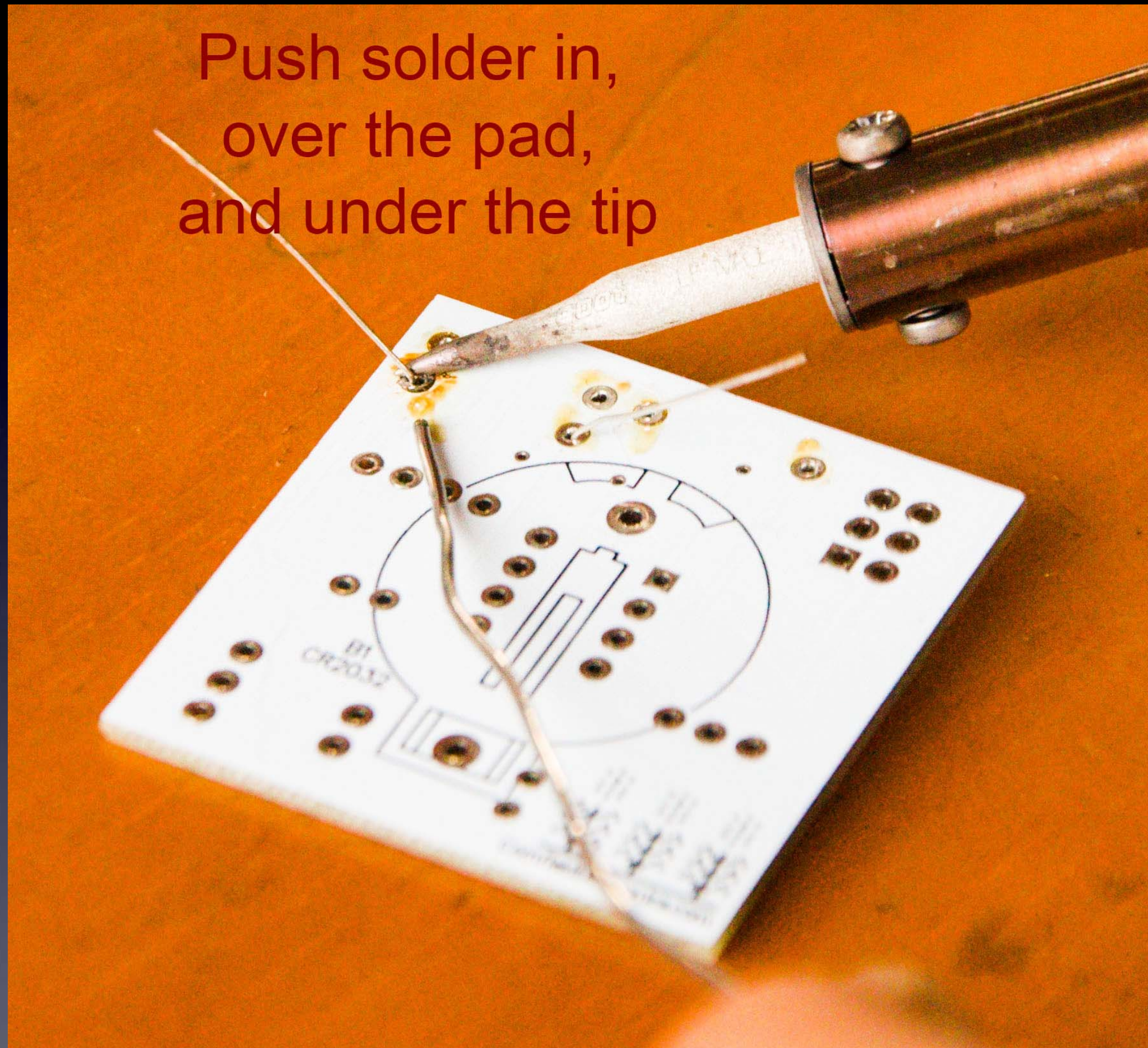
Keep the tip shiny silver!

knock solder off the tip

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

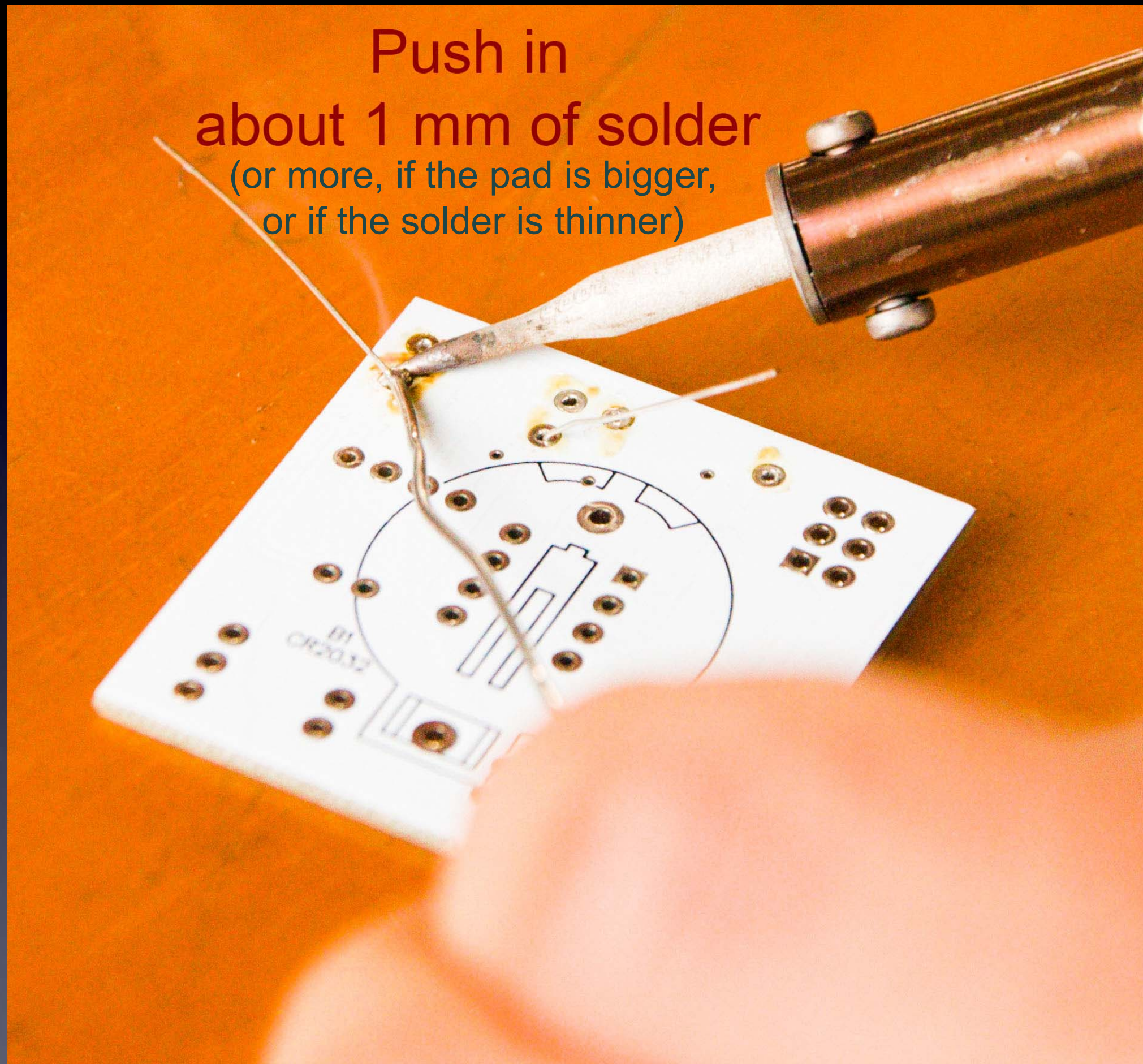


Do this quickly (slowly doesn't work well) – solder in & out in about 1 second

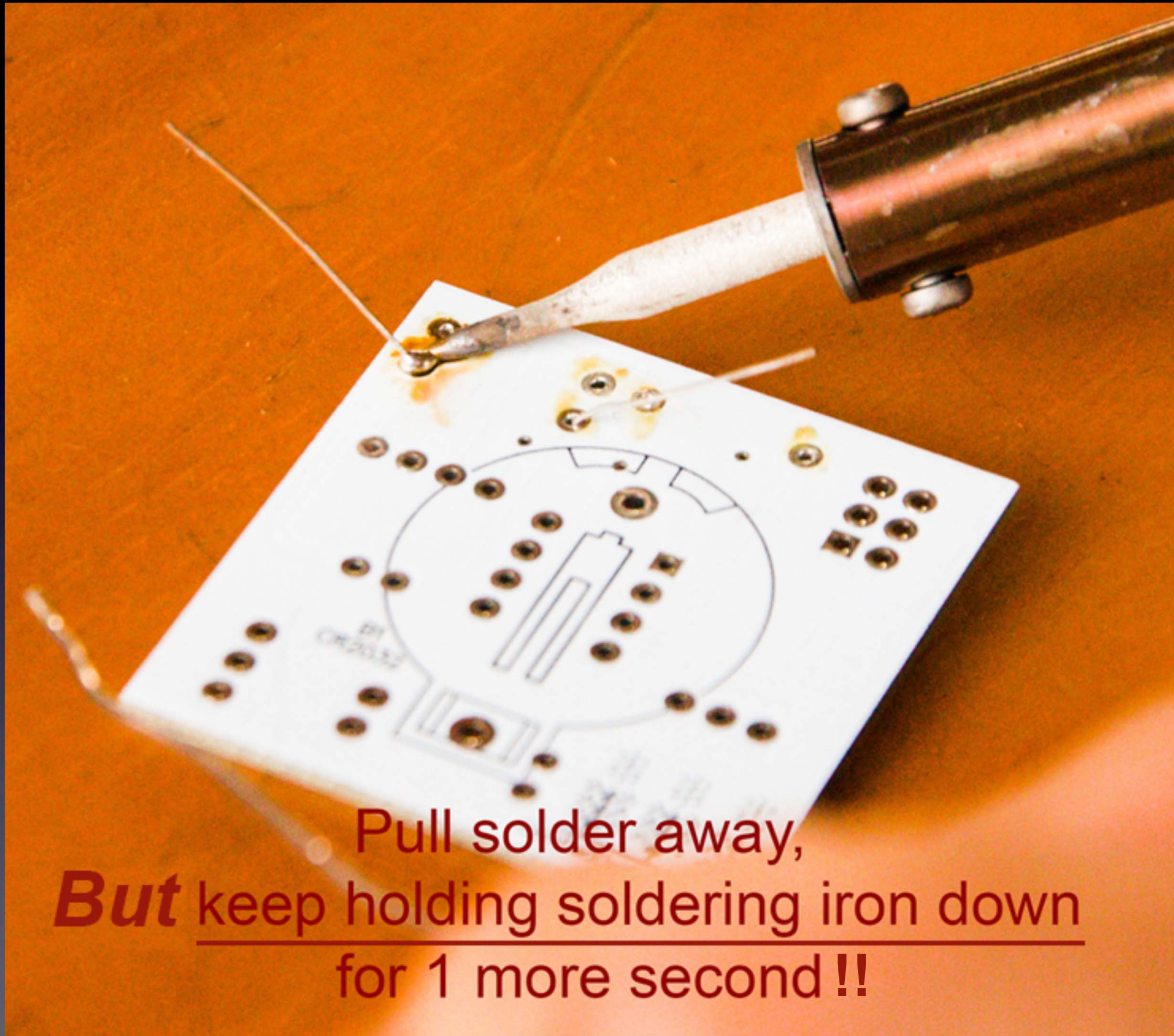


Make sure solder melts on the underside of the soldering iron tip
(not the side or top of the soldering iron tip)!

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



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



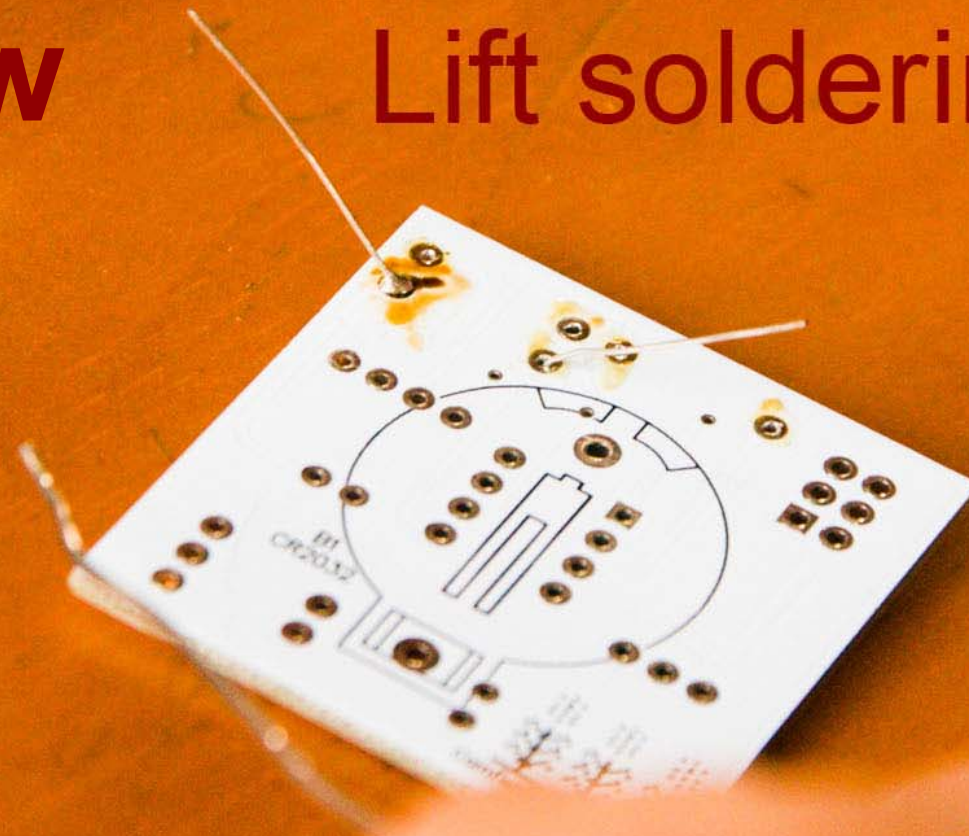
Pull solder away,
But keep holding soldering iron down
for 1 more second !!

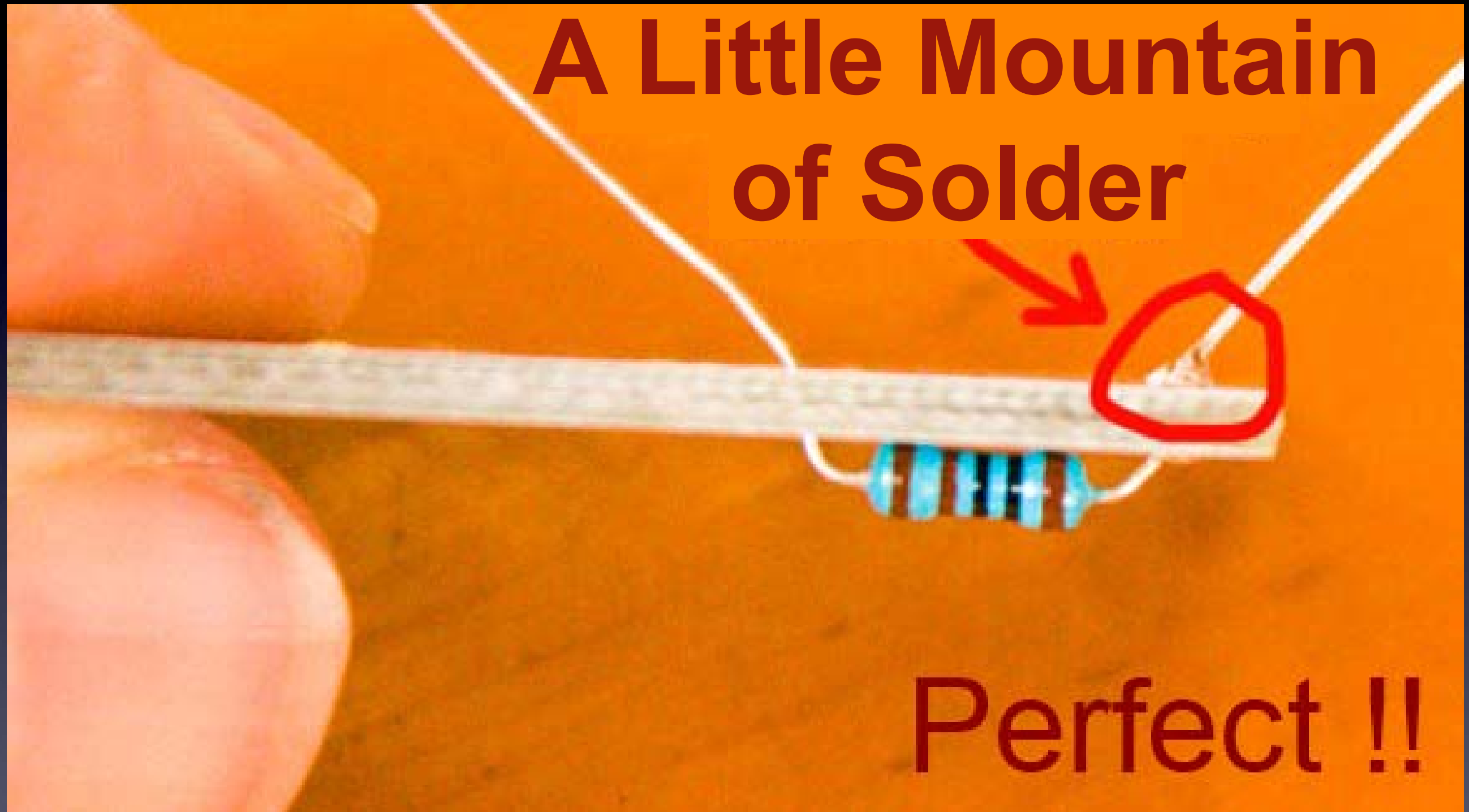
Secret #2:

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

Now

Lift soldering iron





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

The Rhythm !

is just as important as the preceding steps!

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



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



Tip **Down**

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



Solder **In**

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



Solder **Out**

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



WAIT !

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



Lift Tip

The Rhythm !

and speed (about 1 second per step)



The Rhythm !

and speed (about 1 second per step)

Clean the tip



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



Tip **Down**

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



Solder **In**

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



Solder **Out**

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



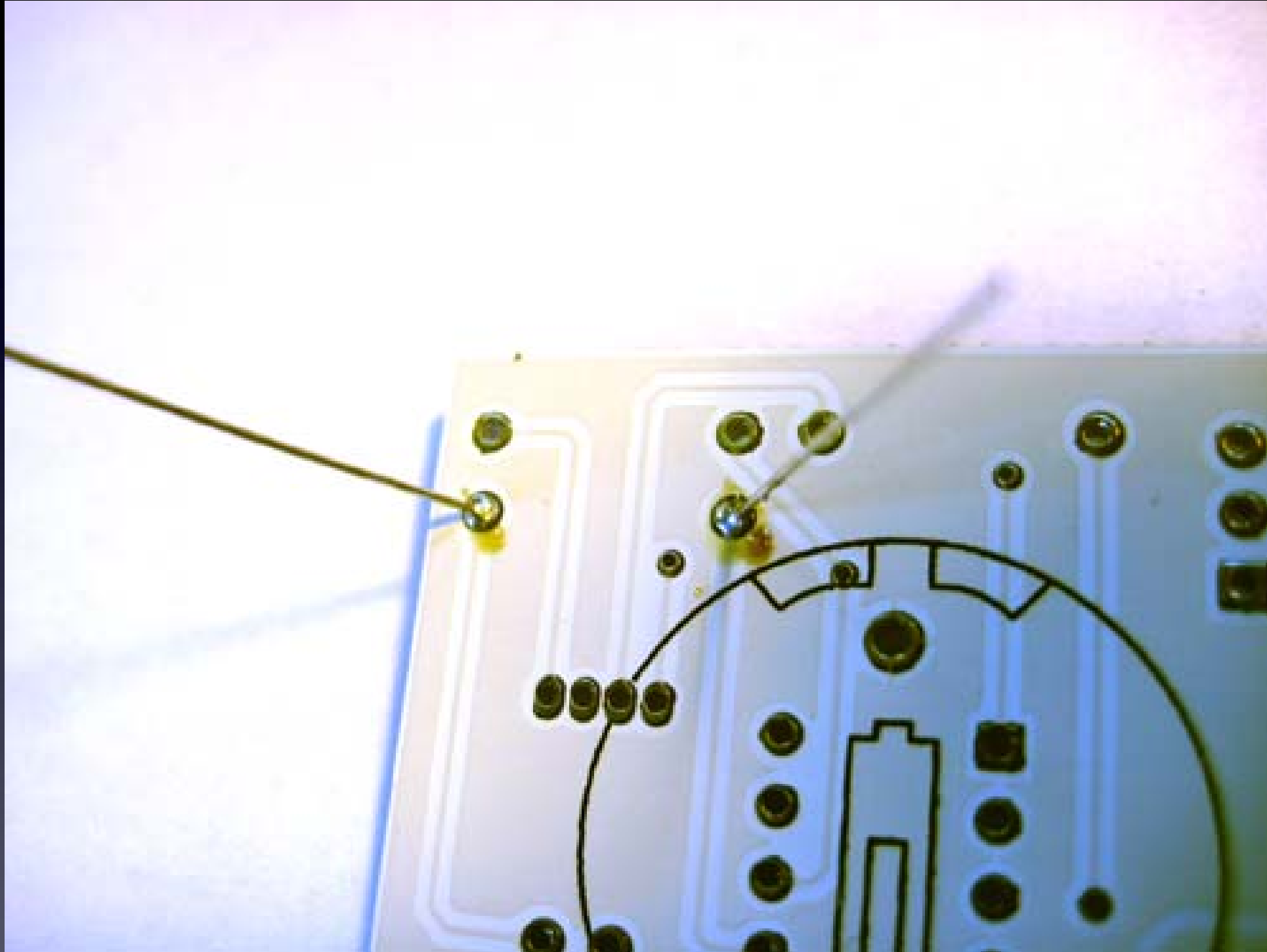
WAIT !

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



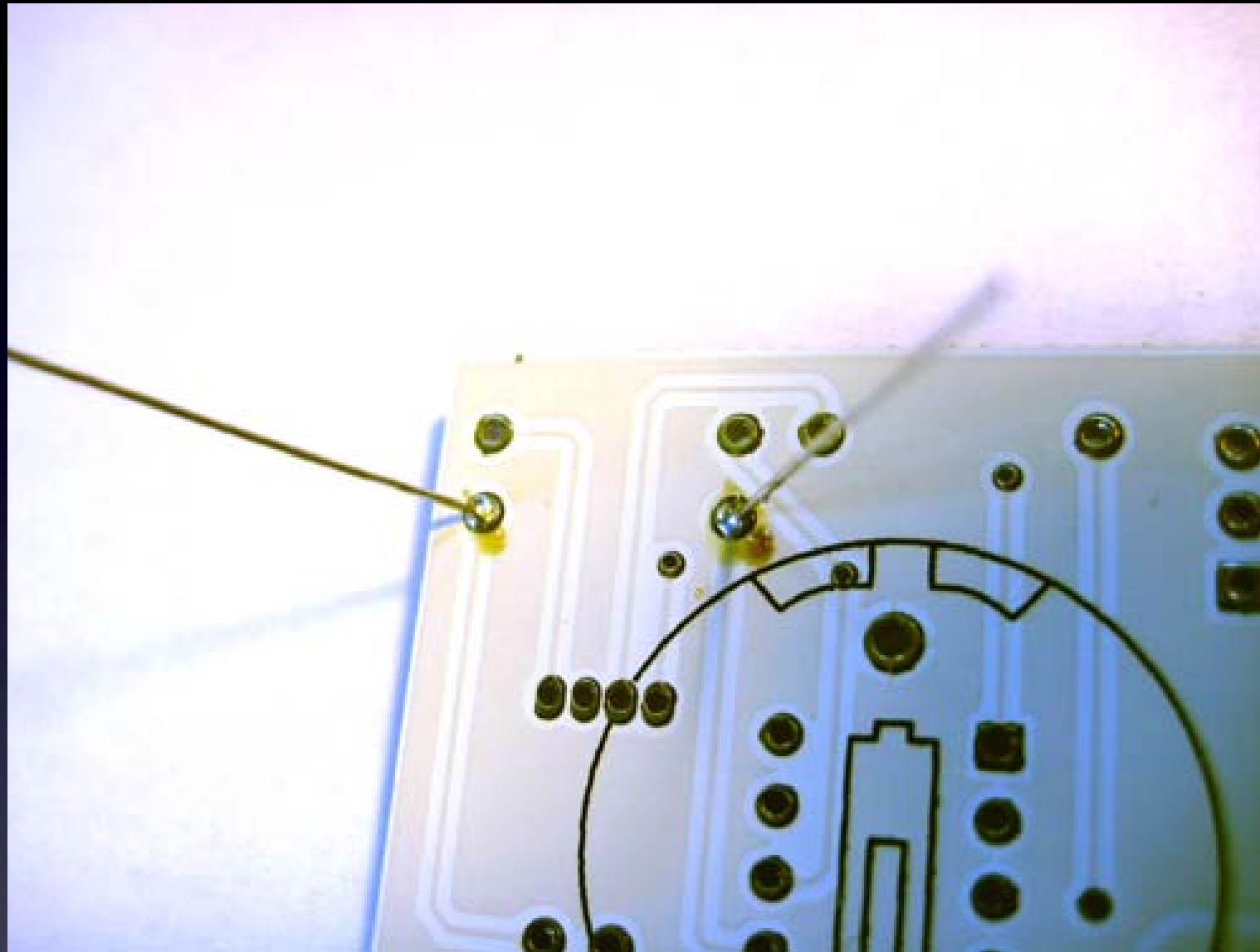
Lift Tip

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

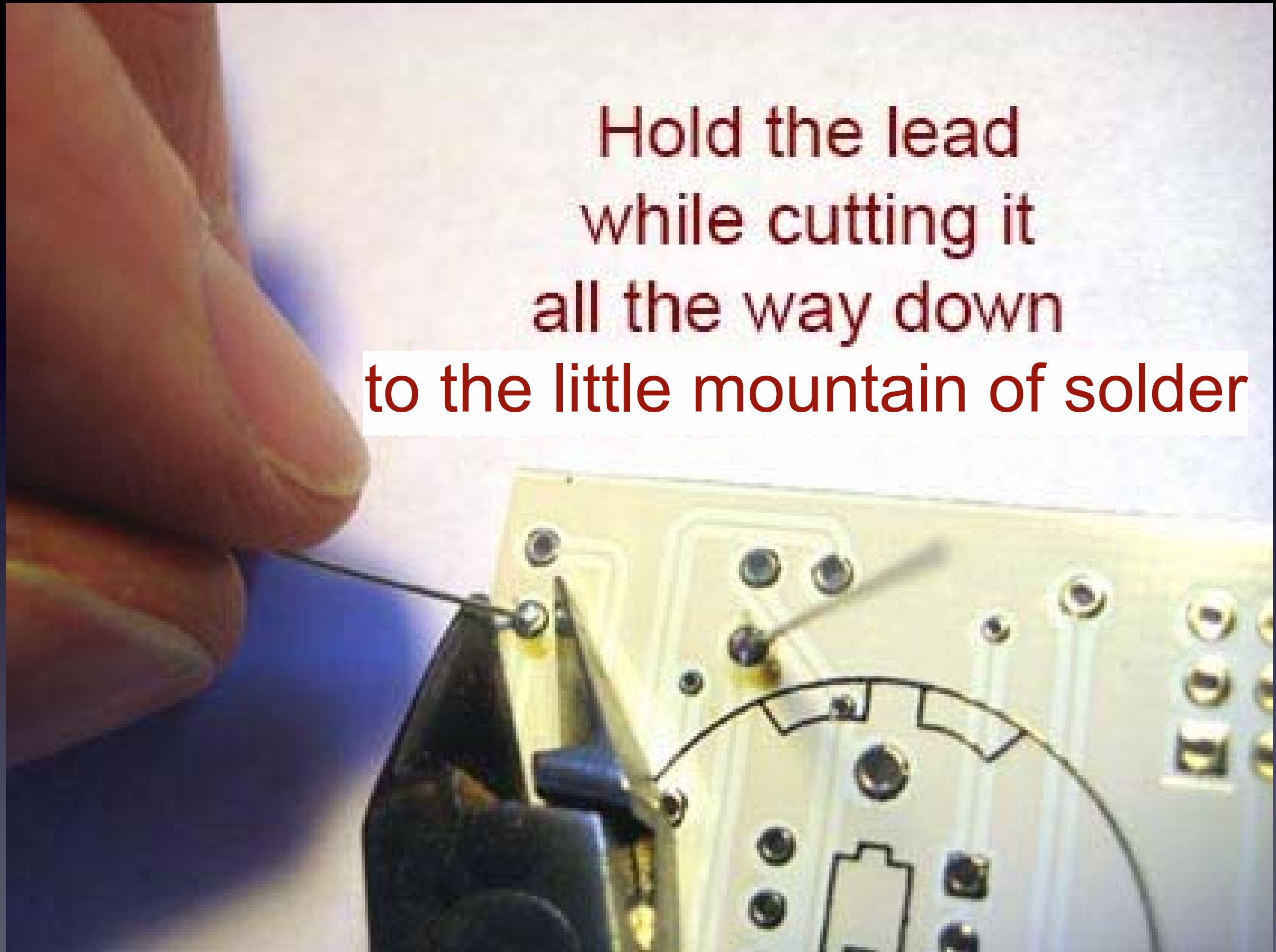
Two good solder connections



- 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 !

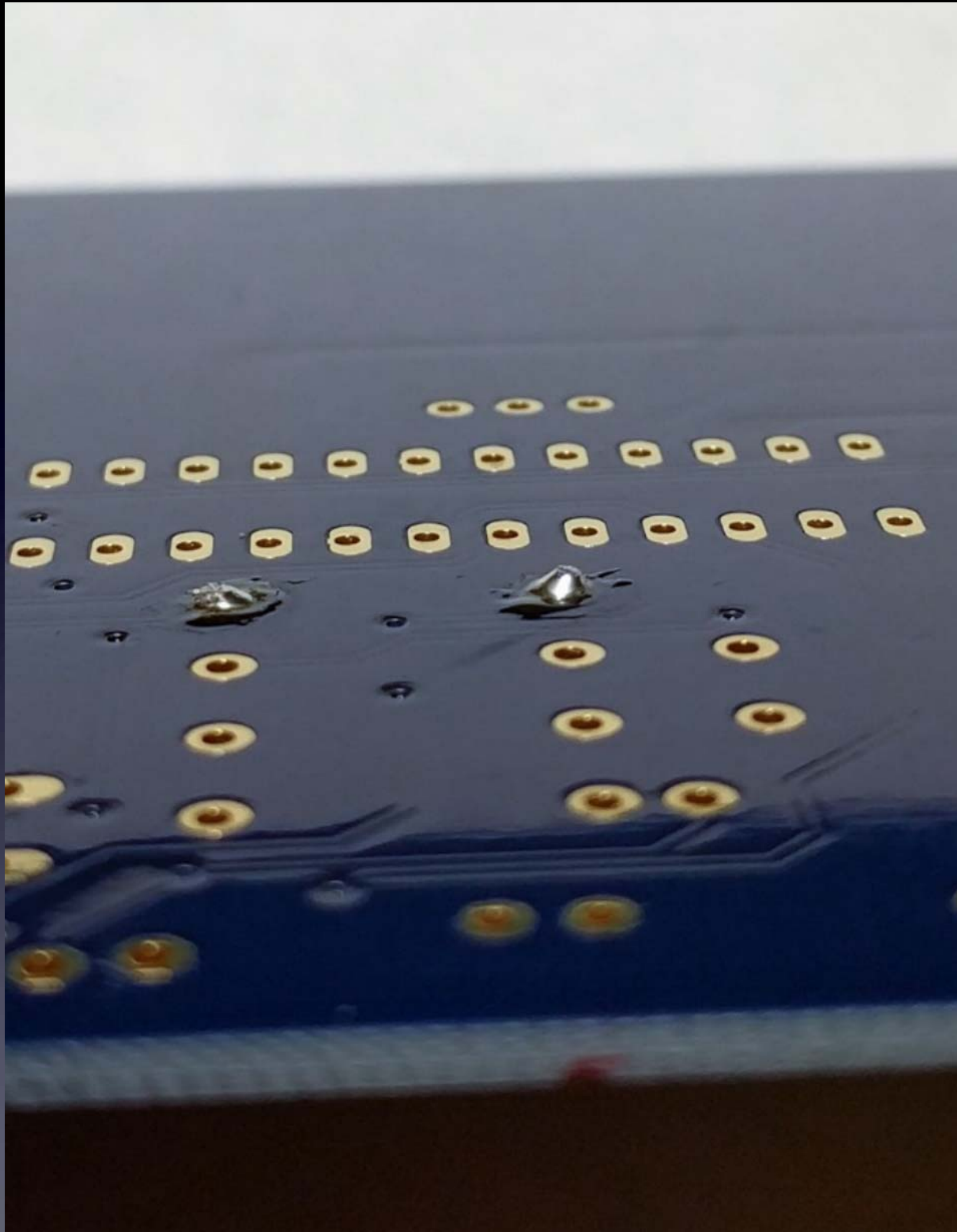
(or it will fly into your eye!)

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



All done !

No wires sticking out



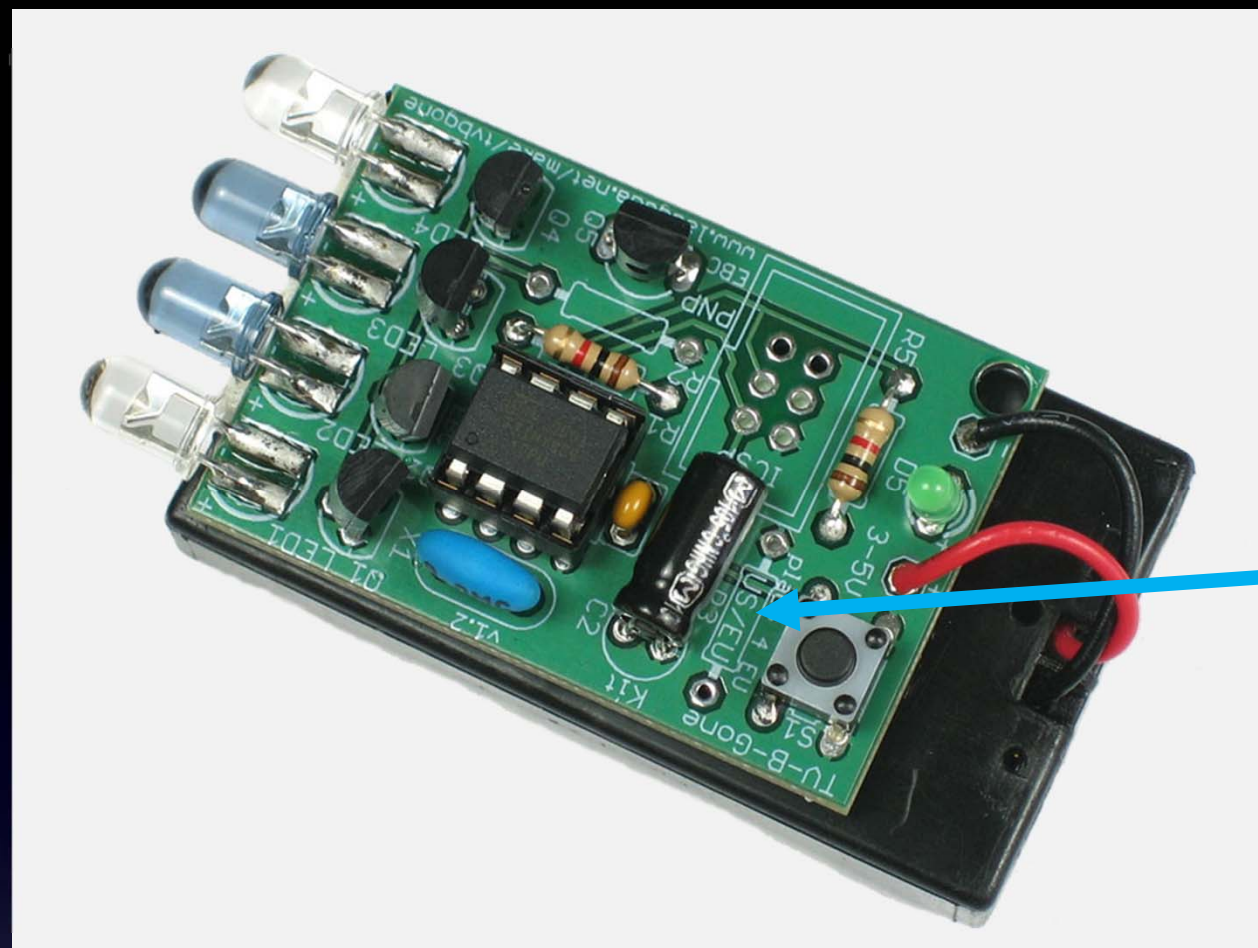
A closer look at good solder connections

Notice that:

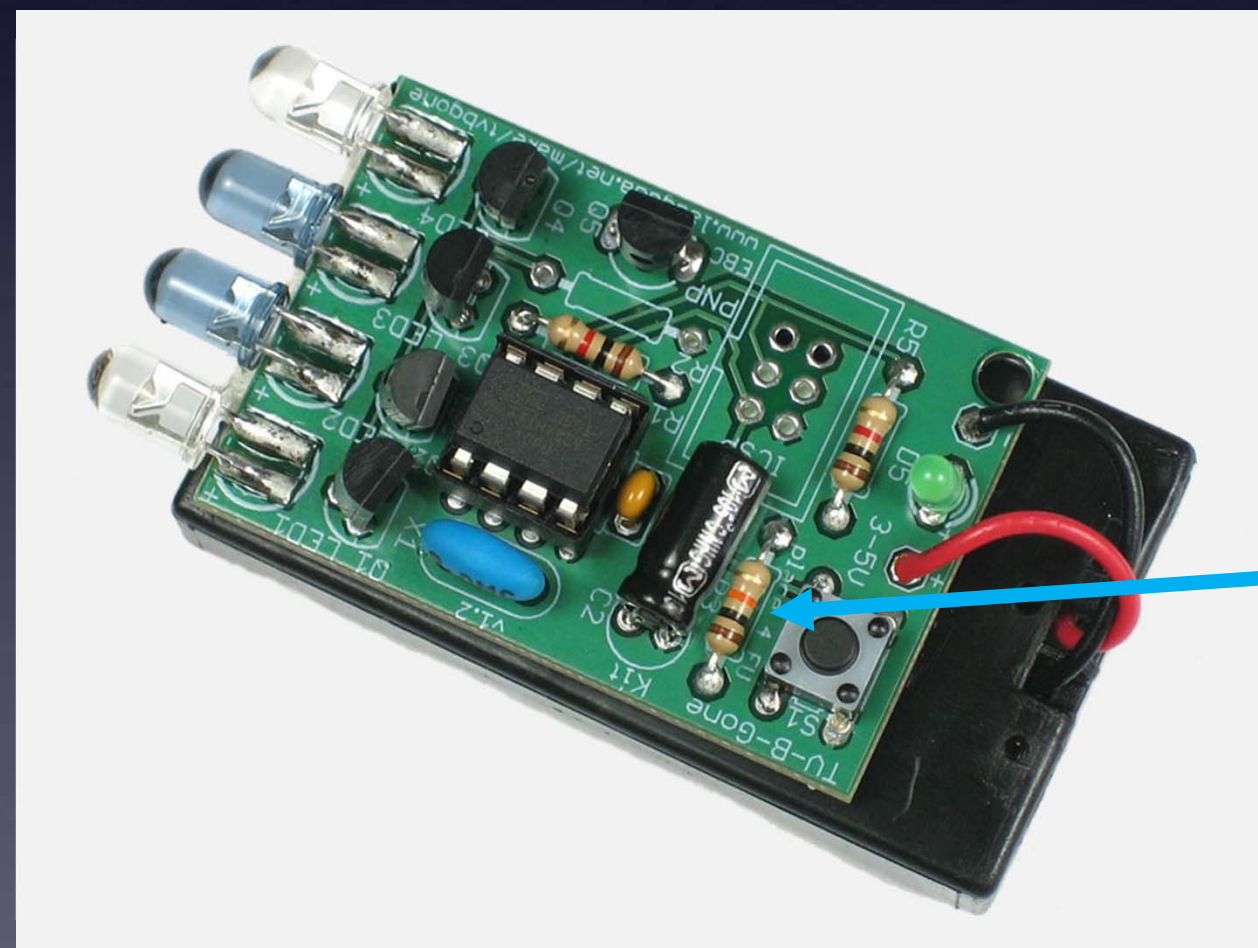
- Each connection is a small mountain (not flat)
- You cannot see any pad (they're totally covered with solder)
- You cannot see the holes (they're totally covered with solder)
- No connections to other pads

One part at a time

Till all the parts are soldered



NA (R3 not soldered)



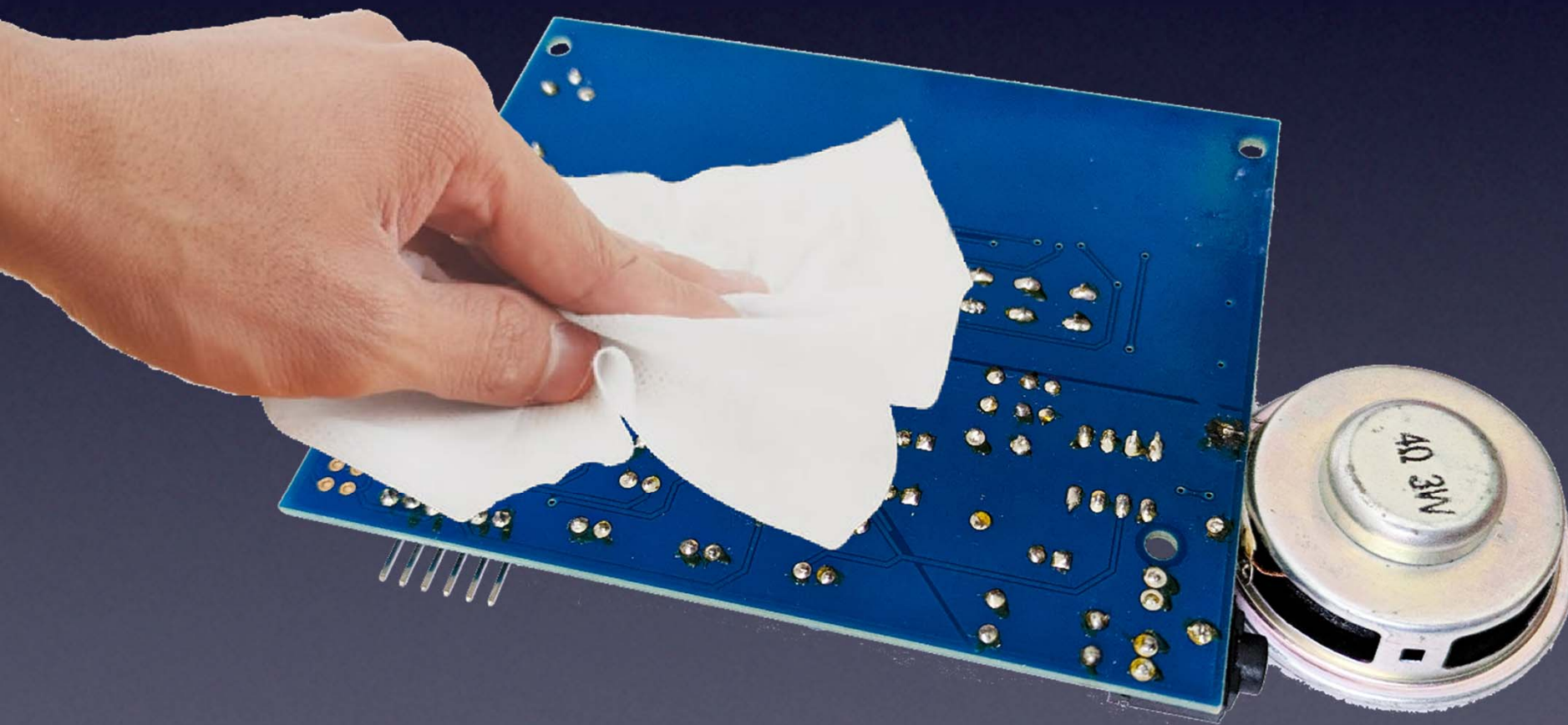
EU (R3 soldered in)

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

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



The bottom of the PCB will be sticky from the flux



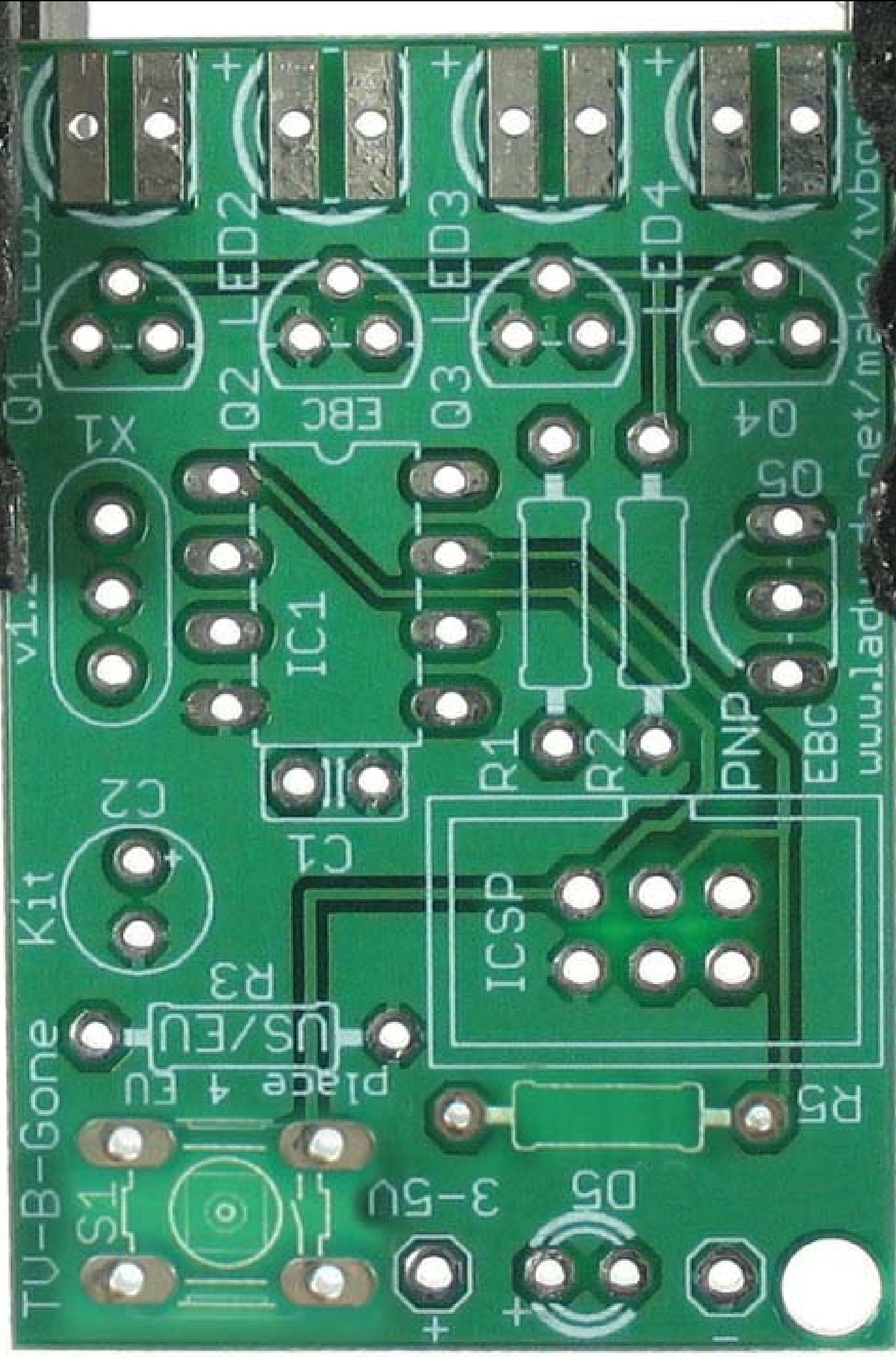
You can clean it with a cloth wet with Isopropyl Alcohol

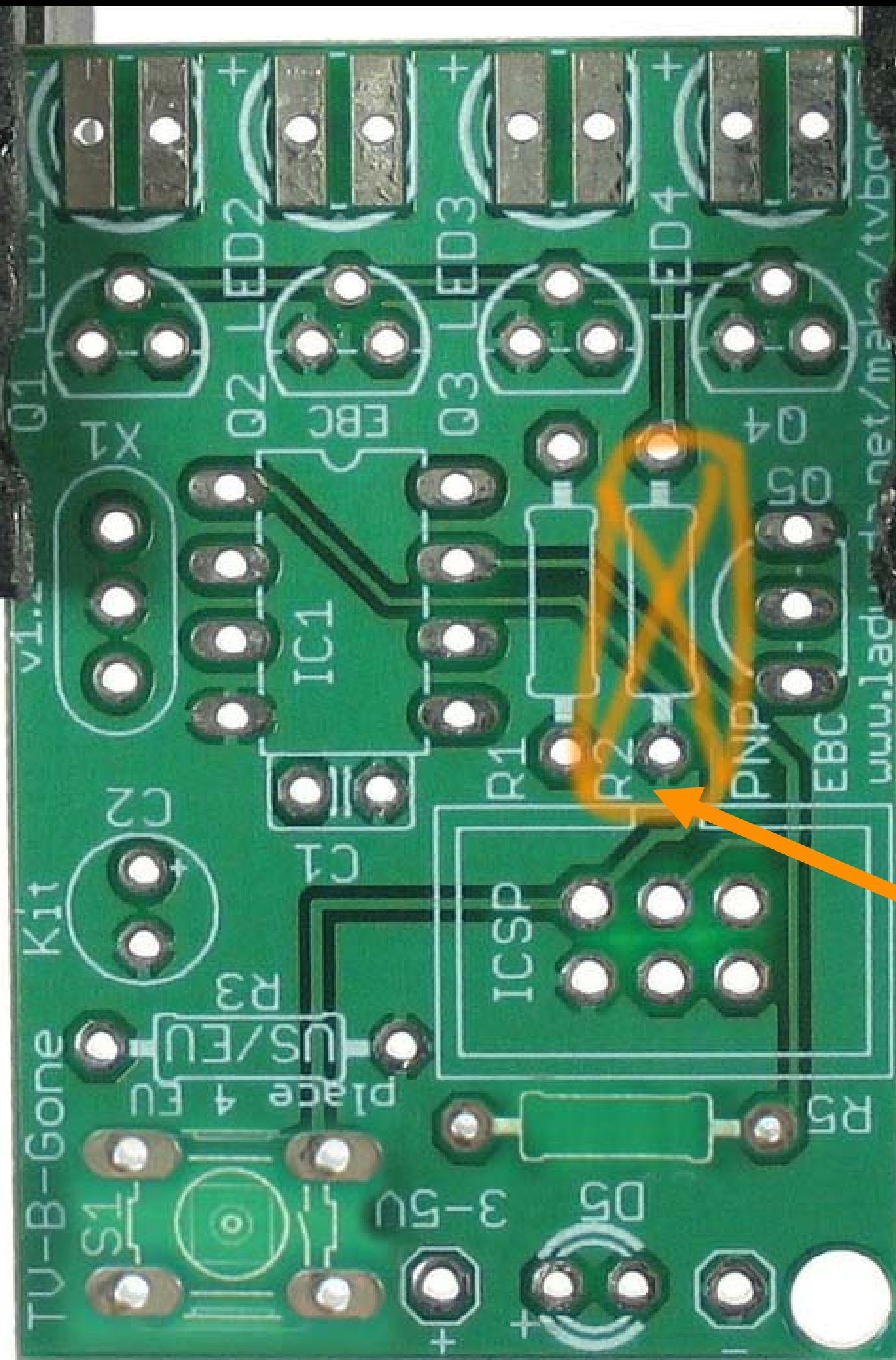
Then test with batteries,

And it works!

(Or you start debugging.)

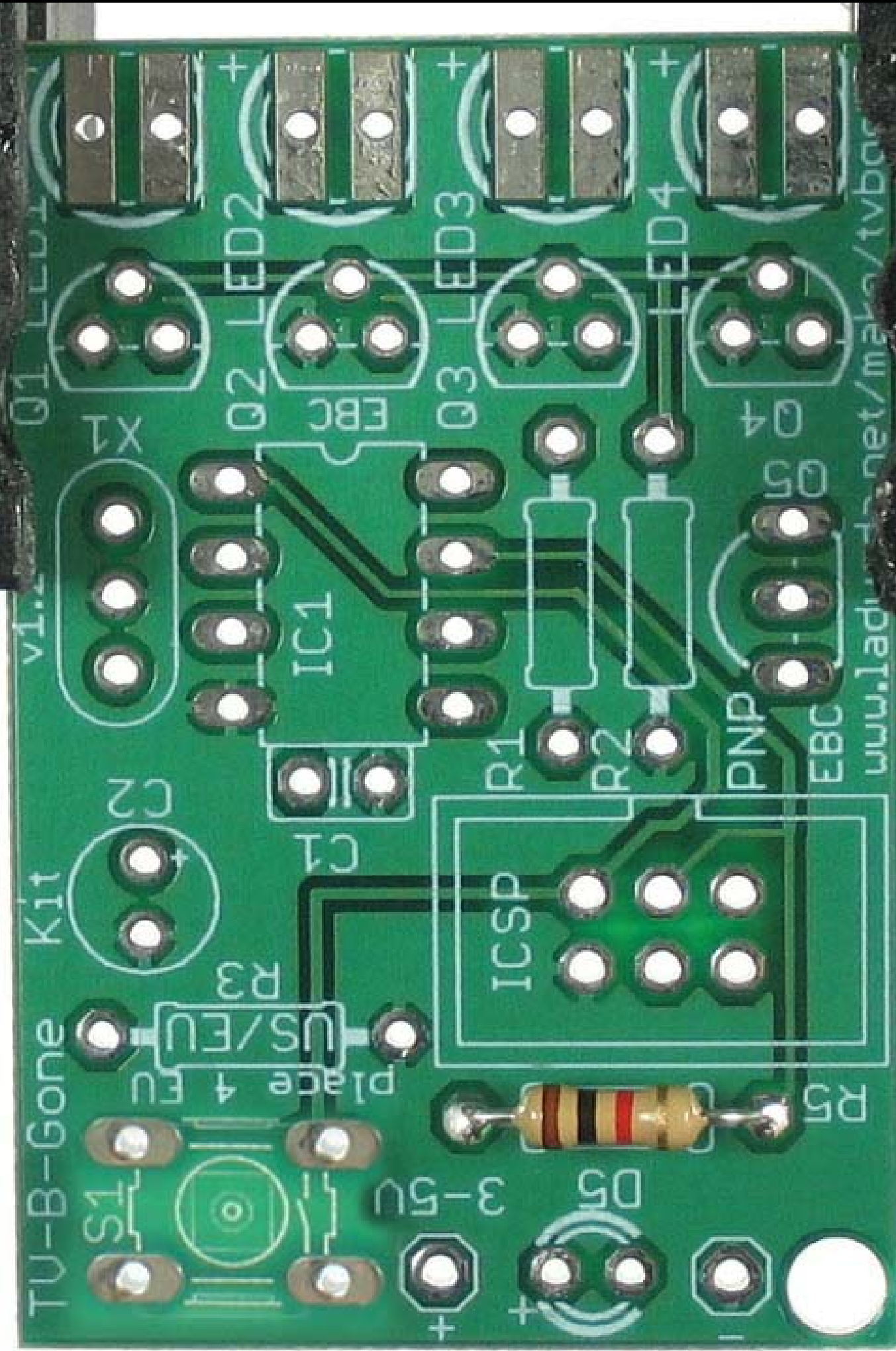
Let's start!



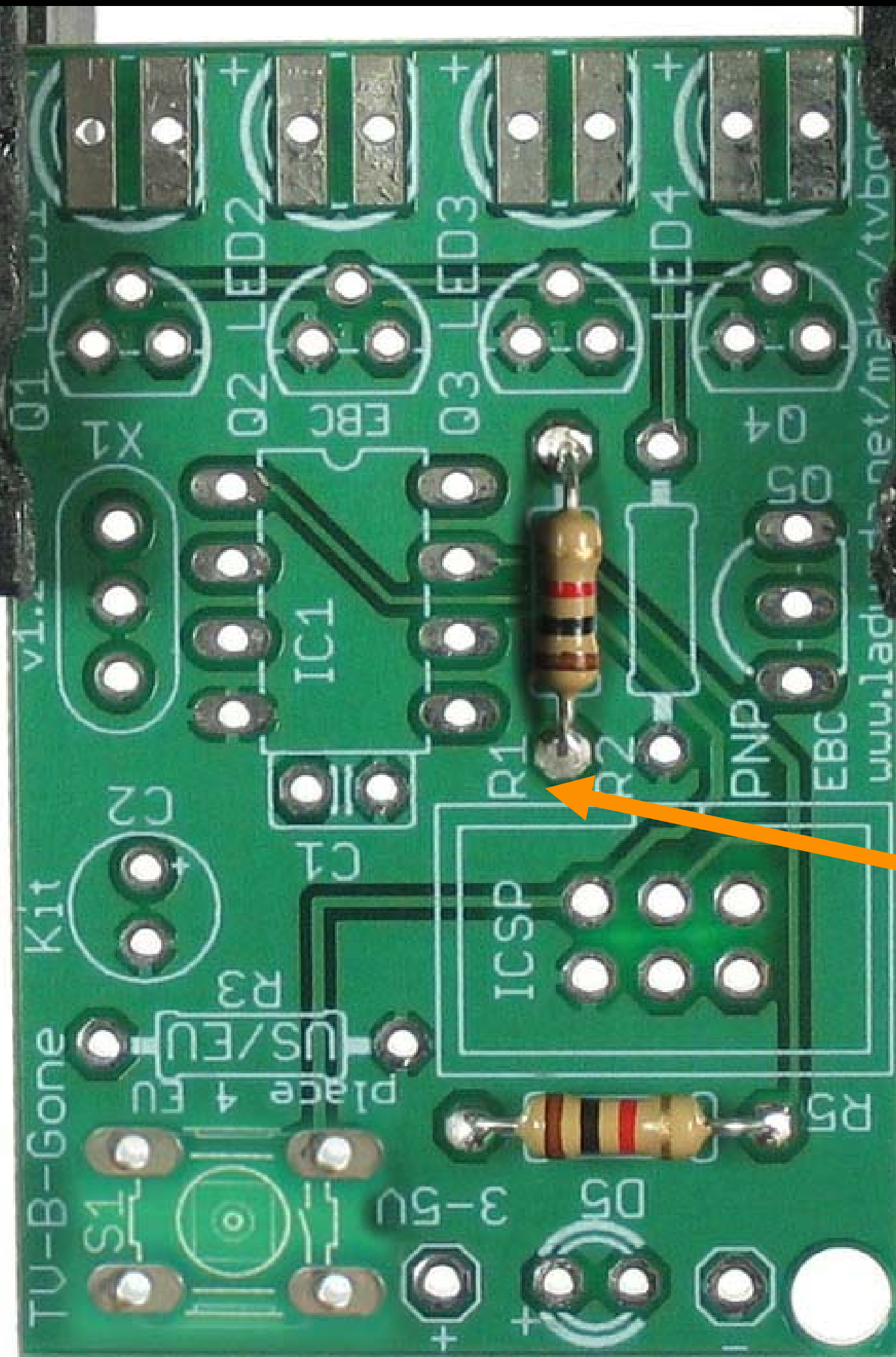


Remember:

**Resistor R2
is unused**



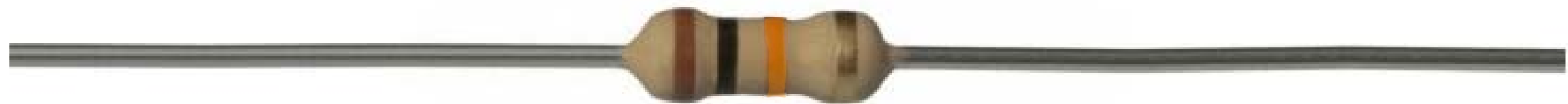
Resistor R5



R1
same as R5

Resistor R3 is ONLY for Europe

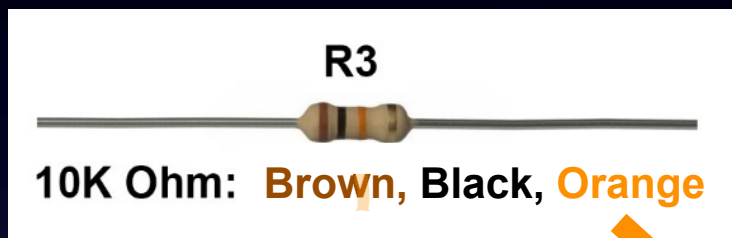
R3



10K Ohm: **Brown, Black, Orange**

NOTE: Do NOT use the ~~[Brown, Black, Red]~~ resistor !

Resistor R3 is ONLY for Europe

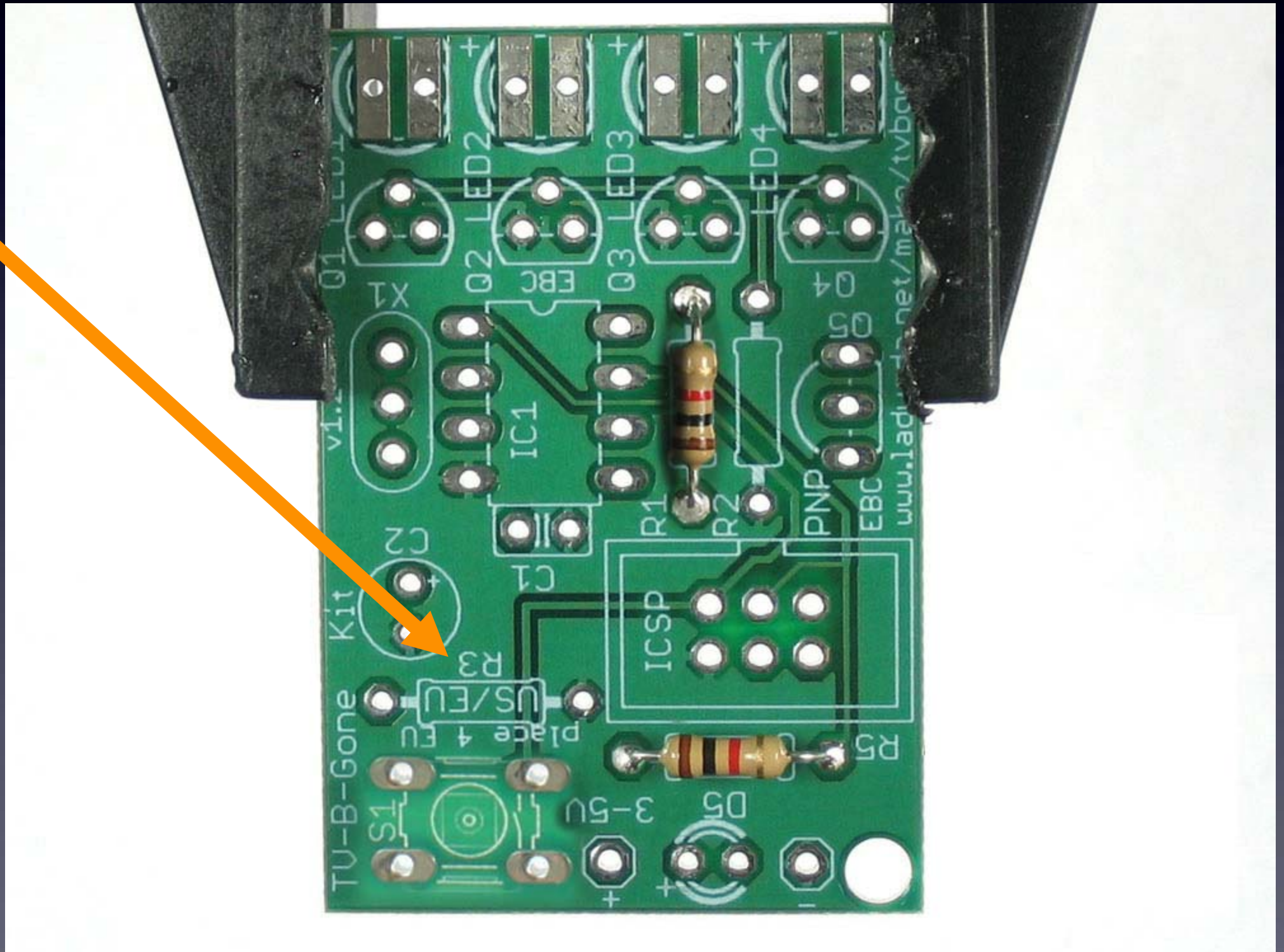


For Europe:
use R3

(also for Middle-East, Australia, and Afrika)

For North
America:
no R3

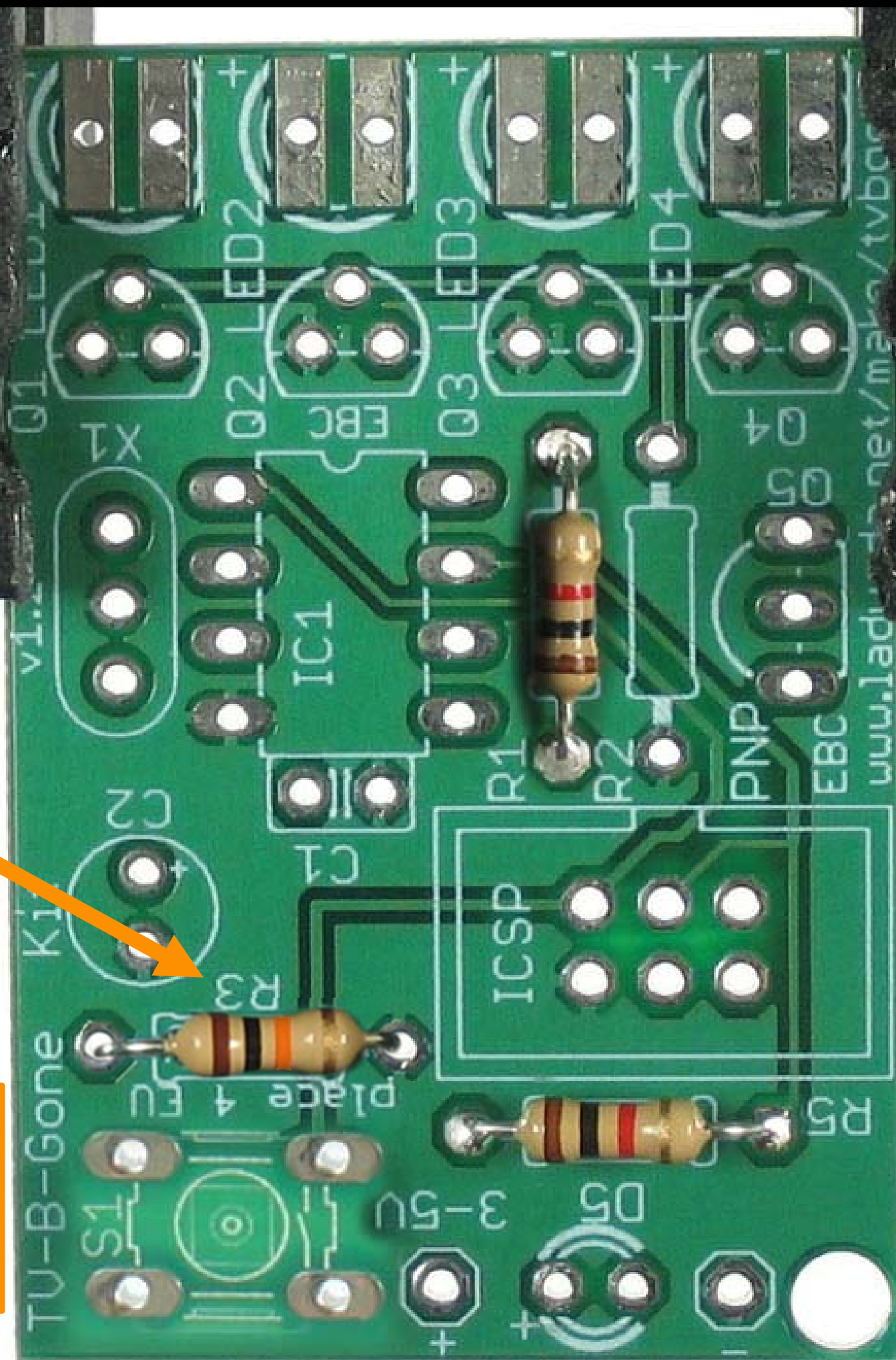
(also for Asia and South America)

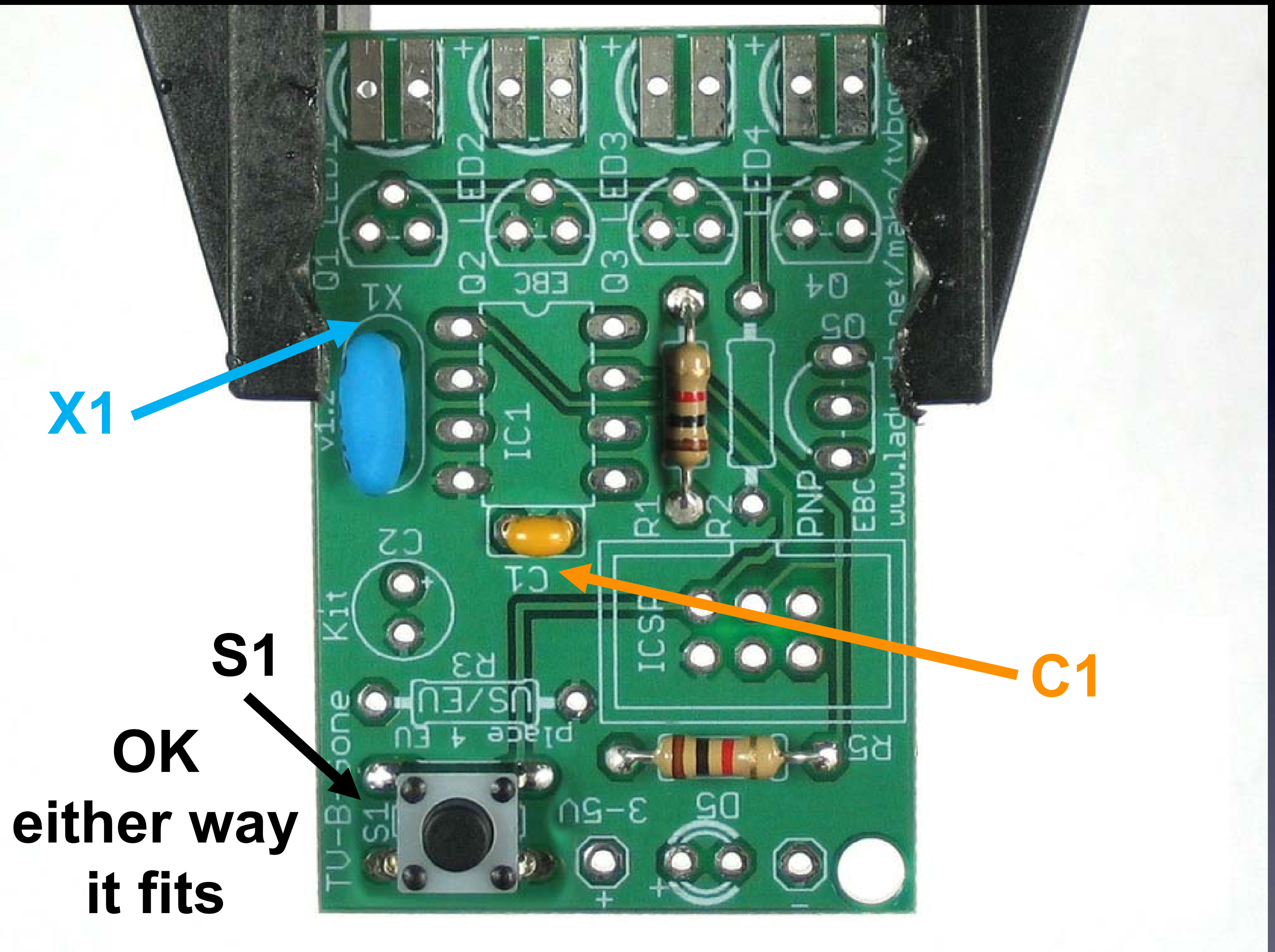


R3

**ONLY for
Europe**

**For NA
don't solder in
R3**

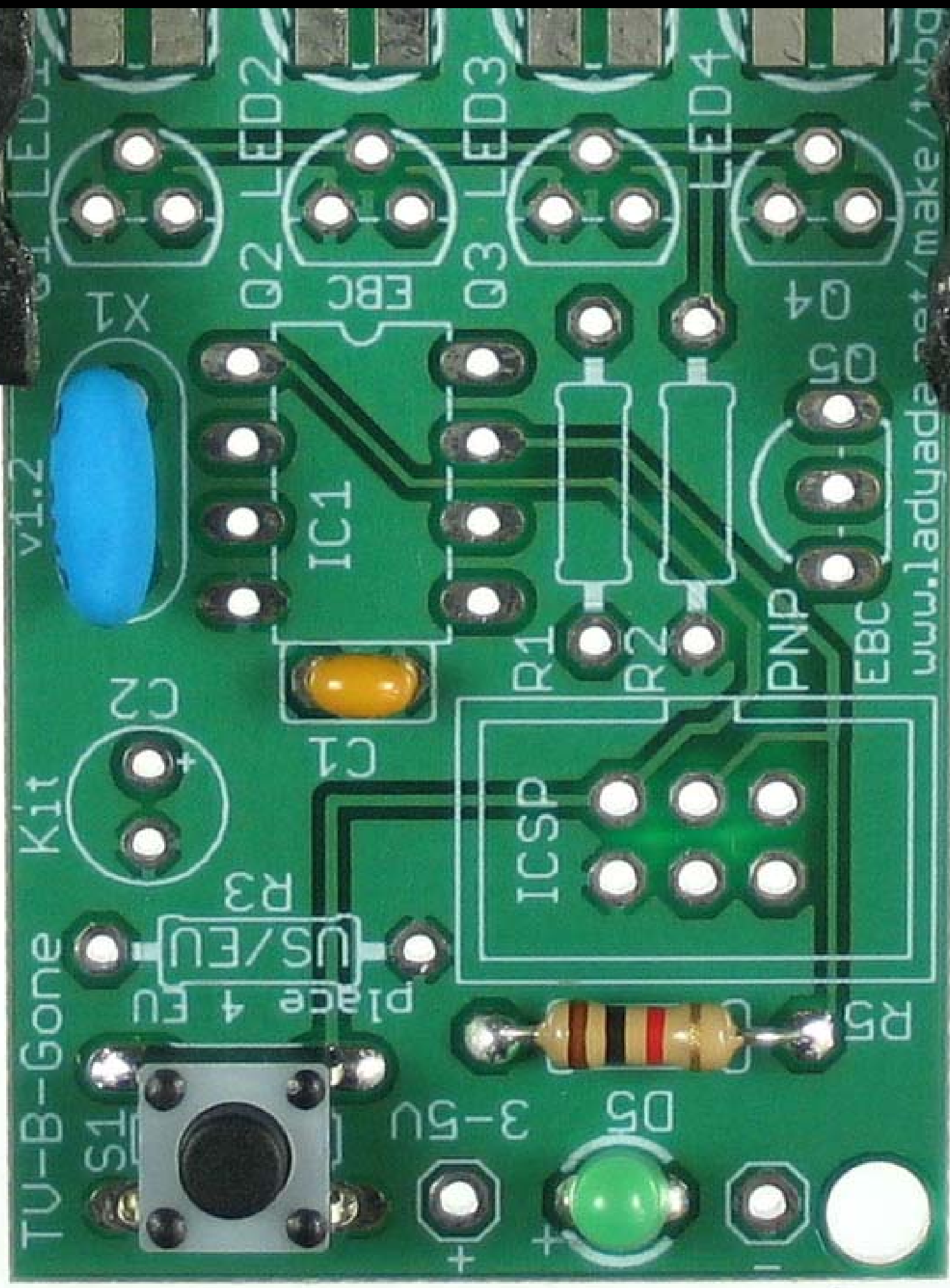


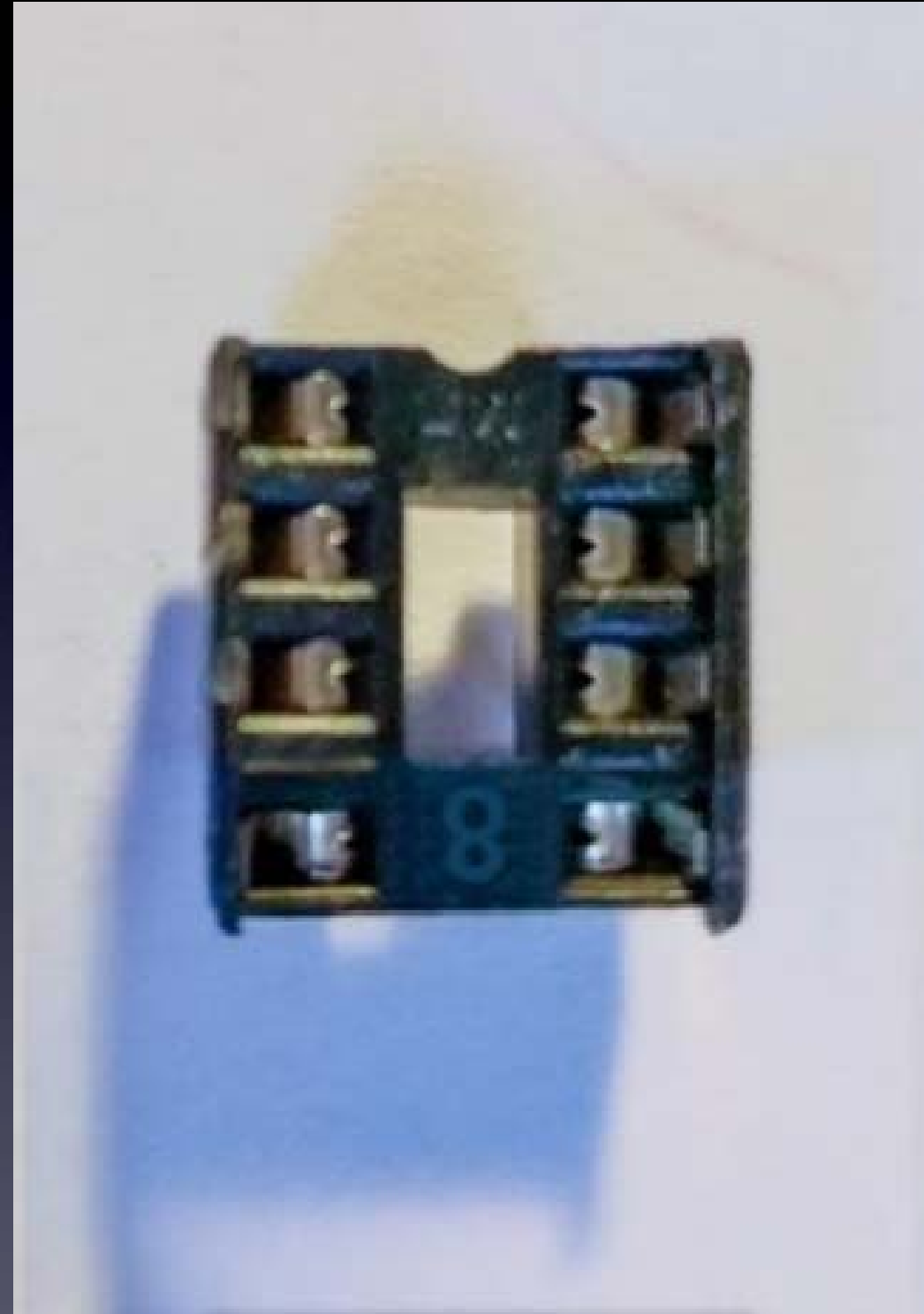


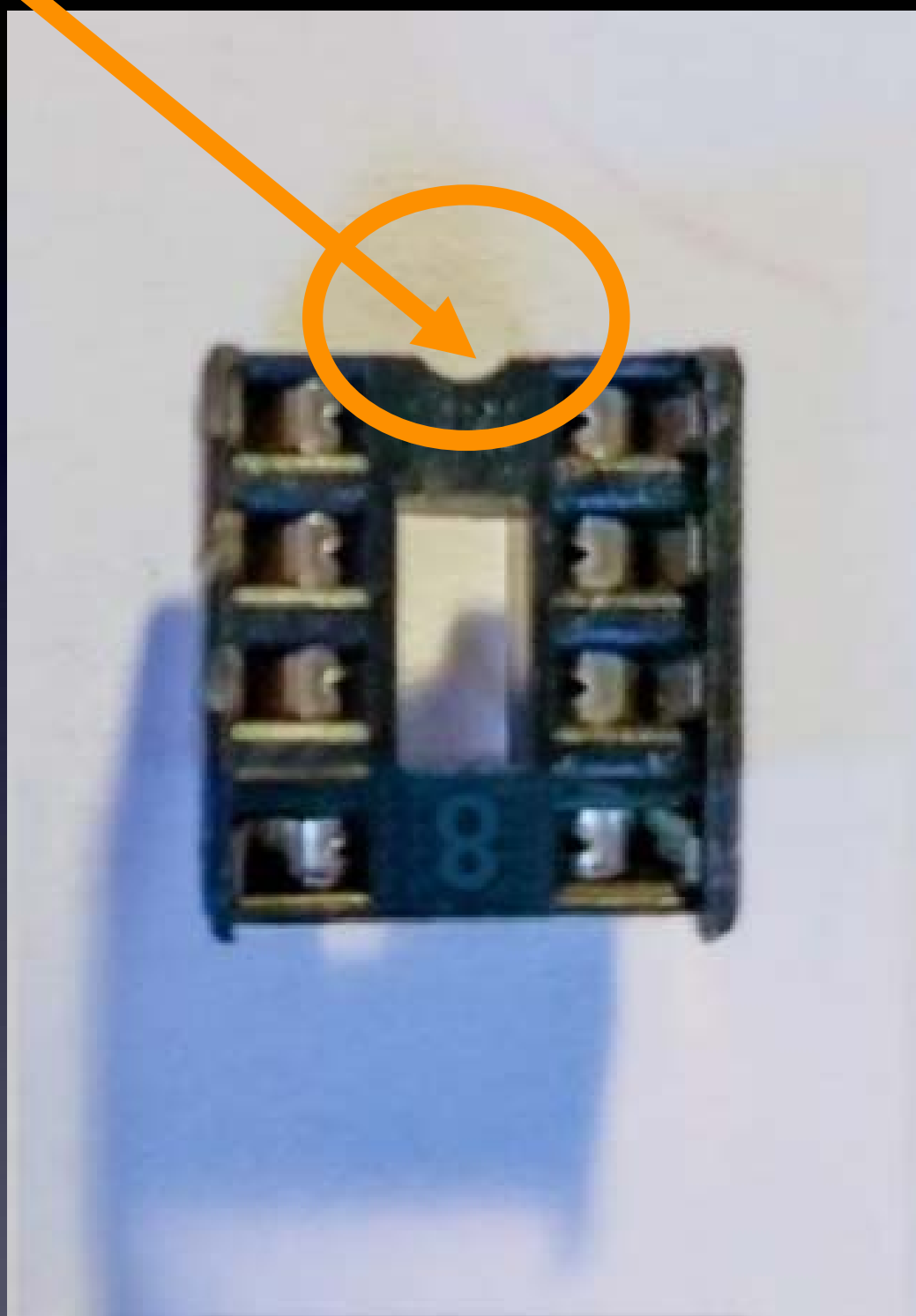
D5
Long lead

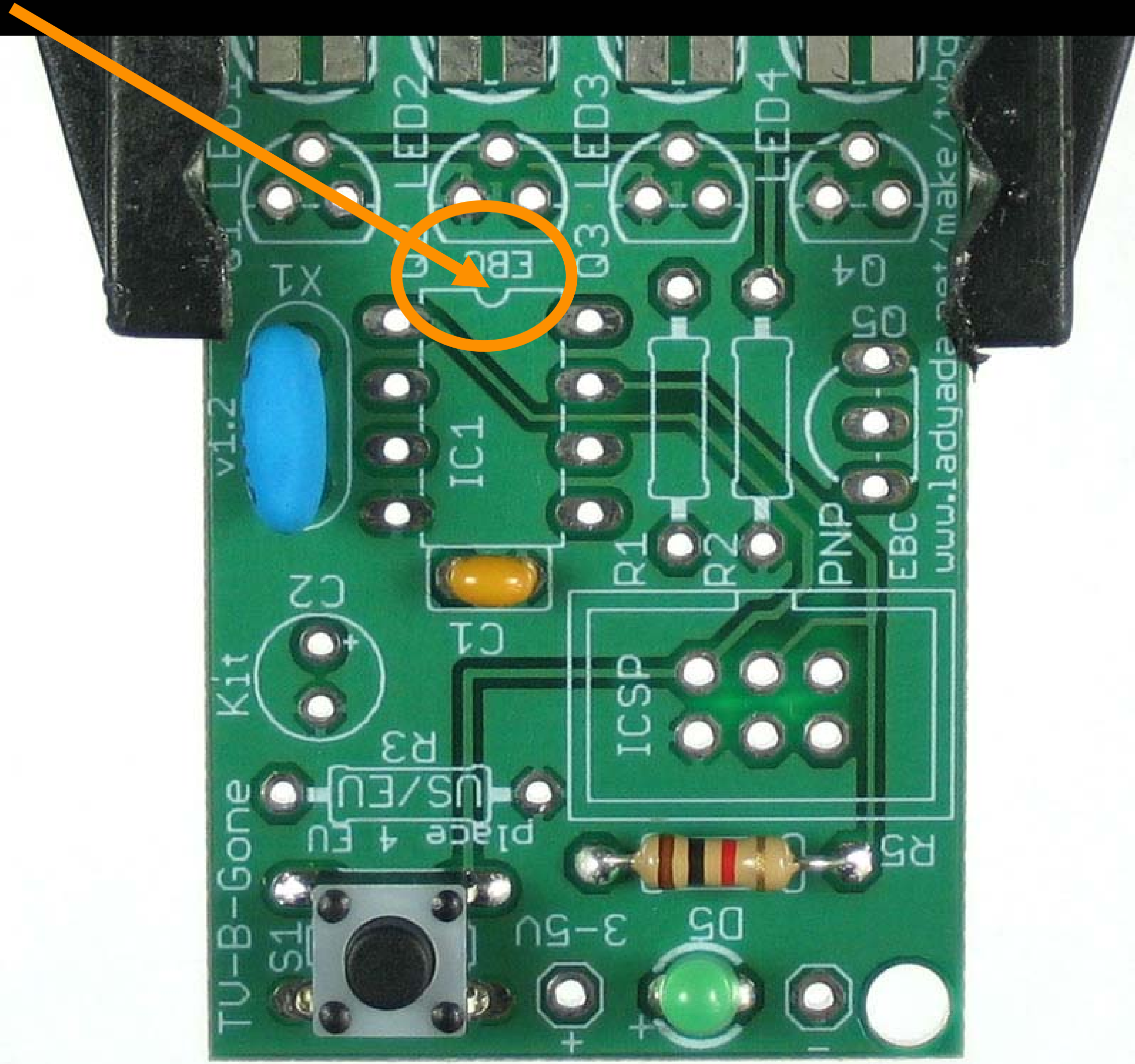
Short lead

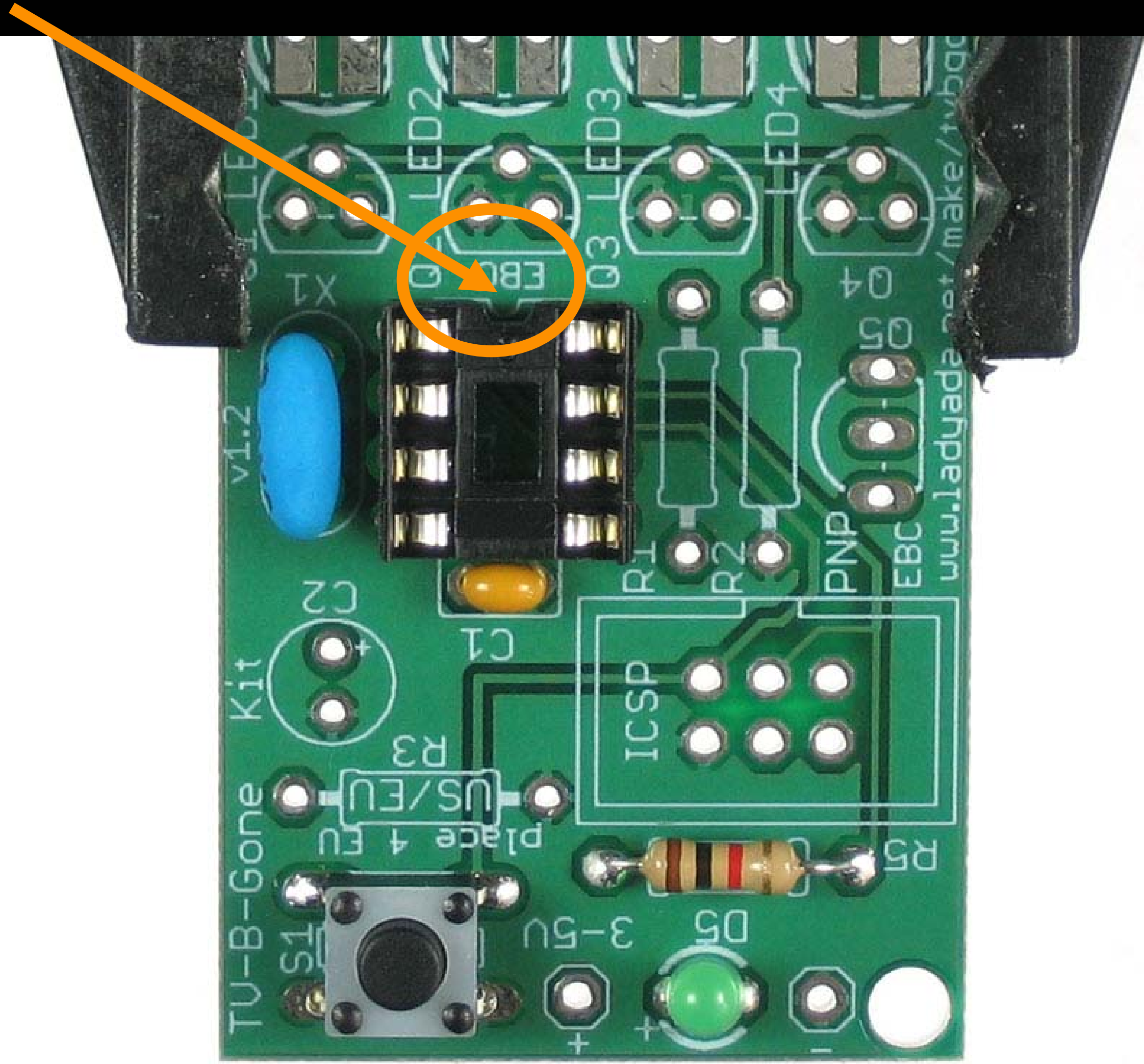
Short lead



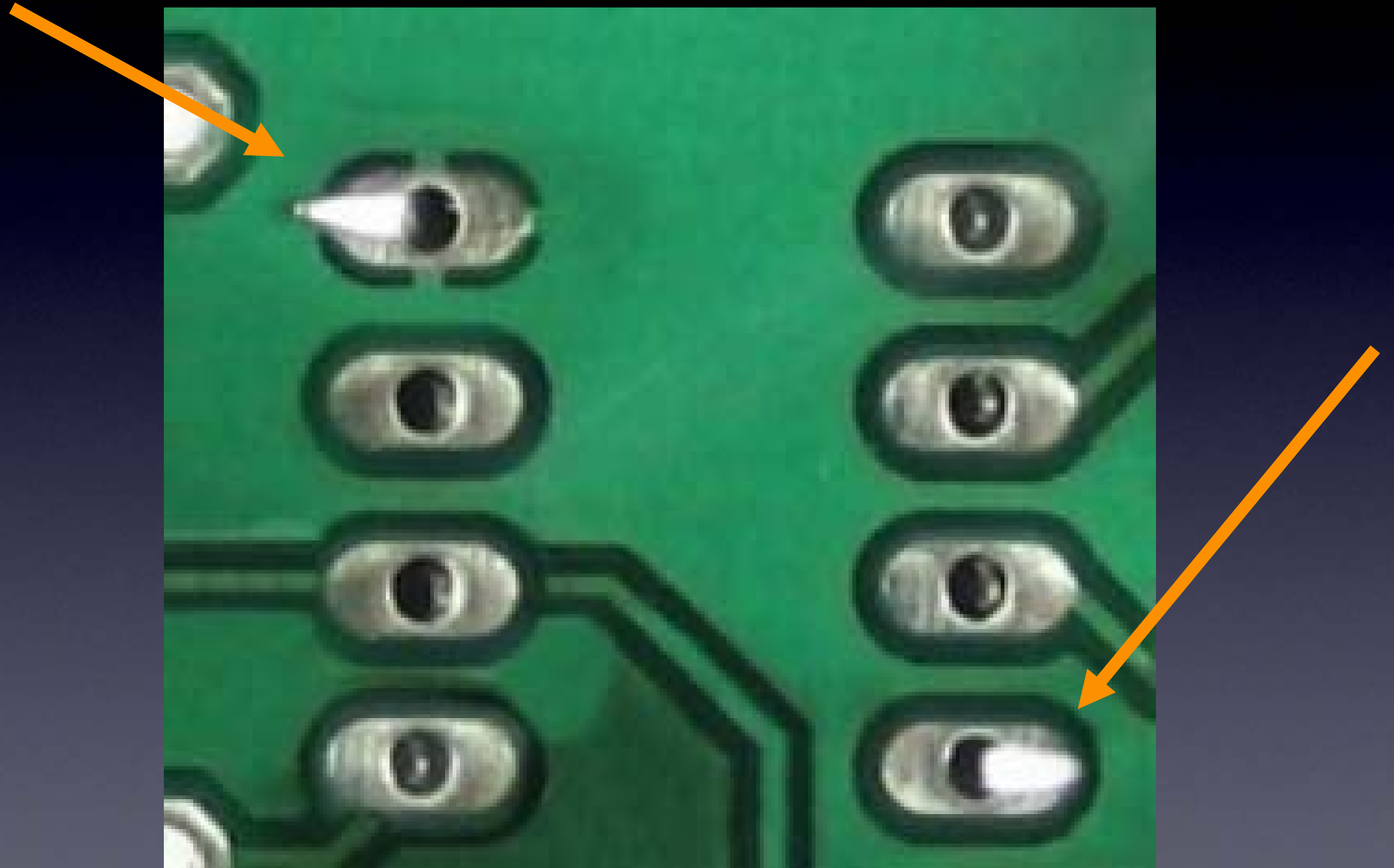








Bend pins on 2 opposite corners

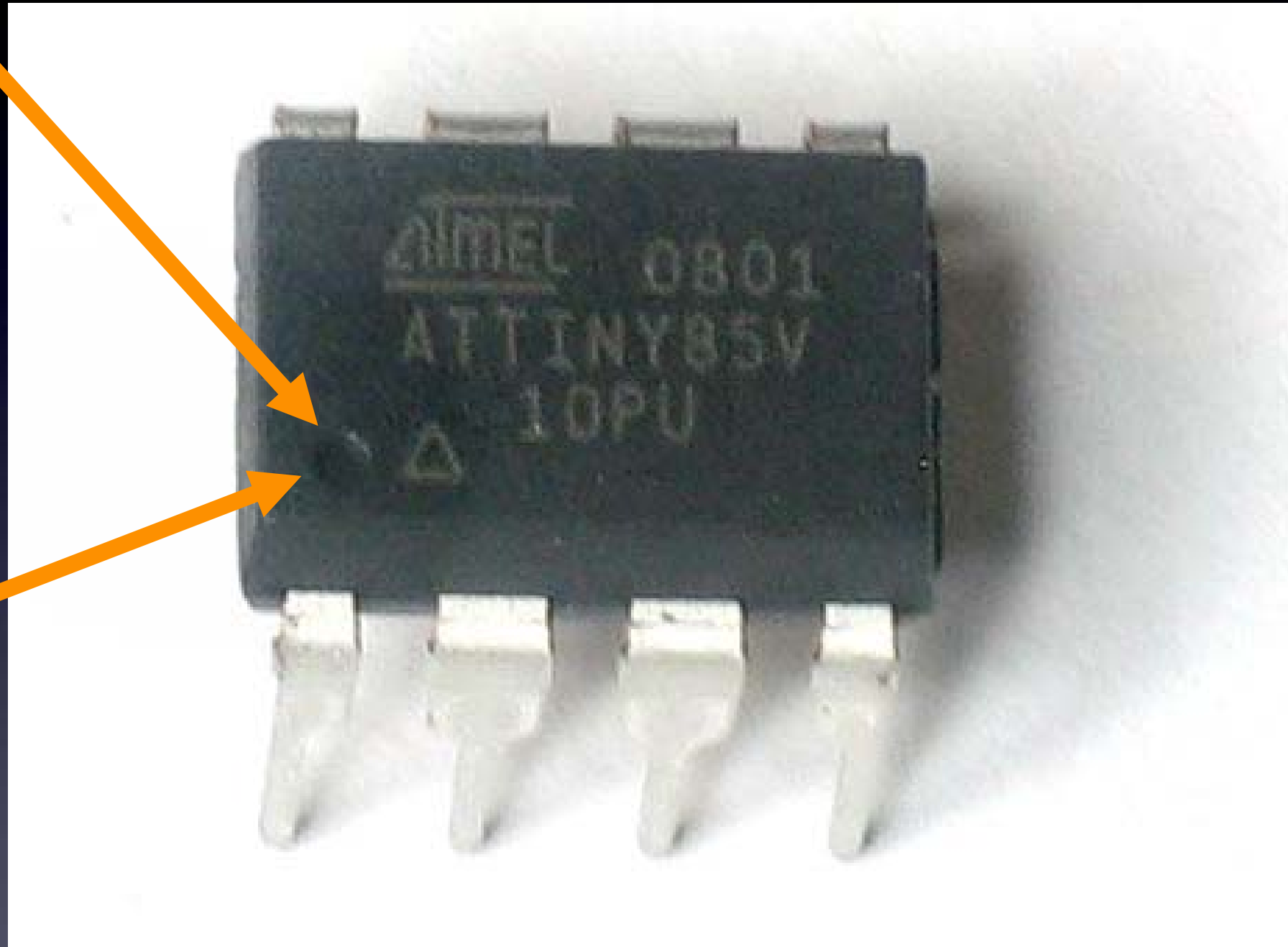


so socket won't fall out while soldering

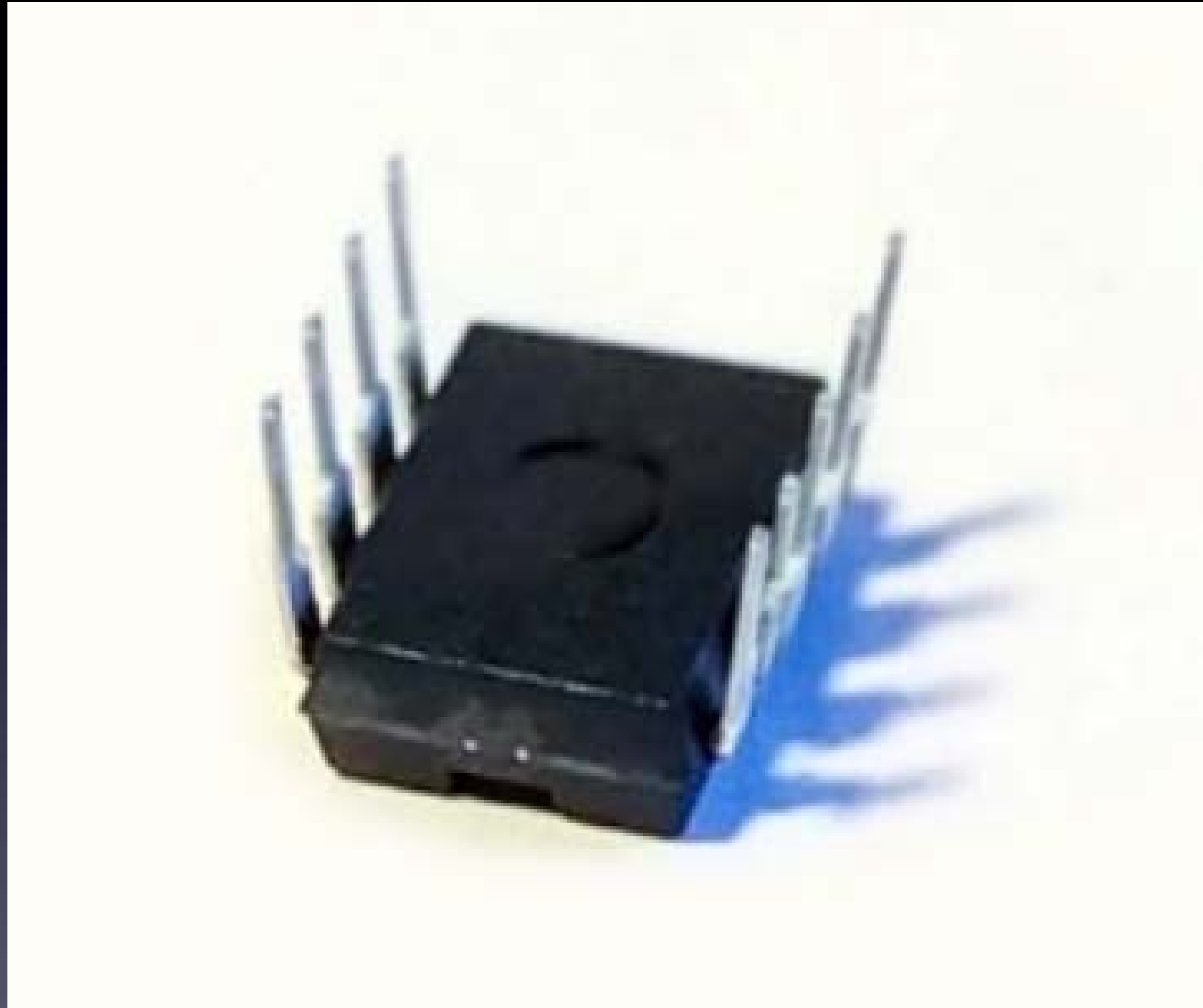
Pin 1

IC1

**Indented
black dot**

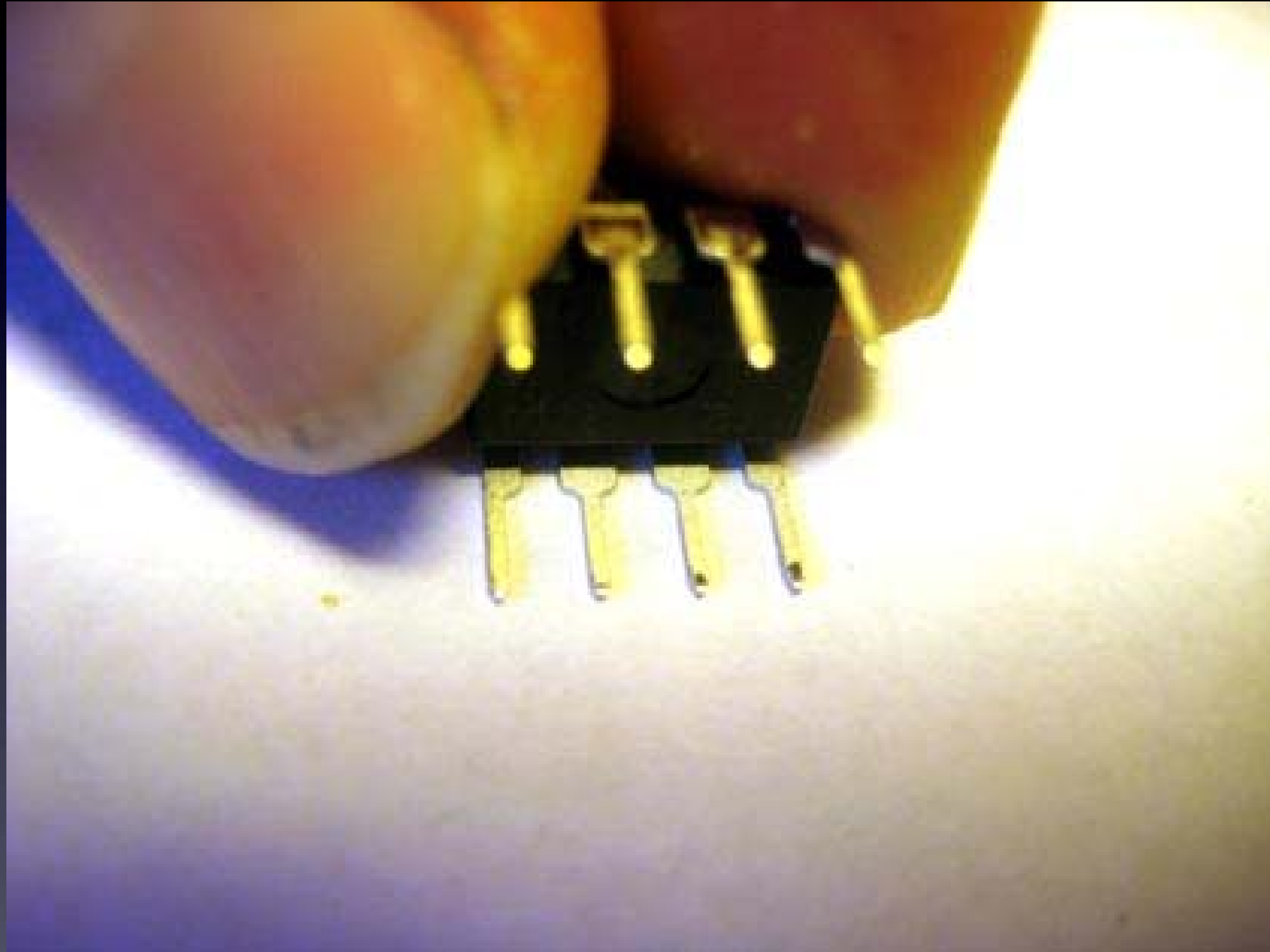


IC1



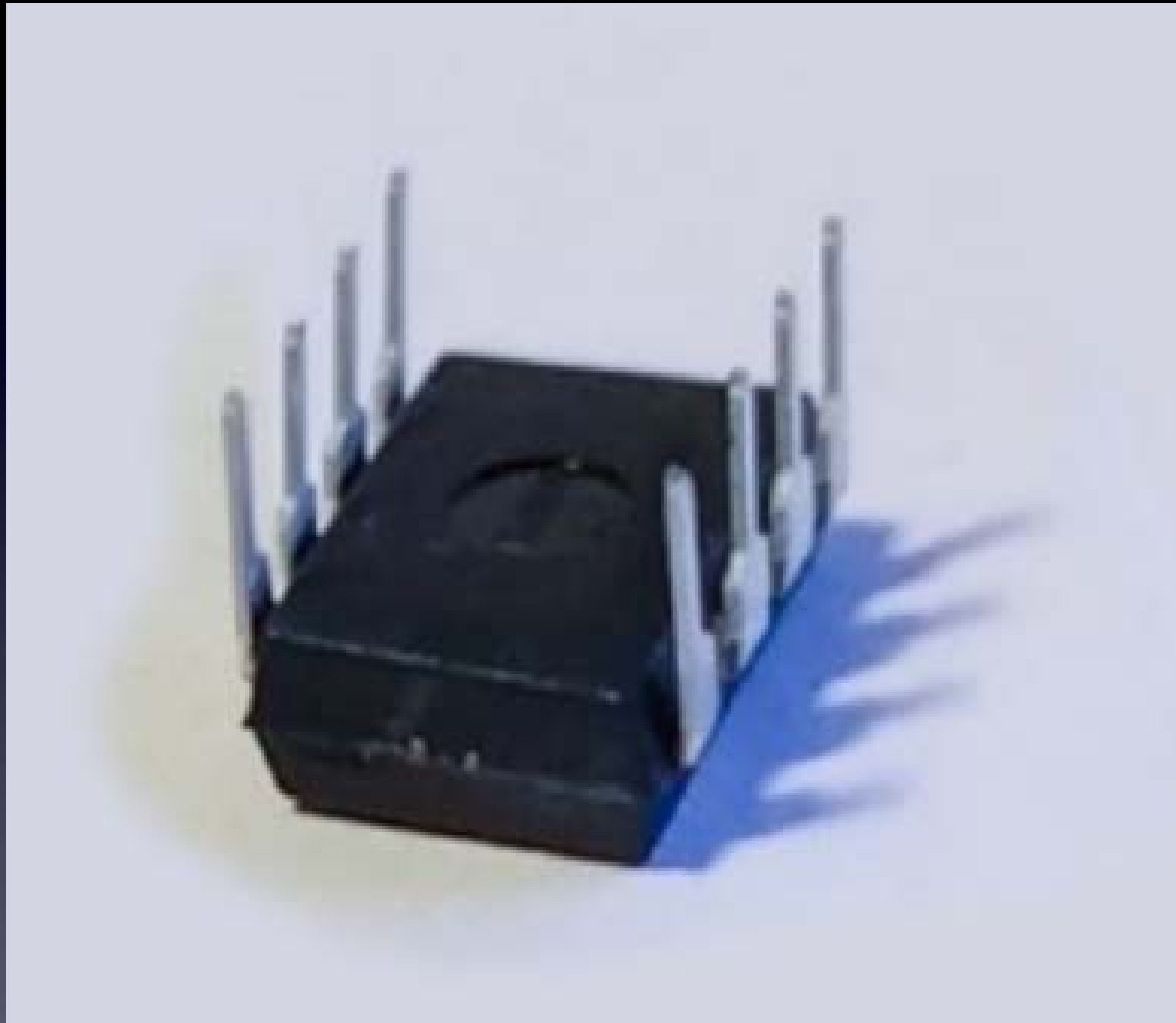
**When chips are new,
their pins are bent out.**

IC1



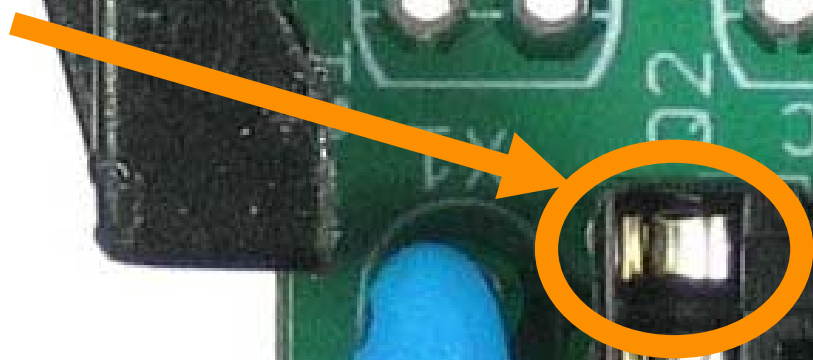
**We need the pins bent straight and parallel.
Use your work table to (gently) bend the leads.**

IC1

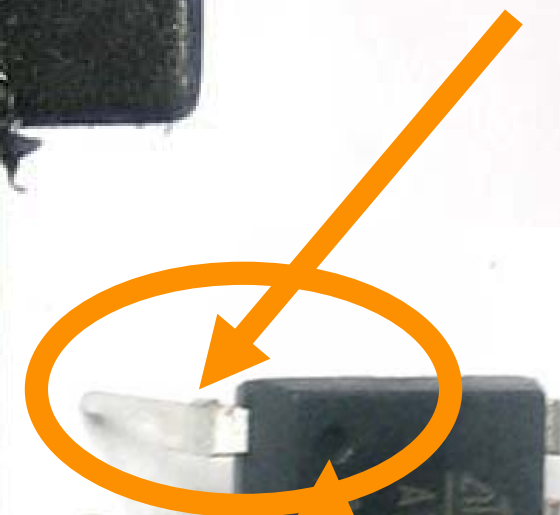


Gently bend leads so they're straight and parallel

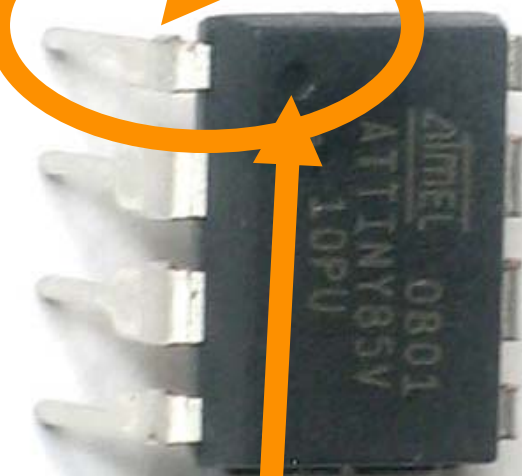
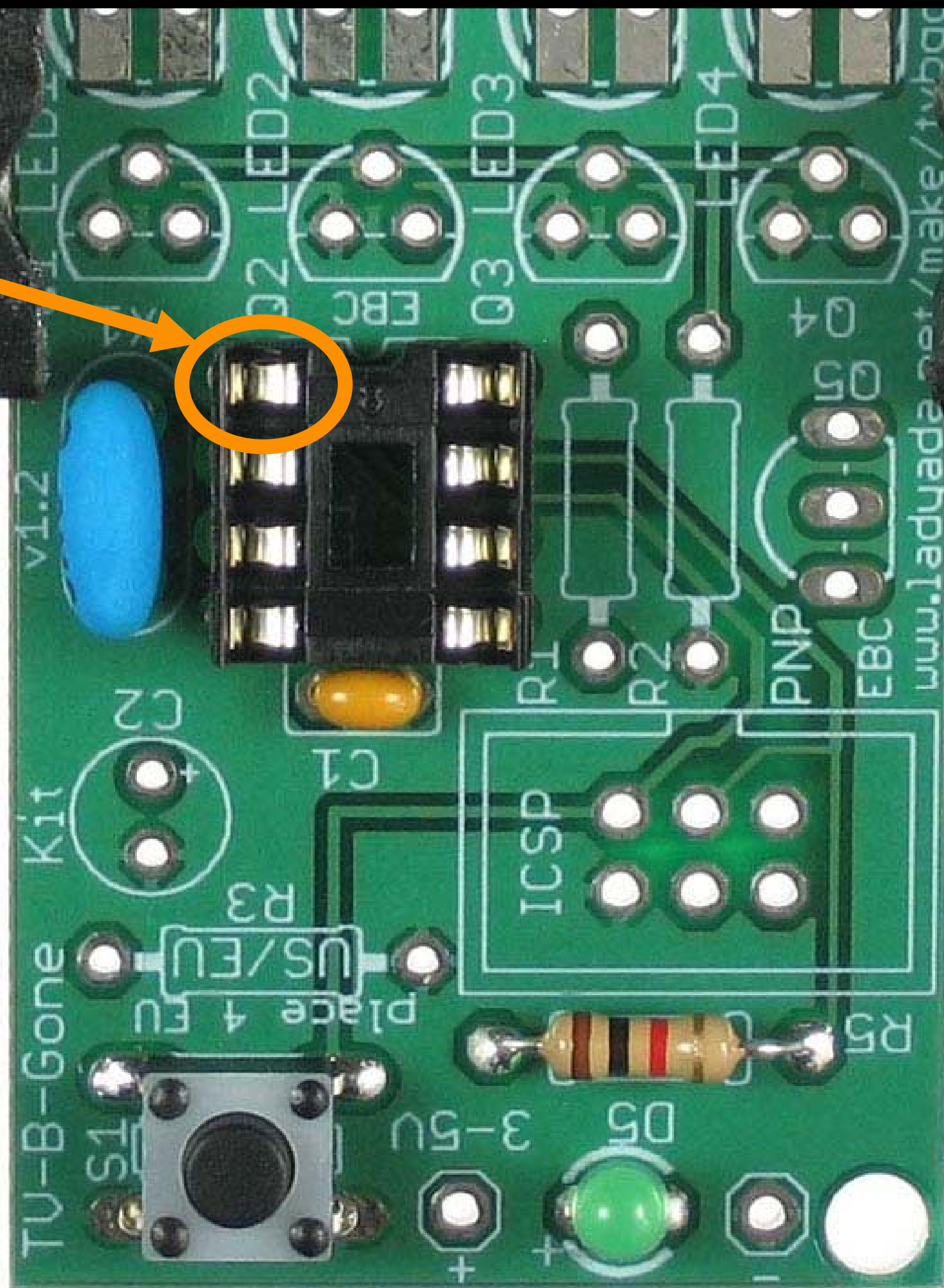
Pin 1



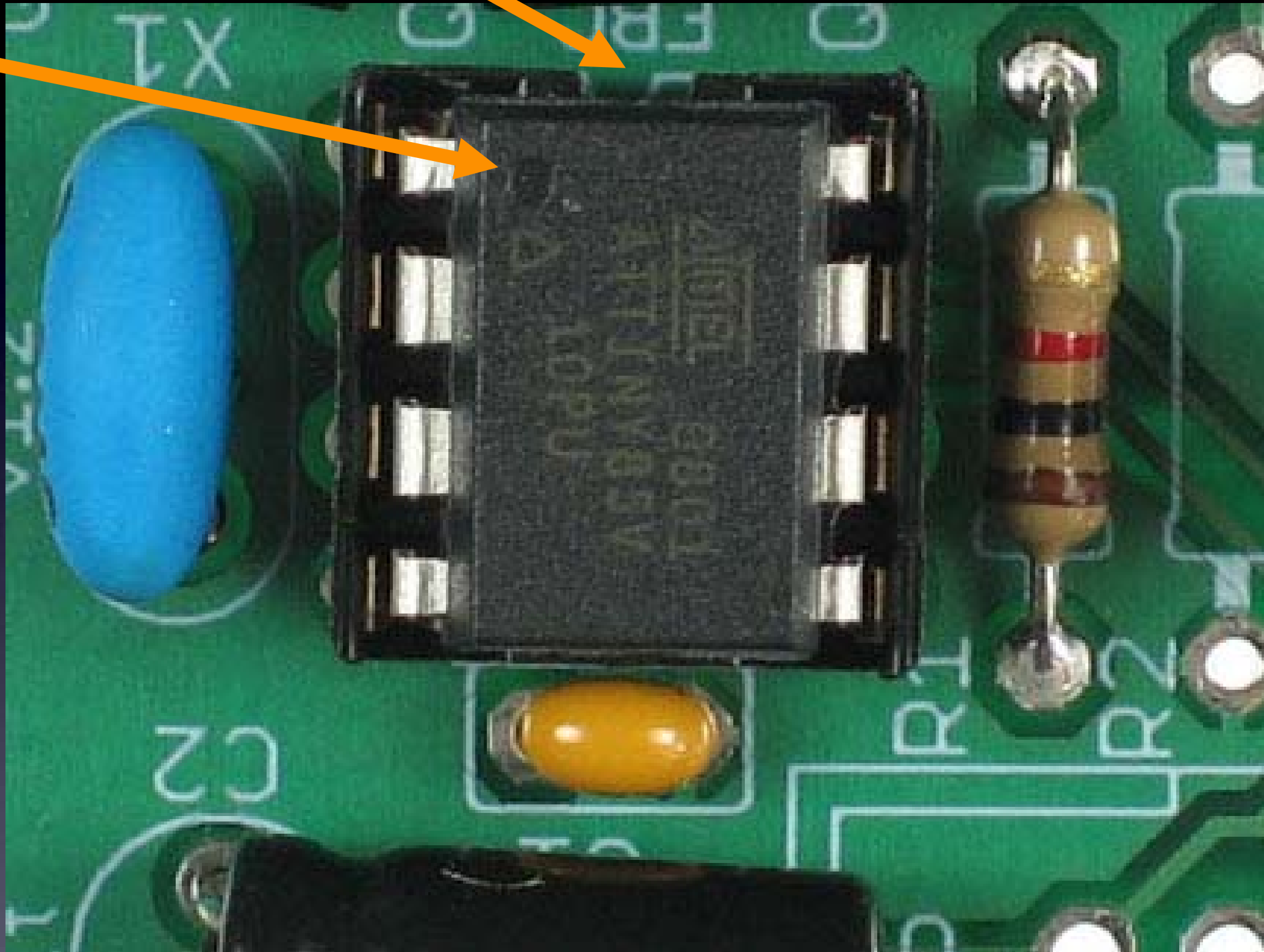
Pin 1



Indented
black dot

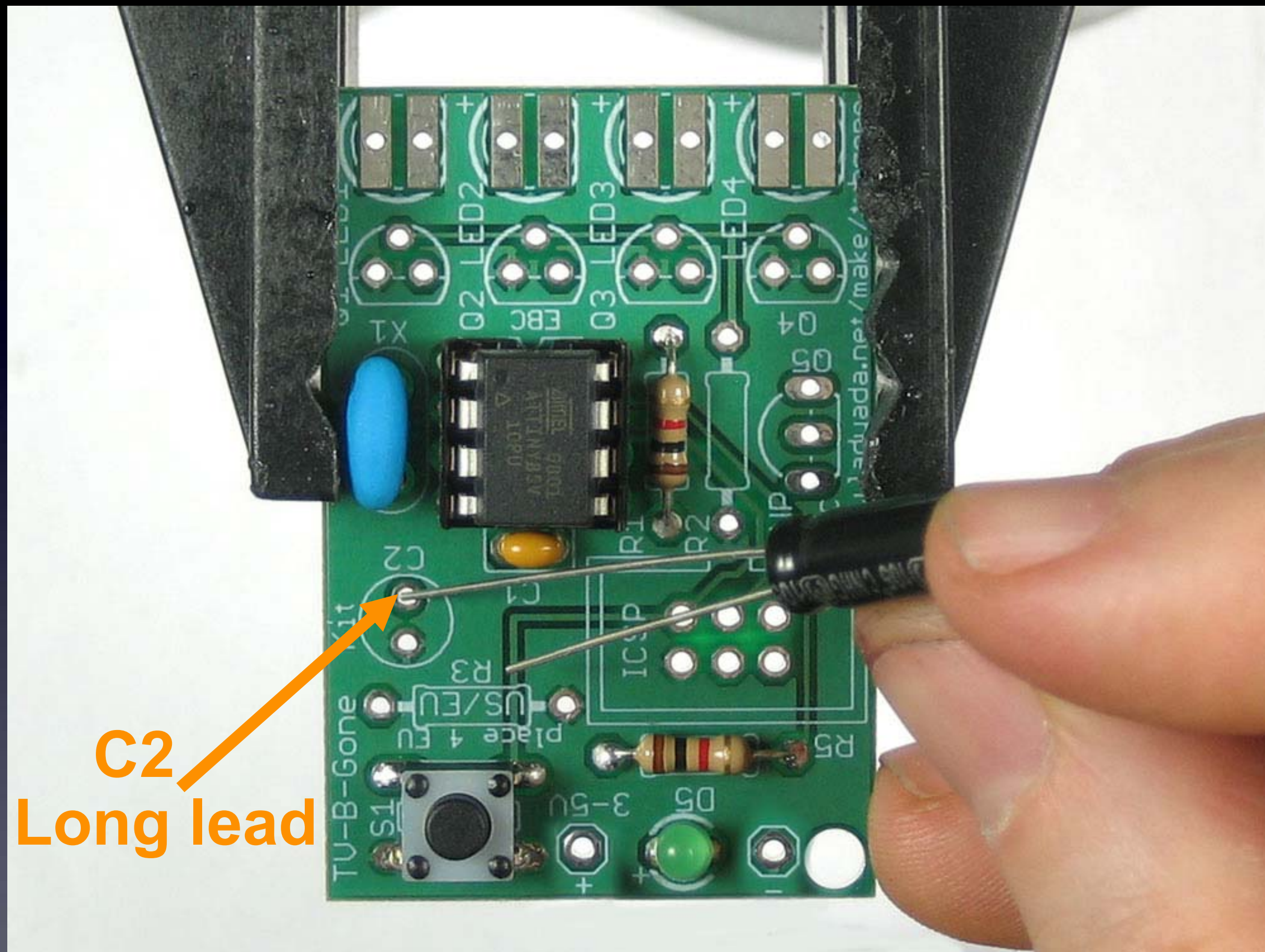


**Make sure all 8 pins
are in place,
and push it into its socket.**



Proper orientation

C2
Long lead

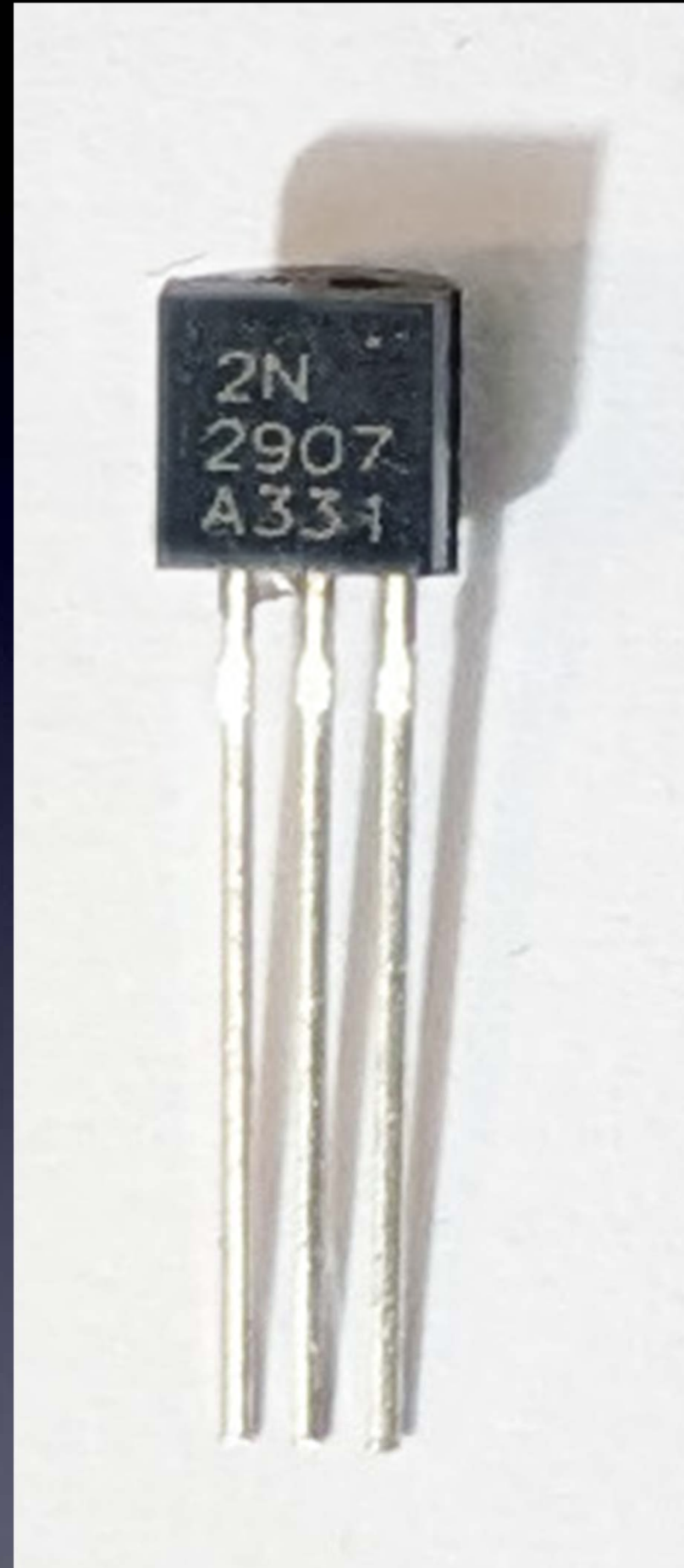
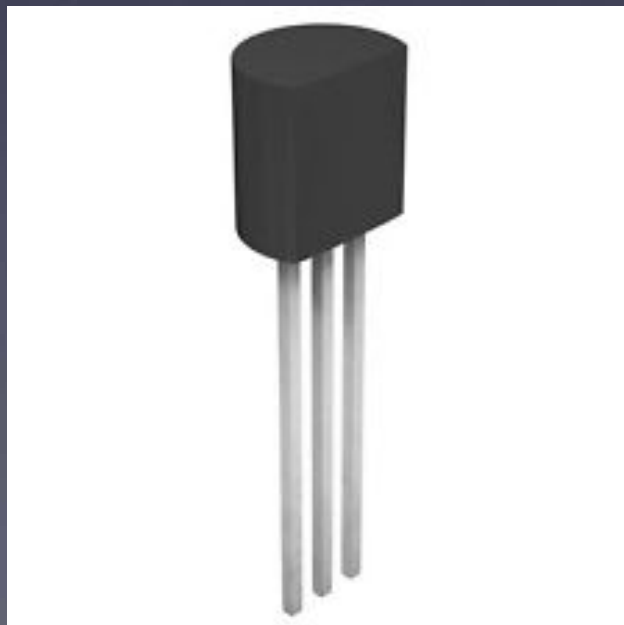


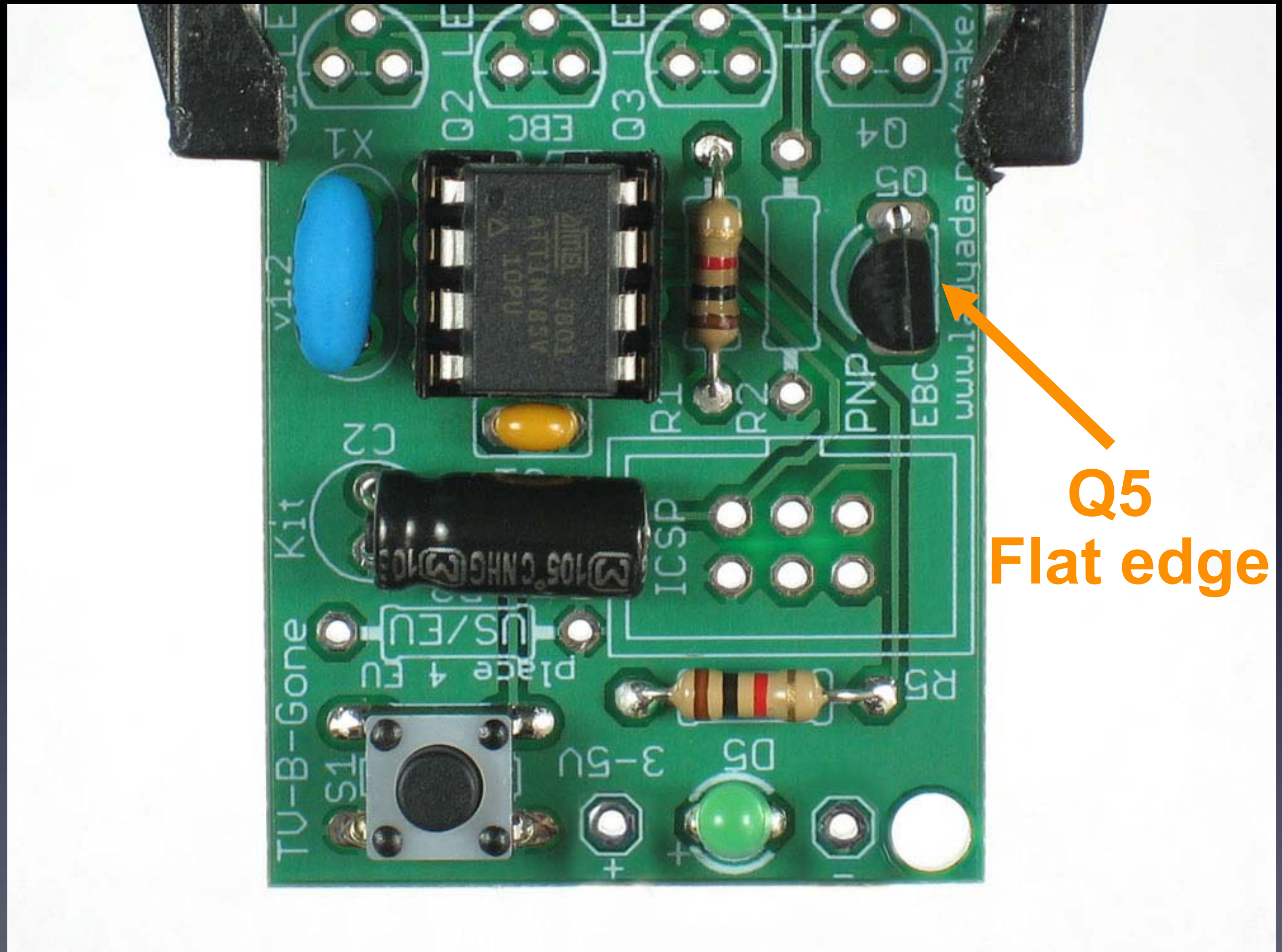
Q5

2N2907

**(the one that
is not
taped to others)**

Look at this shape:



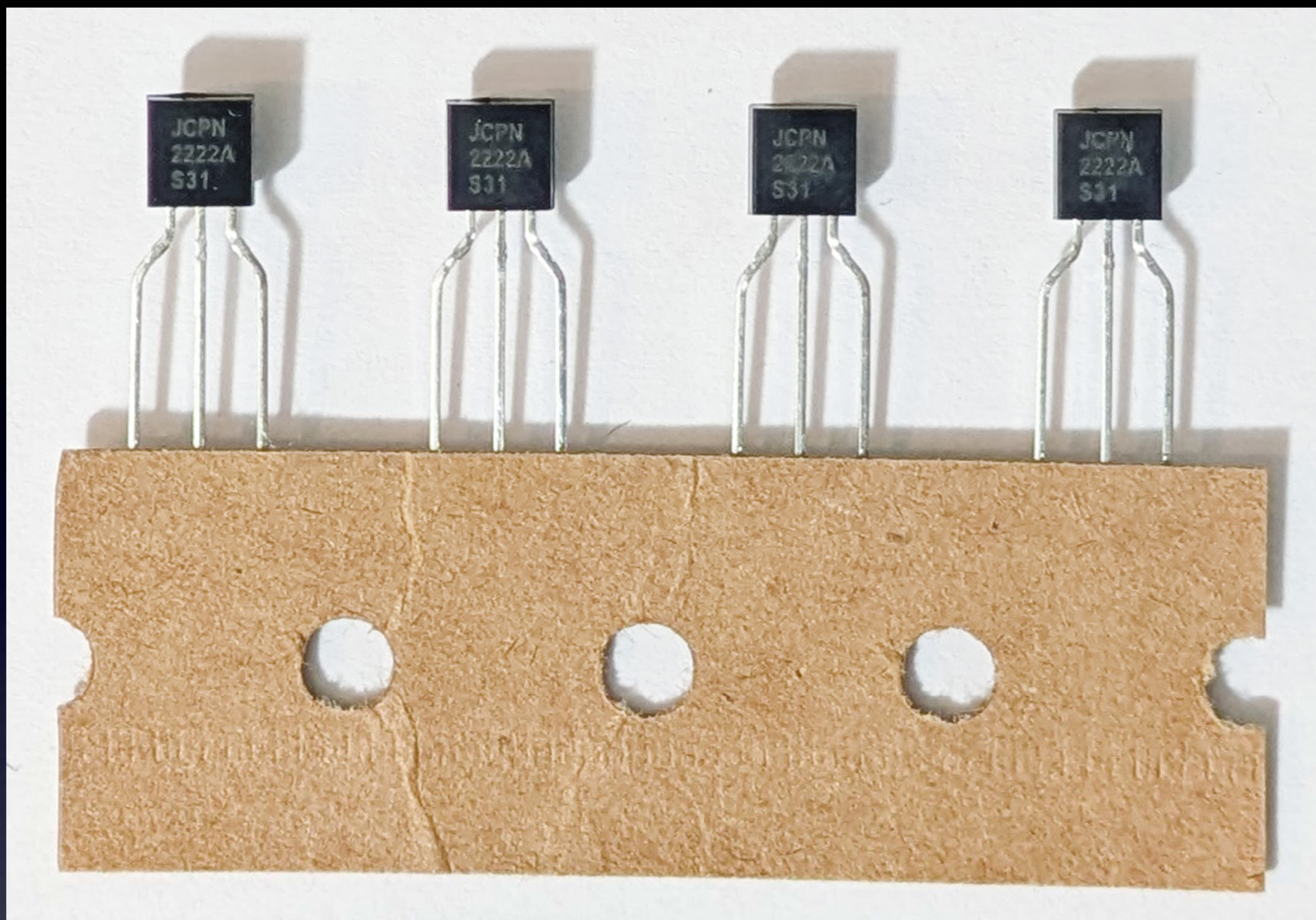


DO NOT push transistors all the way into the board

DO NOT push transistors all the way into the board

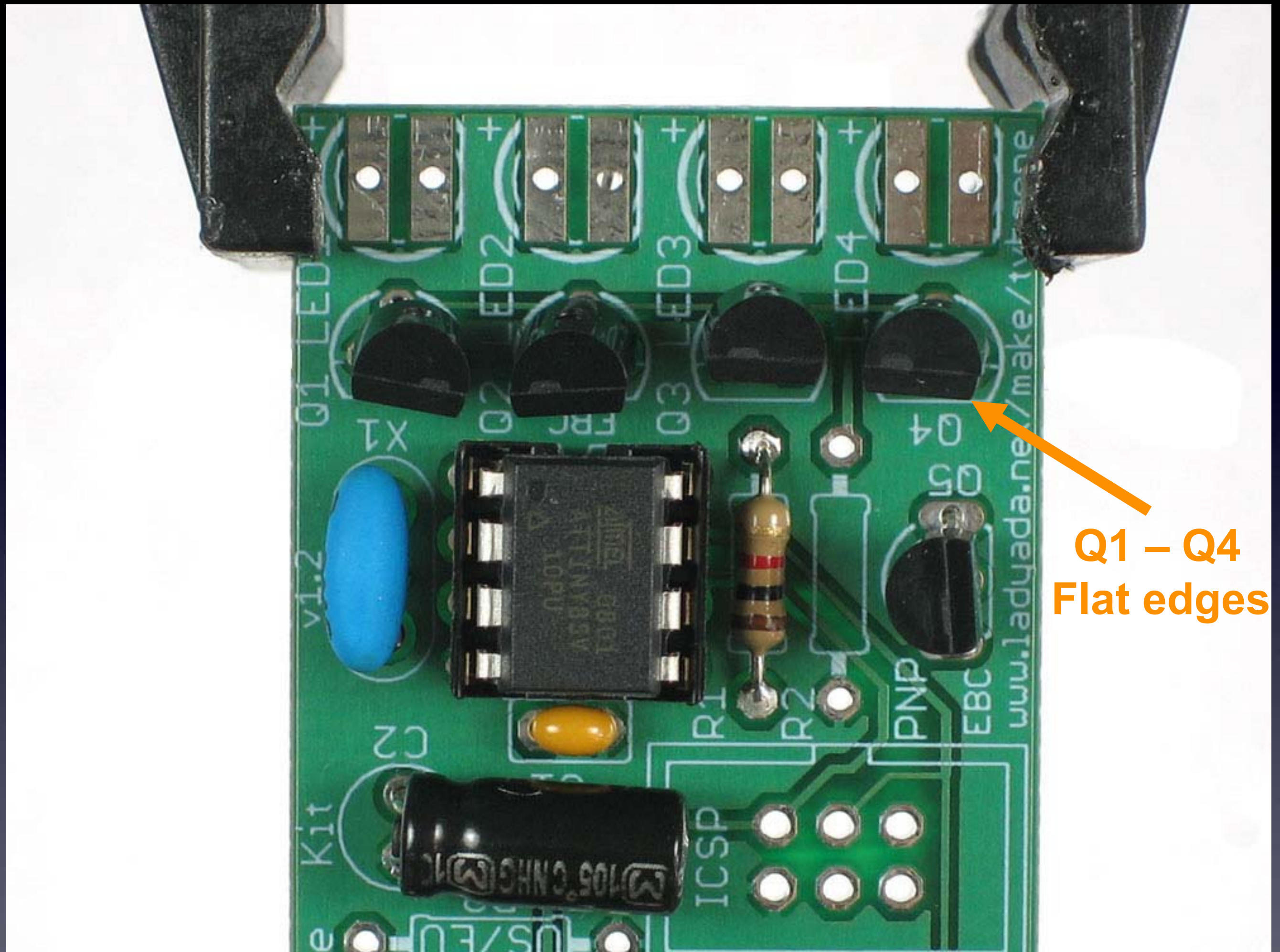


Only push till it is a little hard to push more



Q1, Q2, Q3, Q4
2N2222

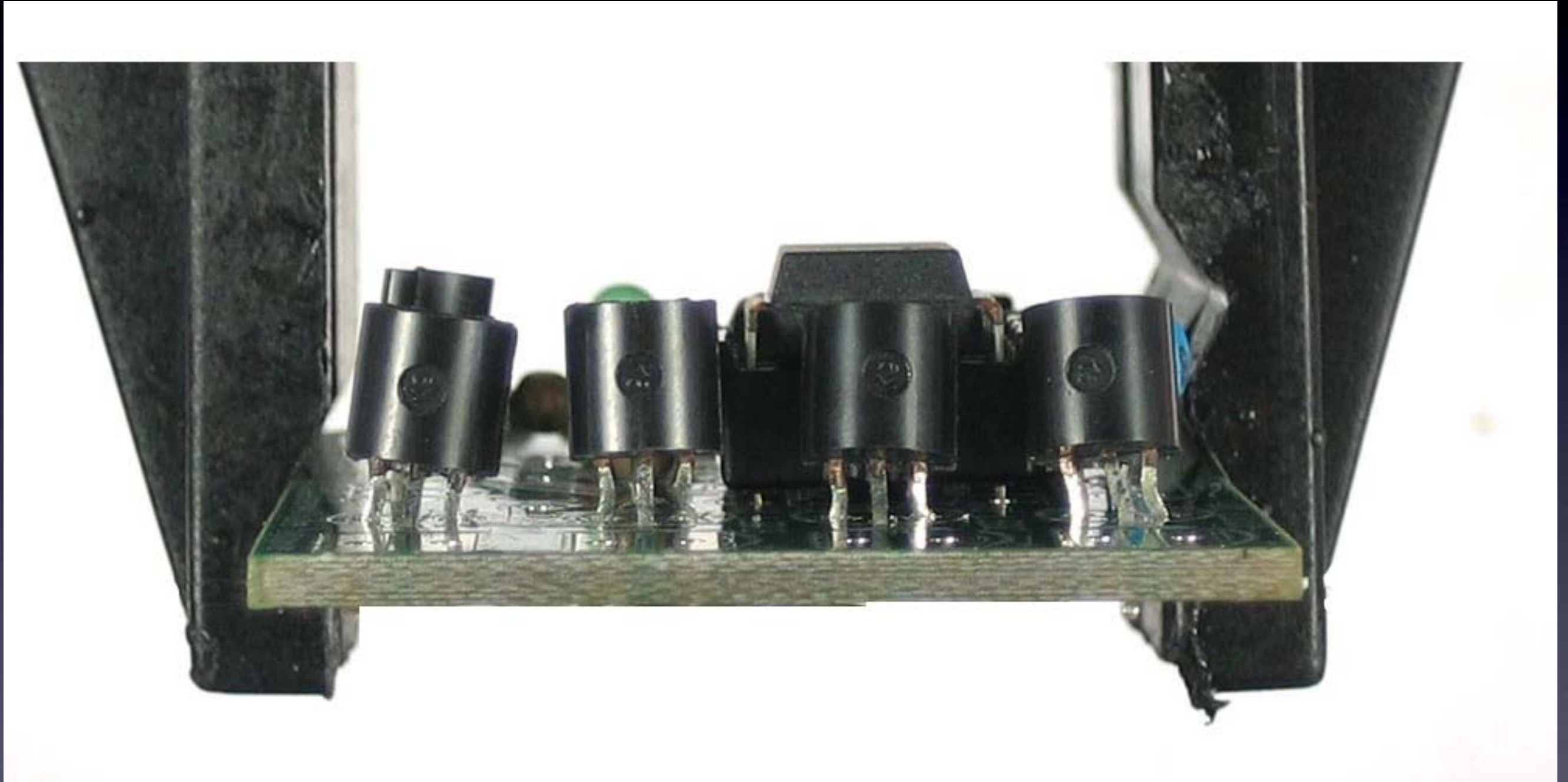
(taped together)



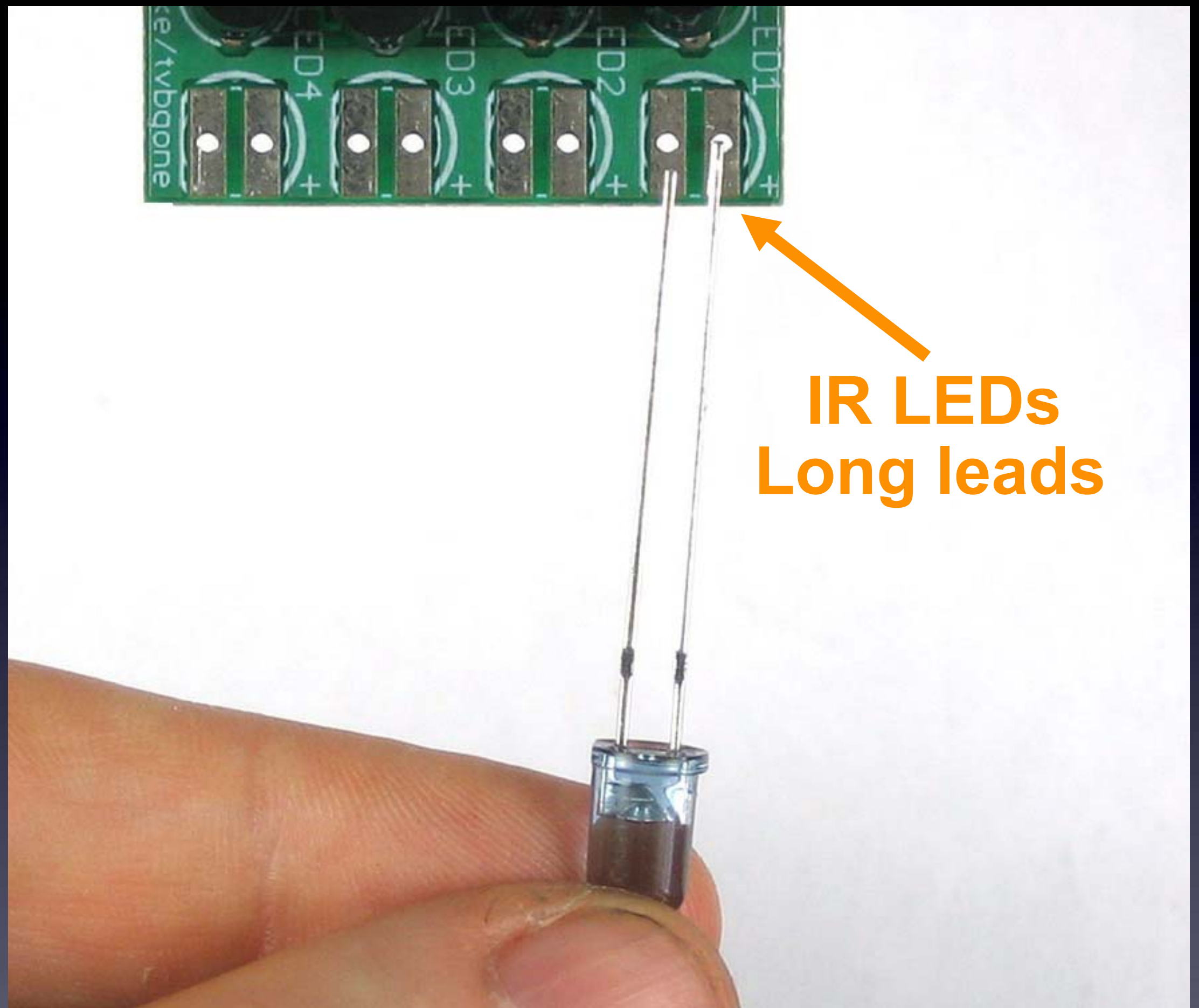
Q1 - Q4
Flat edges

DO NOT push transistors all the way into the board

DO NOT push transistors all the way into the board



Only push till it is a little hard to push more

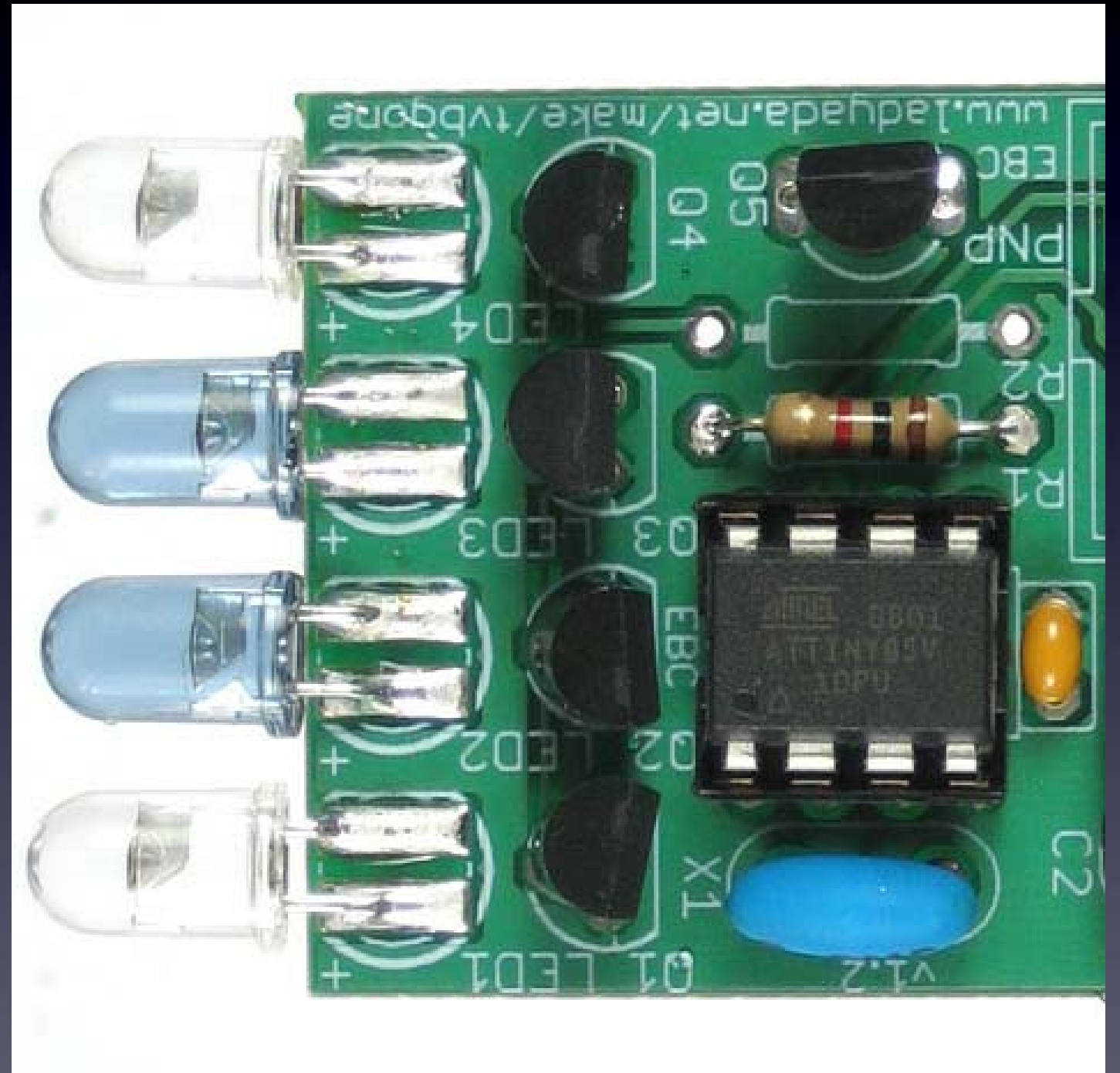


DO NOT solder these yet!

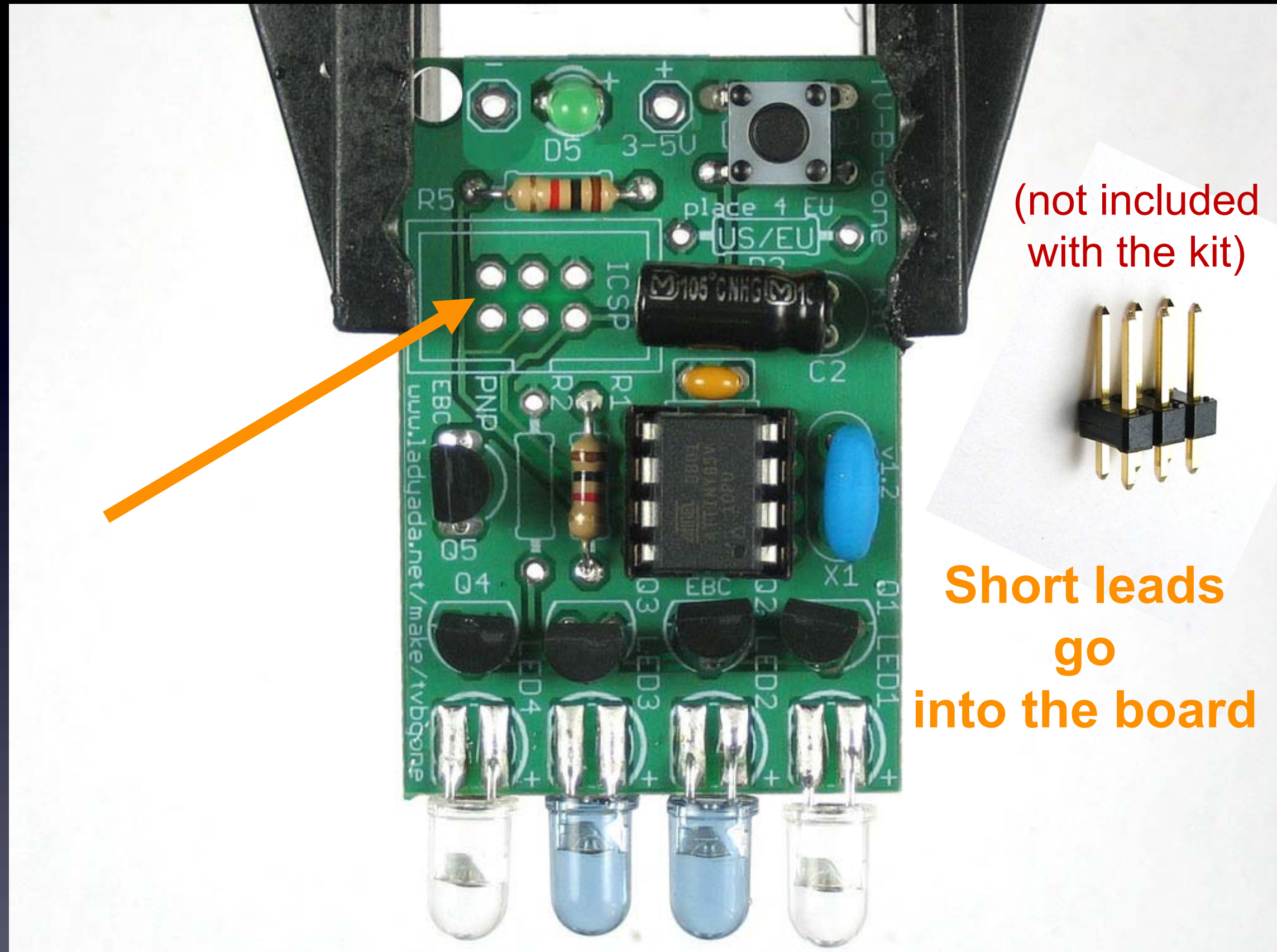
You may want to bend the IR LEDs over, like this:



**The color of
these LEDs
is unimportant**



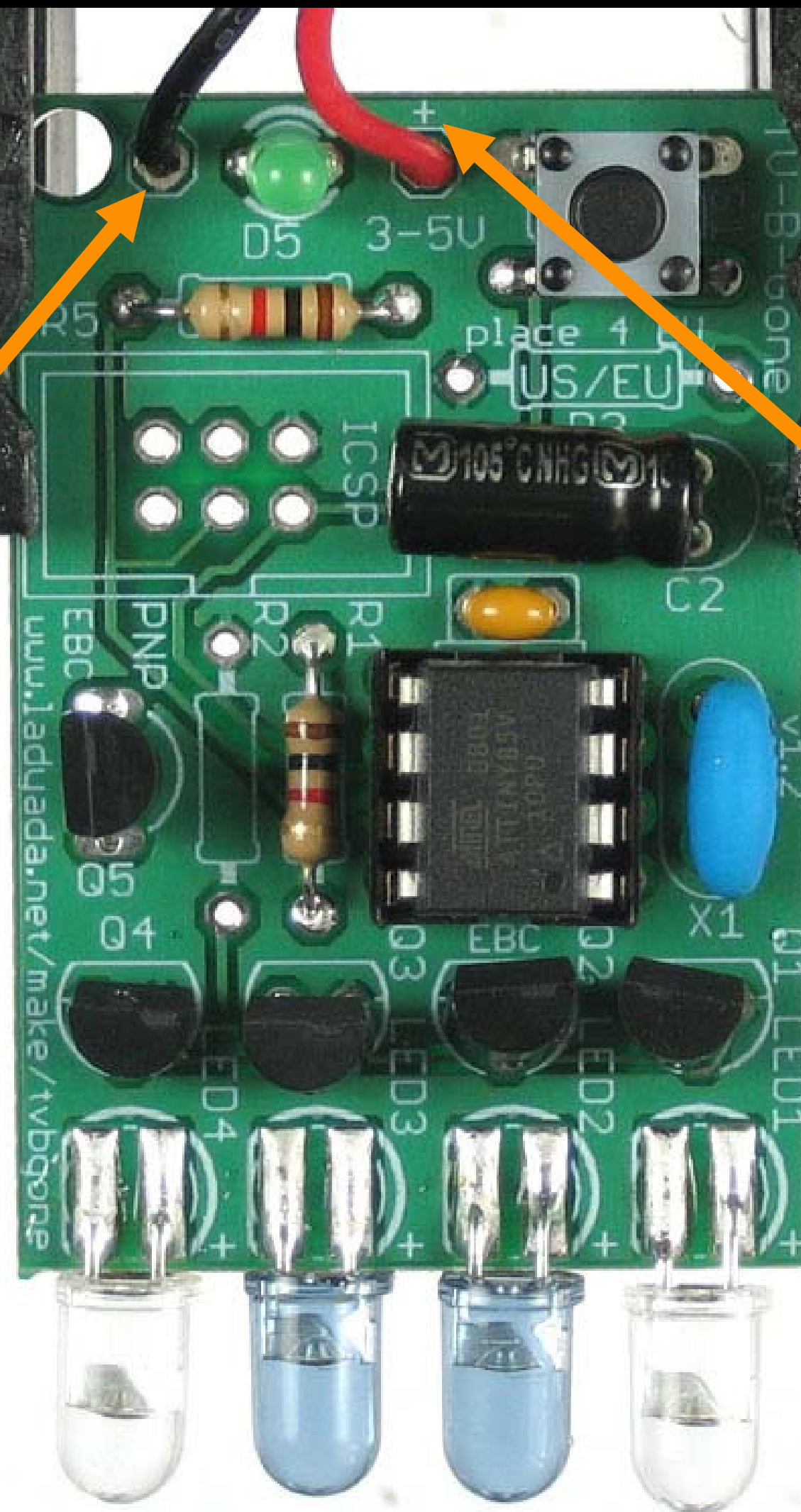
(The ordering of these LEDs is unimportant)



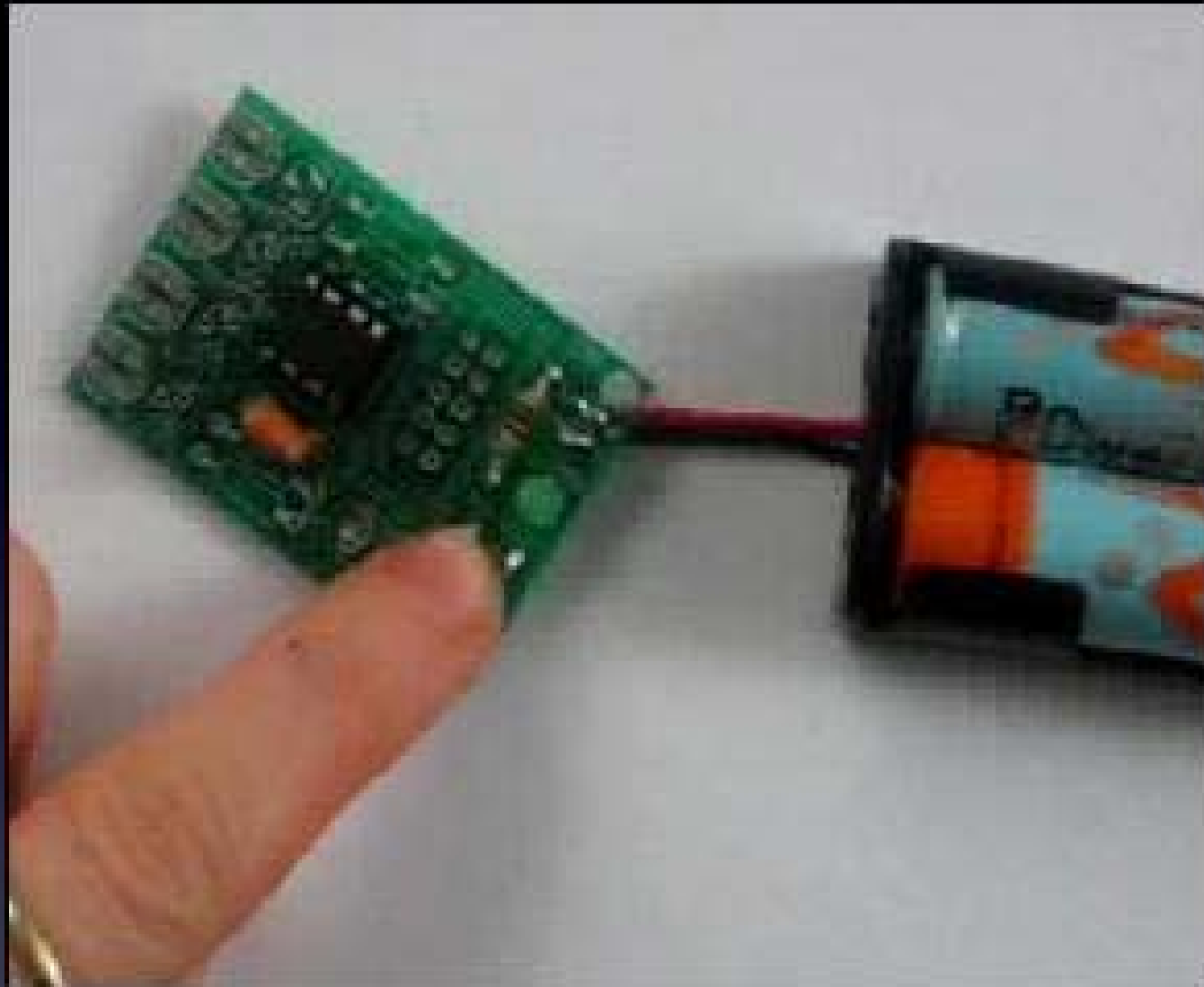
Optional: ICSP header
(for re-programming the microcontroller)

**Black wire
of battery pack
“-”**

**Red wire
of battery pack
“+”**



Test 1

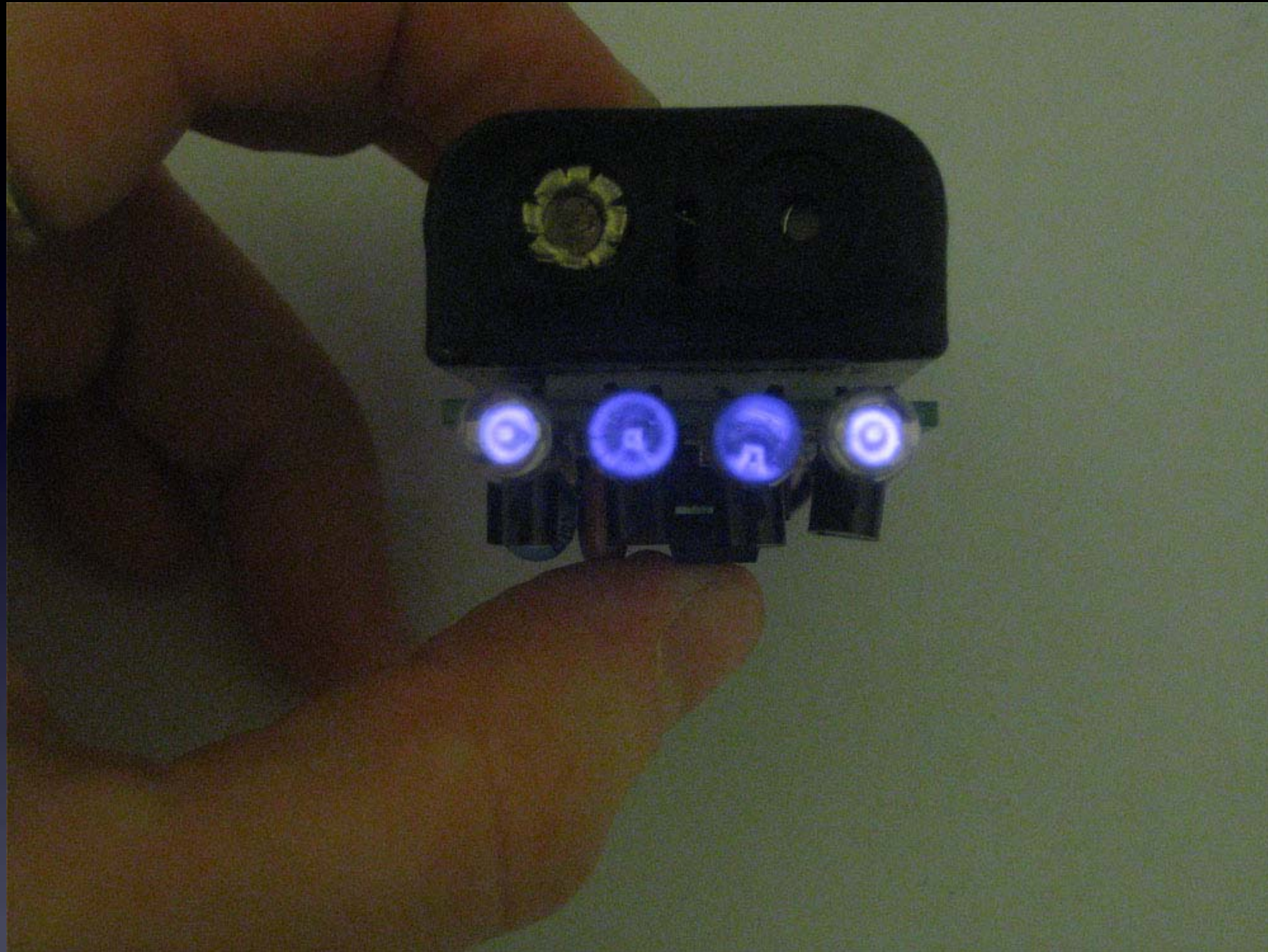


**IMPORTANT:
Use Alkaline
AA batteries**

other kinds of AA batteries
will not work

Green LED blinks
after inserting batteries
(and continues blinking for about 1 minute)

Test 2



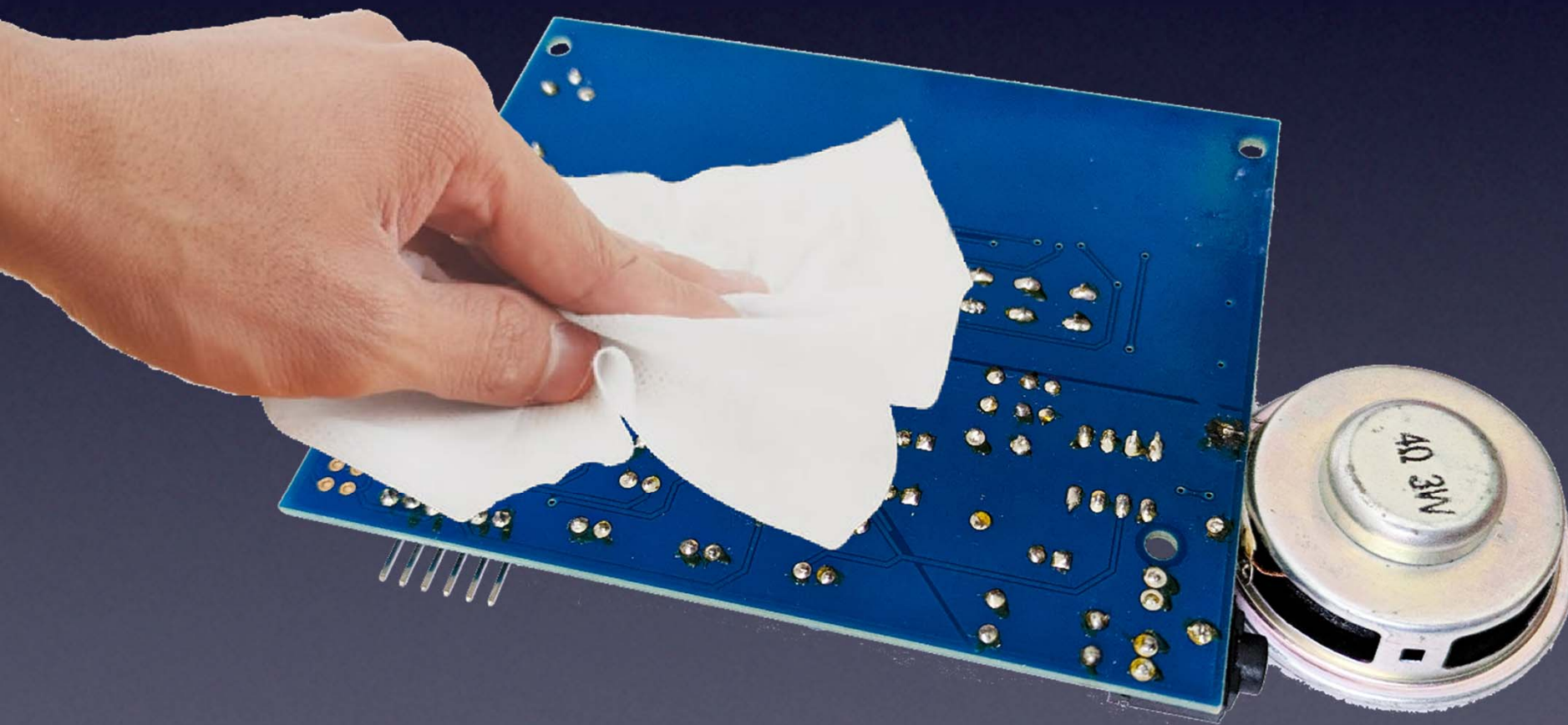
All IR LEDs blink

(using your phone's front-facing camera)

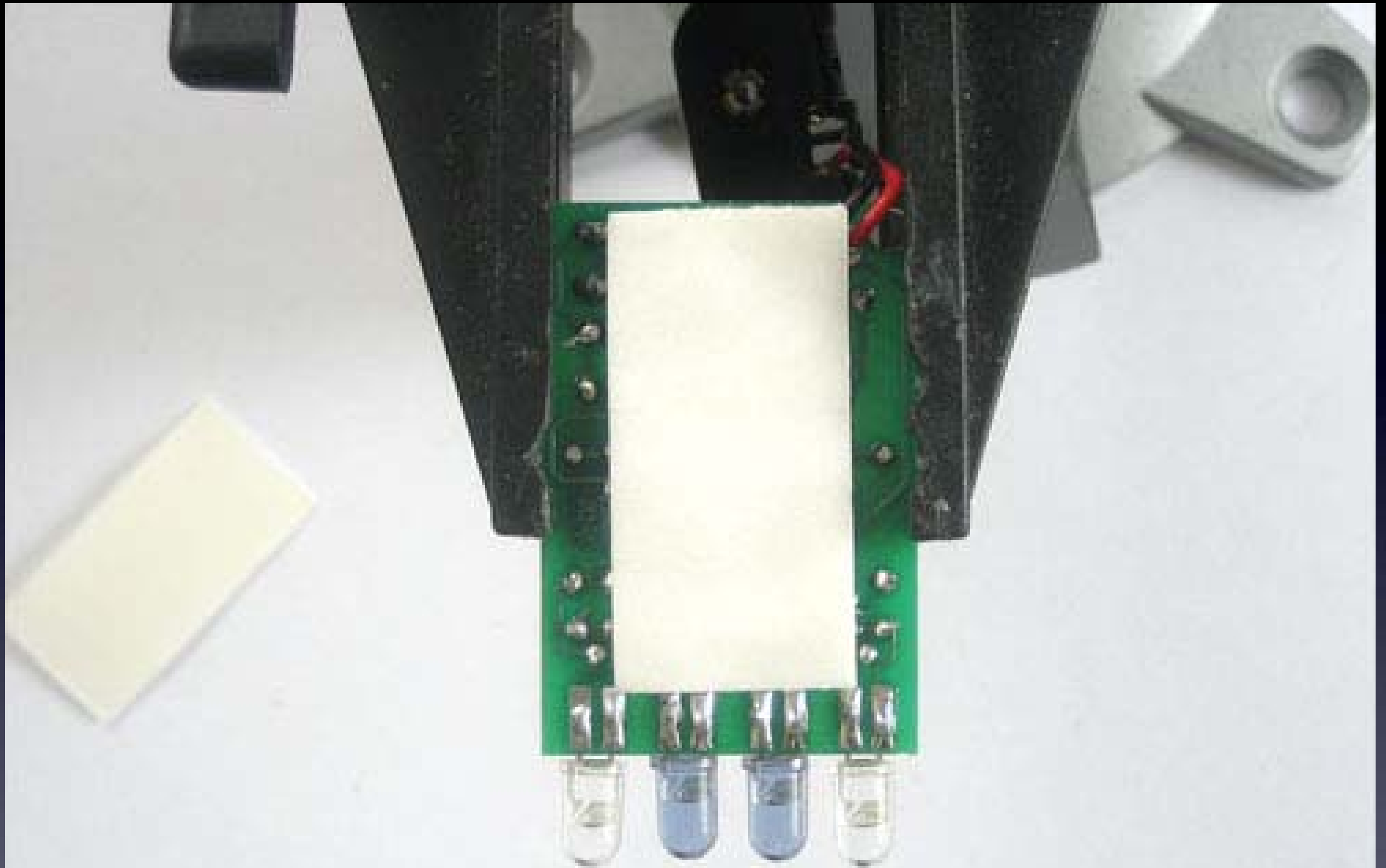
If you used any *flux paste* for *re-working problems*



The bottom of the PCB will be sticky from the flux

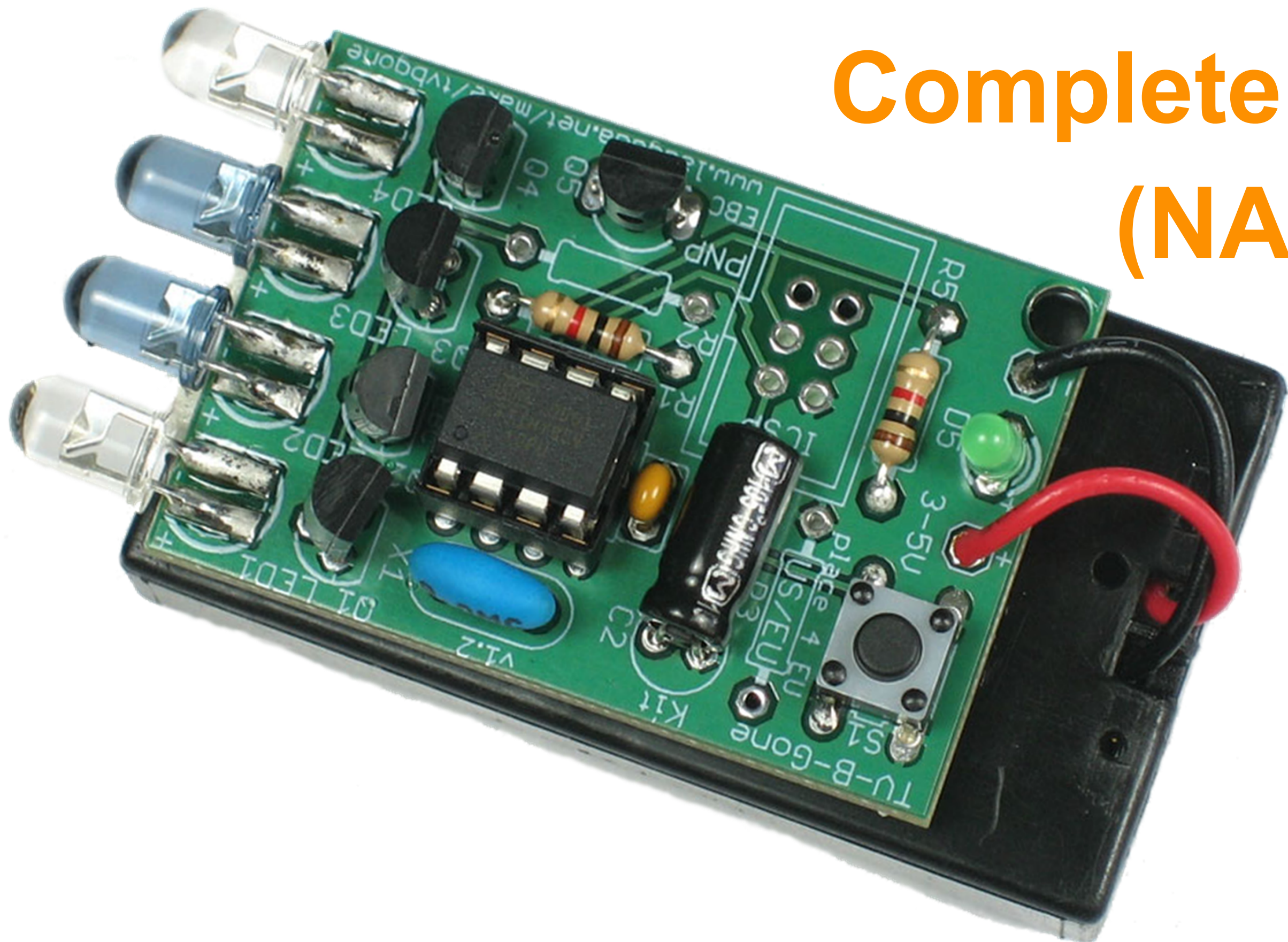


You can clean it with a cloth wet with Isopropyl Alcohol

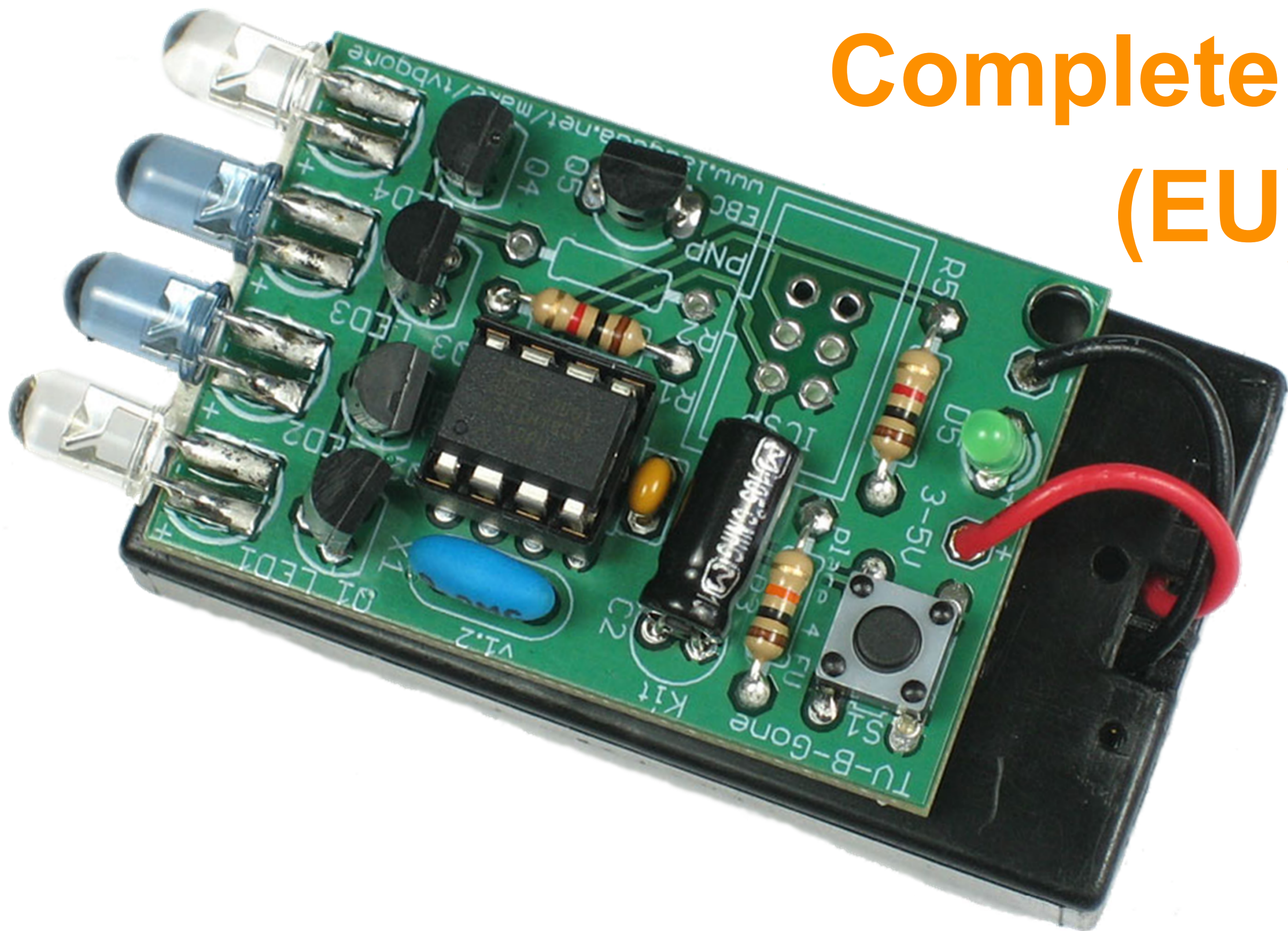


You can use the double-sided tape to connect the PCB to the battery pack

Complete!
(NA)



Complete!
(EU)



TV B GONE®

Turn off TVs!!



Make the world a better place

Please Remember:

to

Wash your hands

after soldering



Make your own



Mitch Altman

Chief Scientist, **Cornfield Electronics**, San Francisco, CA

Inventor of **TV-B-Gone** universal remote controls

Co-founder of **3Ware** (successful Silicon Valley startup)

Pioneer of **VR** (in the mid-1980s)

Founding mentor at **HAX** (1st and biggest hardware accelerator)

Co-founder of **Noisebridge** (San Francisco hackerspace)

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