

SynShop Solder Buildup

Presented by Charley Jones, PMP aka Dataman





SynShop

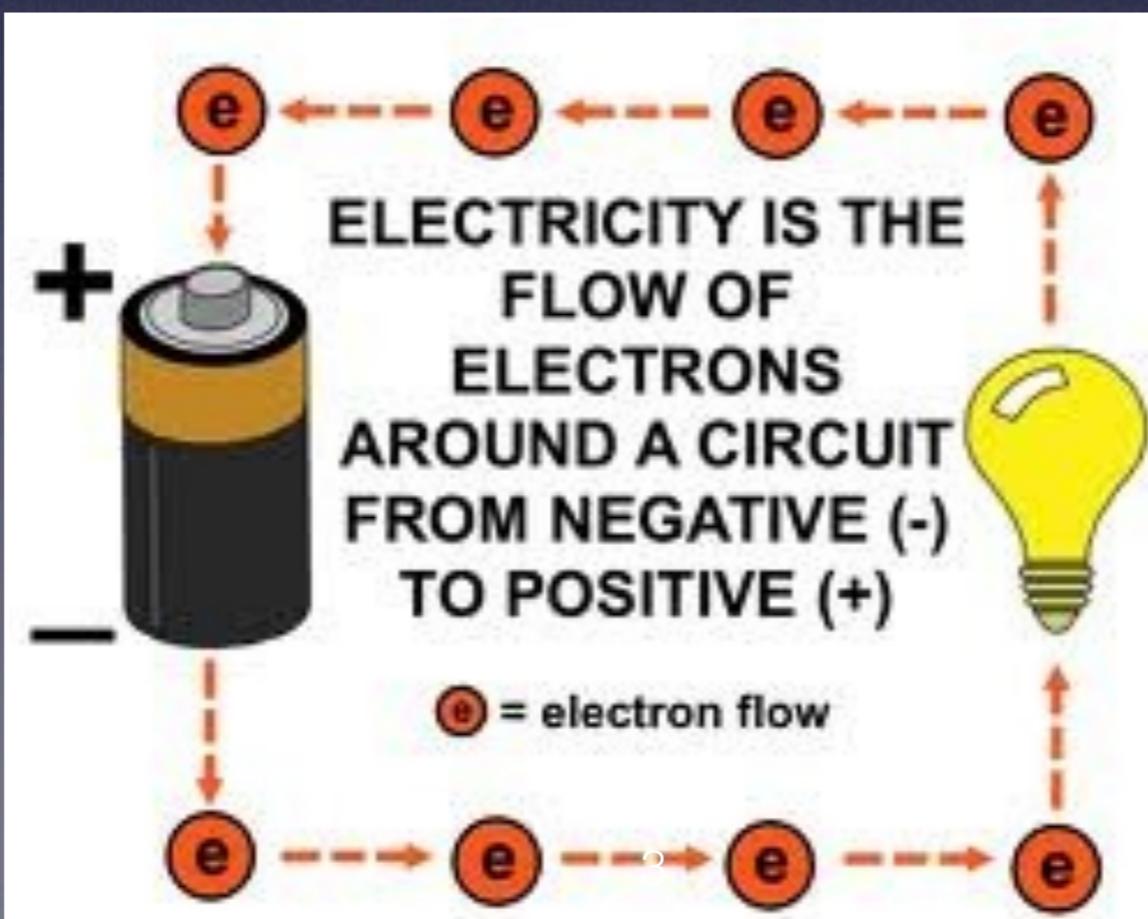
Prototyping

**Just a review
from the last class...**



SynShop Prototyping

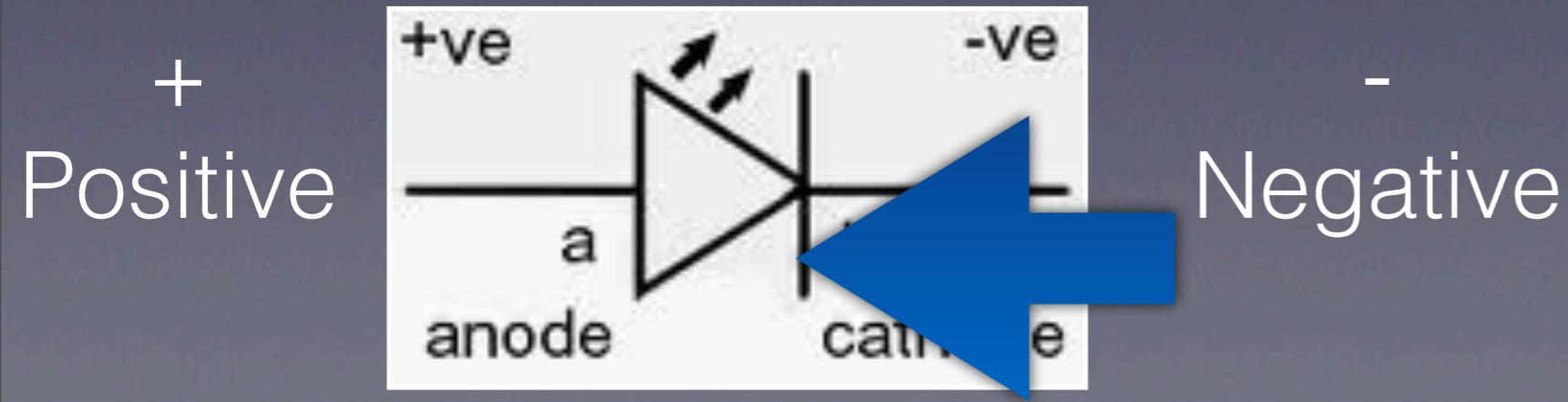
Electrons flow from negative to positive





SynShop Prototyping

**Arrows typically point towards negative. You're a salmon
Swimming up river... Against the arrows...**





SynShop

Prototyping

Voltage
How badly electrons want to move.
Potential...





SynShop Prototyping

Current

How many electrons are moving.
Amps... Volume
Water moving through a firehose.





SynShop
Prototyping

**Resistance
Limits How much current is
allowed to flow. Ohms.**





SynShop Prototyping

Ohms law.

$$V=IR$$

$$R=V/I$$

$$I=V/R$$



SynShop
Prototyping

Mega x 1 Million
Kilo x 1 Thousand
Milli / Thousand
Micro / Million
Nano/ Billion

1k ohm = 1,000 ohms
1milli volt = 0.001 volts



SynShop Prototyping

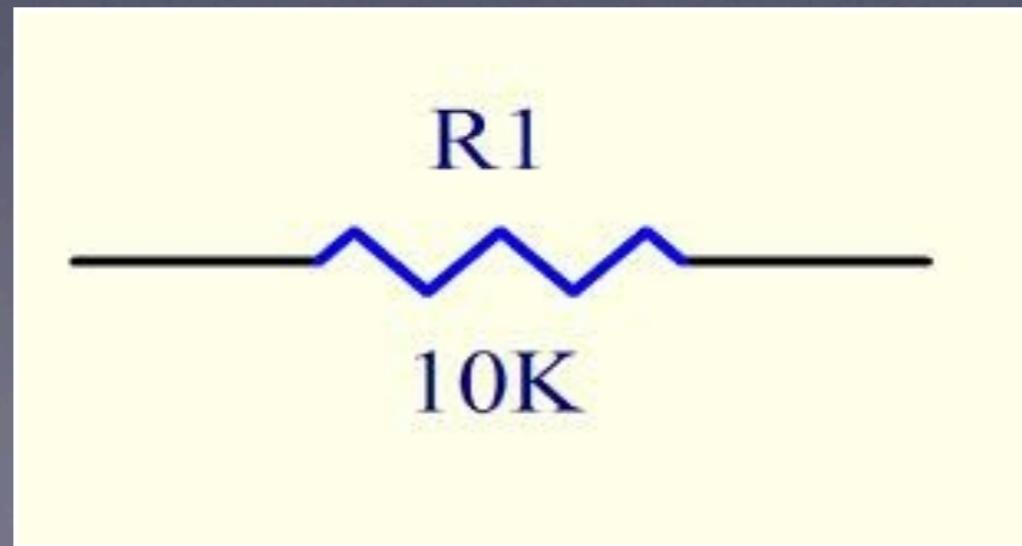
Resistor

Most common electrical part.

Resists current. In Ohms.

higher value = higher resistance

Color coded



4-Band-Code

2%, 5%, 10%

560Ω ± 5%

COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	± 1% (F)
Brown	1	1	1	10Ω	± 2% (G)
Red	2	2	2	100Ω	± 2.5% (H)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (P)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1	± 5% (D)
Silver				0.01	± 10% (E)

5-Band-Code

0.1%, 0.25%, 0.5%, 1%

237Ω ± 1%

Electronics Express / RSR
<http://www.elex.com>

1-800-972-2225
In NJ 732-581-8020



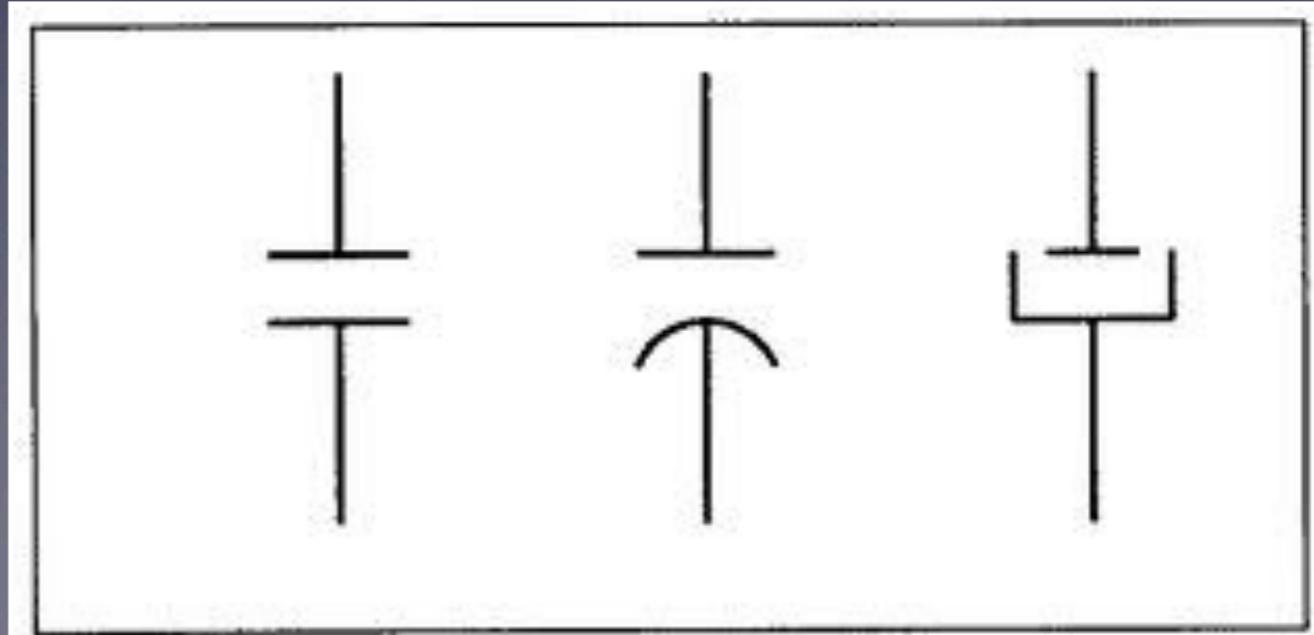
SynShop
Prototyping

Capacitors

Resist changes in voltage.

Polarized, long leg positive.

Value, in farads, written on side.





RC Time Constant
Resistor and capacitor in series
charge at a known rate...

RC seconds = R ohms x C farads

RC = 100k ohms x 10u farads

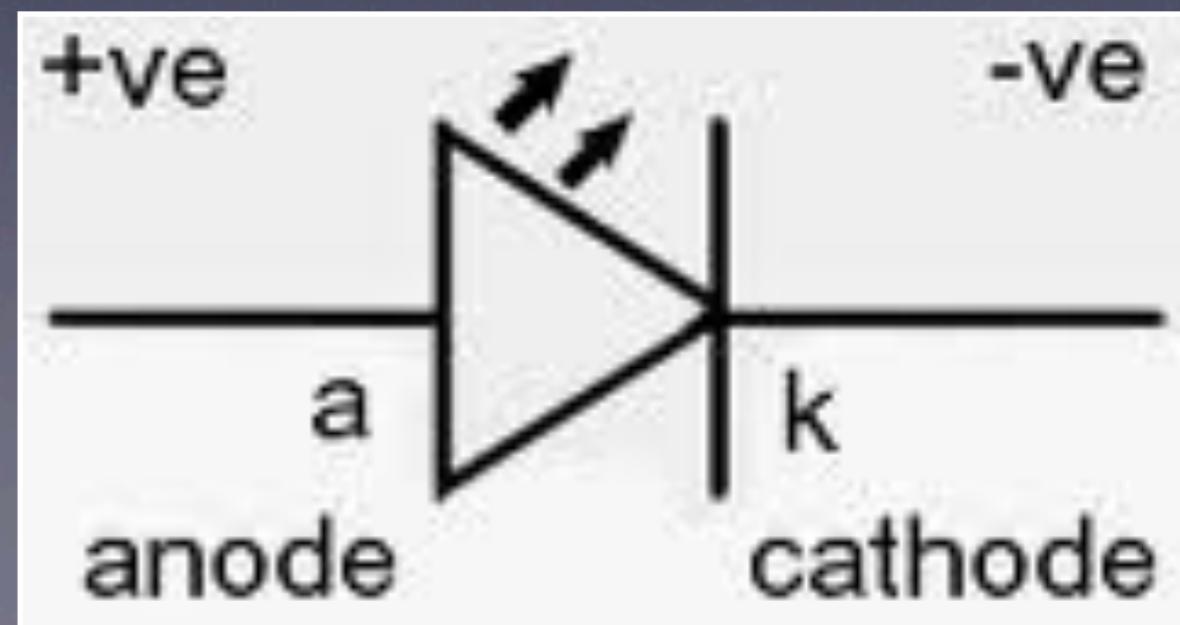
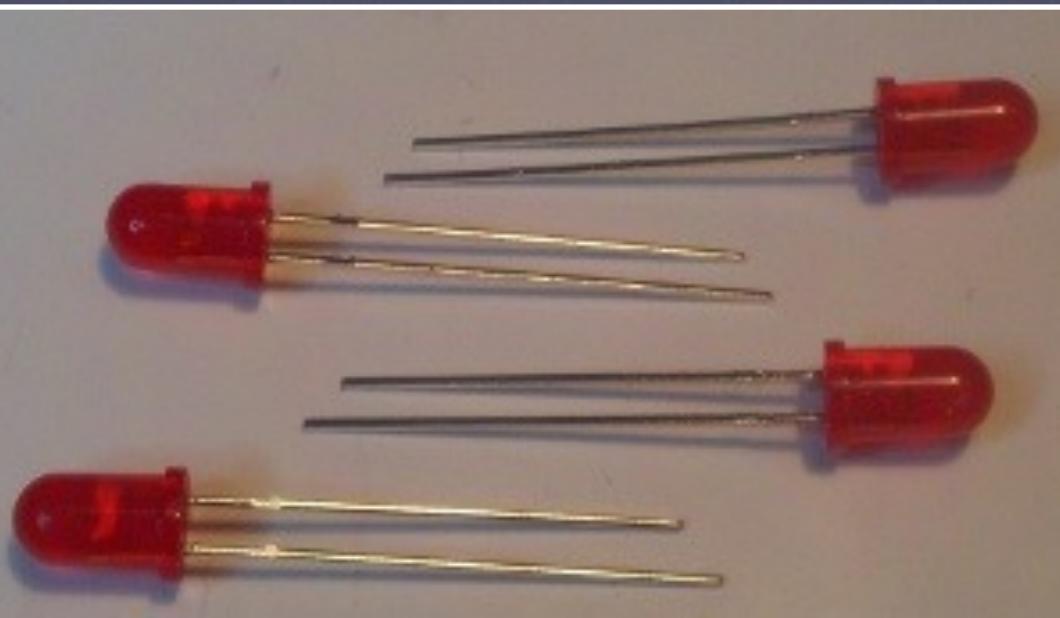
RC = 100,000 ohms x 0.000,010f

RC = 1 second



SynShop
Prototyping

LEDs
Light Emitting Diode
Allows current in one direction
Polarized, long leg positive.

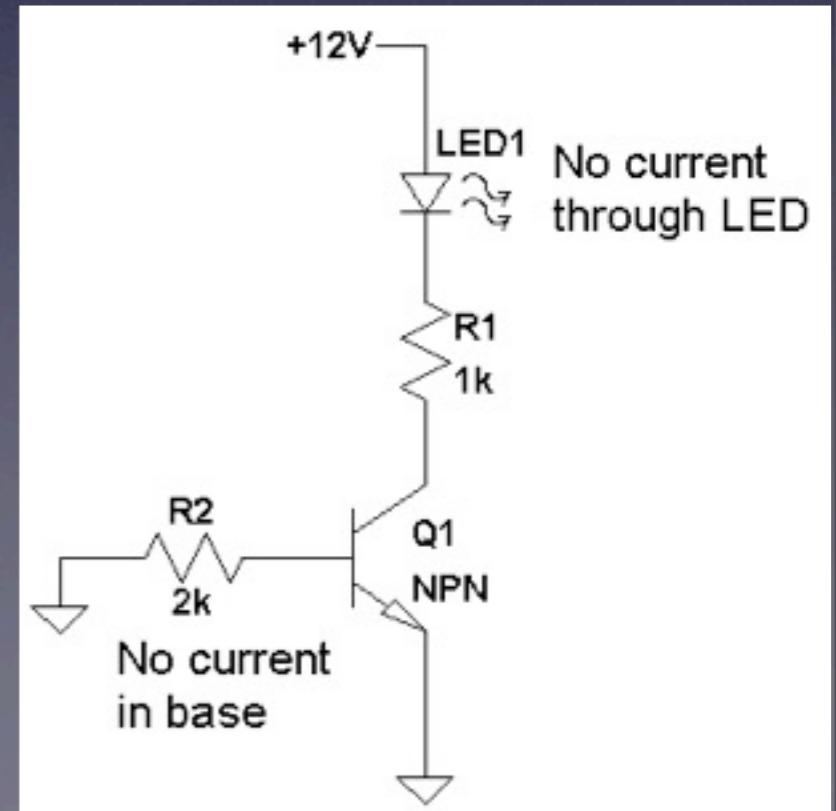
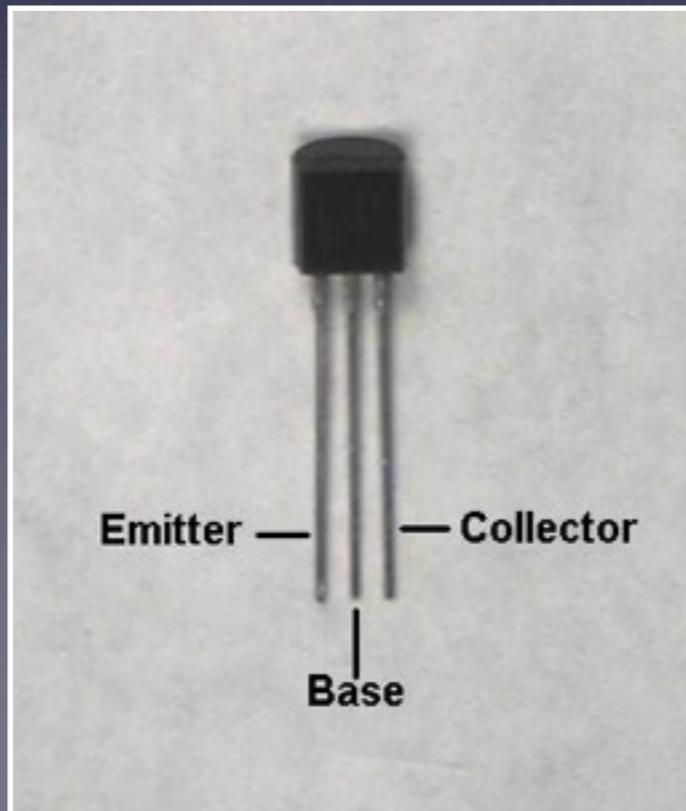
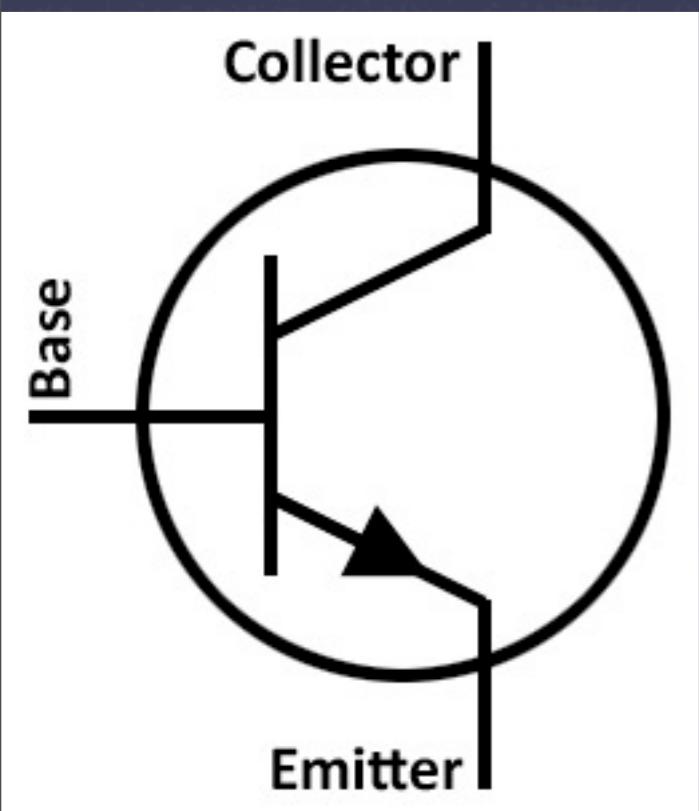




SynShop
Prototyping

Transistor Electronic switch.

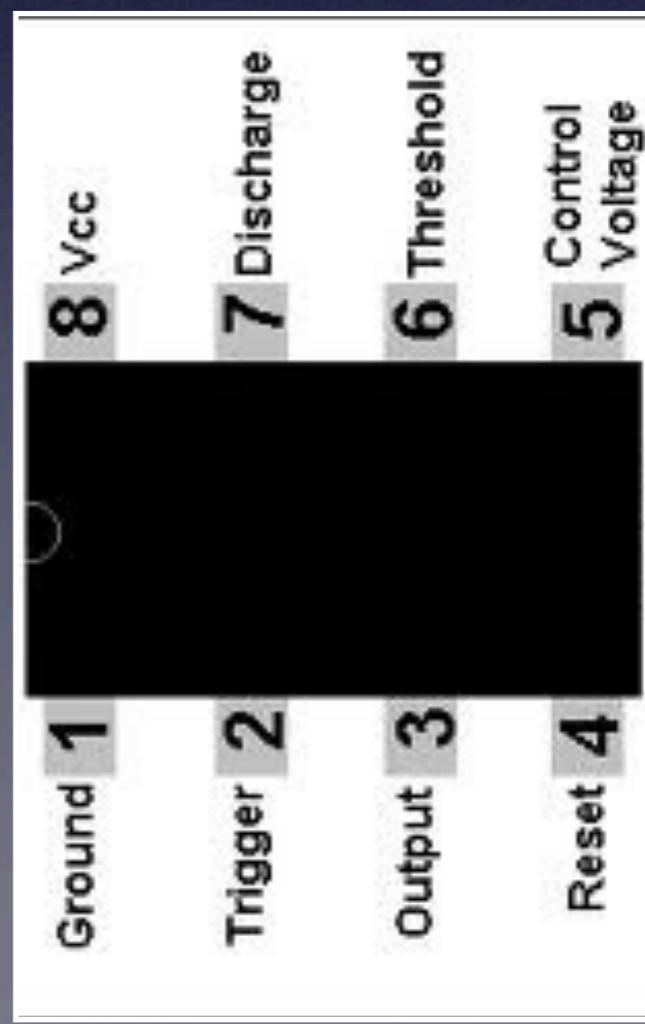
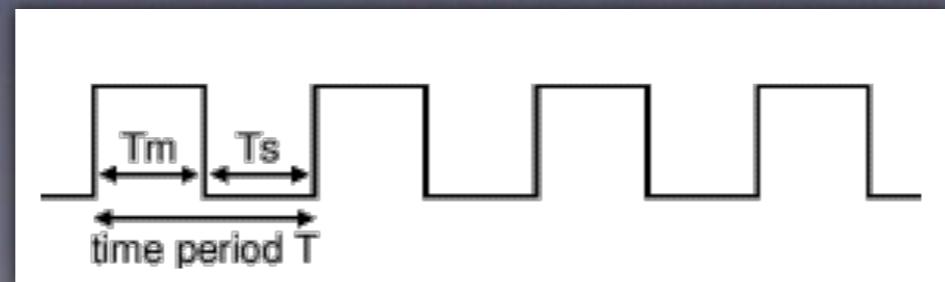
1.67v at base, allows flow between collector to emitter.





SynShop Prototyping

Integrated Circuit - IC
Notch typically goes to the left.
Pin 1 is lower left.
Lots of functionality.
Lots of transistors.
555 is a timer chip.

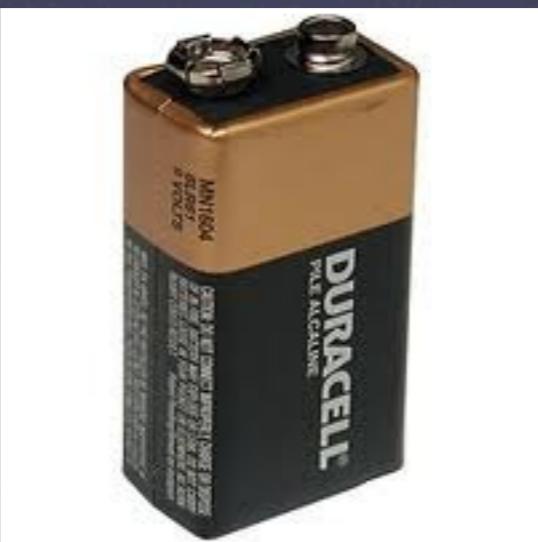




SynShop Prototyping

Battery

**Red + is positive.
Black - is negative.**



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SynShop Prototyping

And now...

Solder Buildup



SynShop

Solder Buildup

Safety First!



SynShop

Solder Buildup

1

**Wear
safety
goggles at
all times.**

**Molten
solder
may fly
and cause
permanent
blindness!**





SynShop

Solder Buildup

2

Be Safe

**Soldering
tip is 700
degrees.**

**NEVER
grab a tip,
even when
off. Parts
and joints
are also
700
degrees!**





SynShop

Solder Buildup

How to Solder!



SynShop

Solder Buildup

1

700

degrees F

A temper-
ature
controlled
iron is
best.





SynShop

Solder Buildup

2

Clean
Tip

Clean tip
by twirling
in brass
tip
cleaner.

Removes
carbon
and
residue.





SynShop

Solder Buildup

3

Wet Tip

Immediately prime the tip by adding a little bit of solder. A dry tip will not conduct heat.





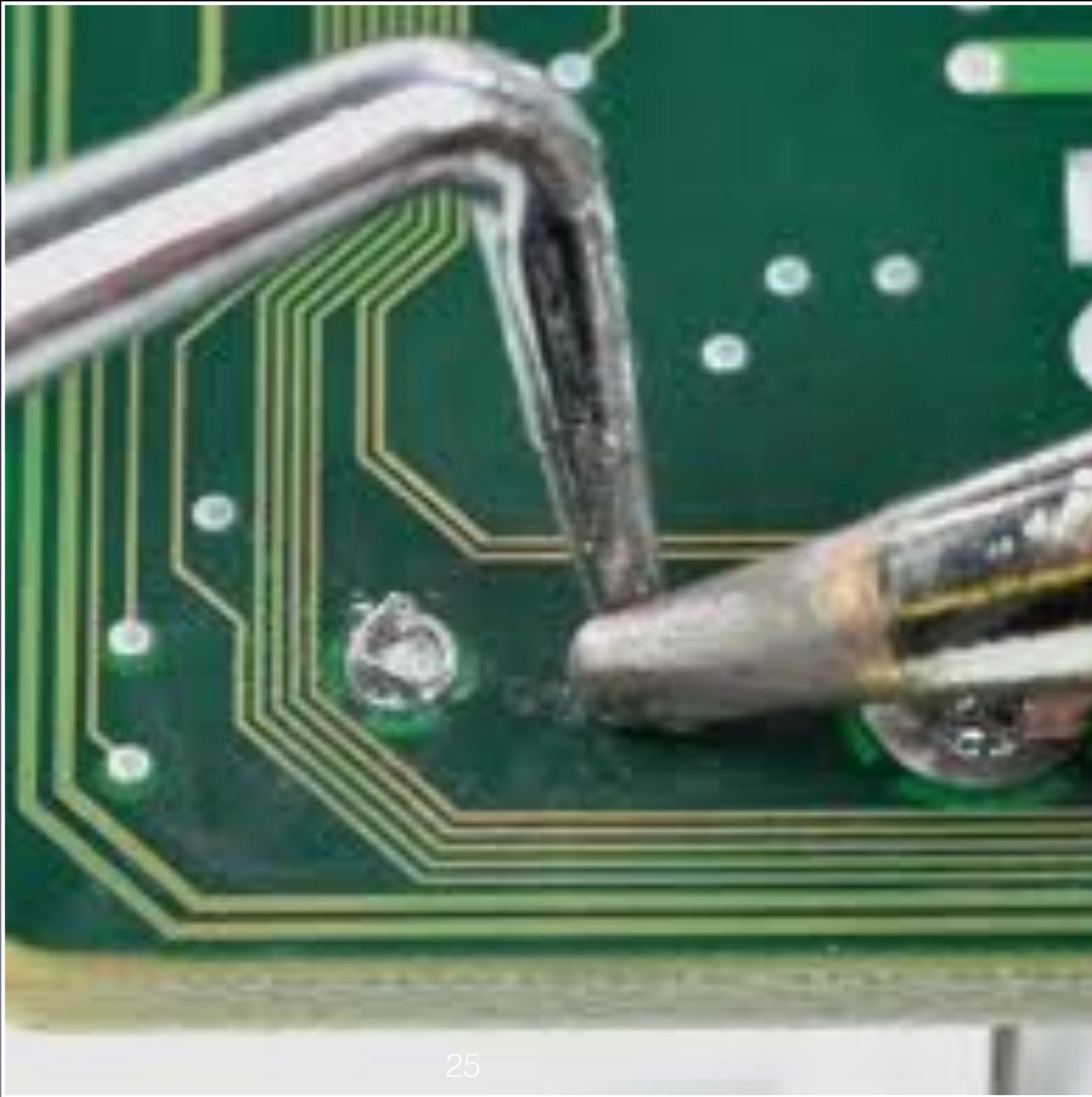
SynShop

Solder Buildup

4

Proper Angle

Hold the iron at 45 degrees. Don't use the point of the tip, but the whole side of the tip.





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Solder Buildup

5

Heat part

**The part
will heat
quickly.**

**Too much
heat will
destroy
the part.
Heat for
1/2-1
second.**





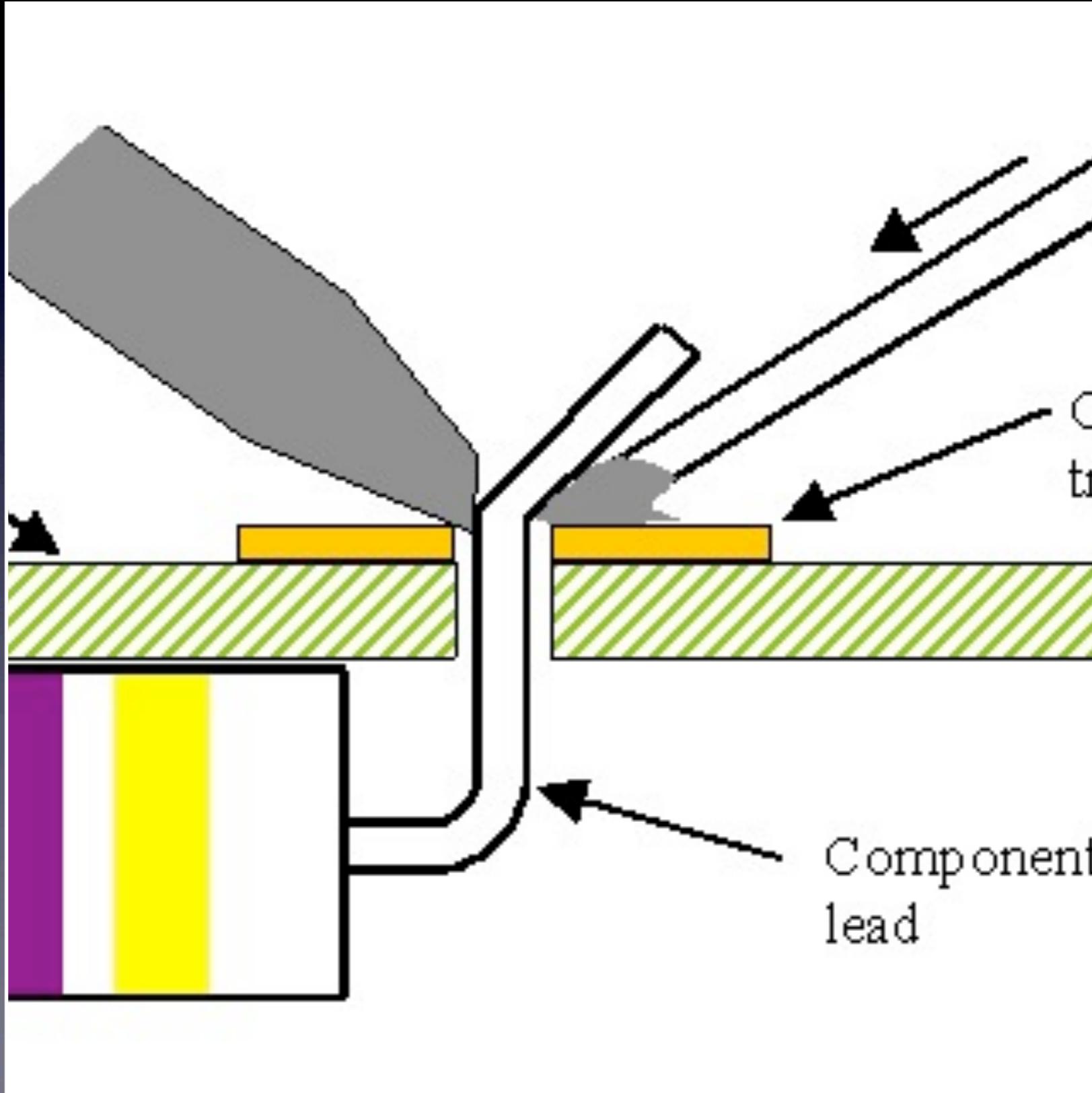
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Solder Buildup

6

Apply Solder

Add solder from the opposite side of the tip. The part will draw in the solder.





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Solder Buildup

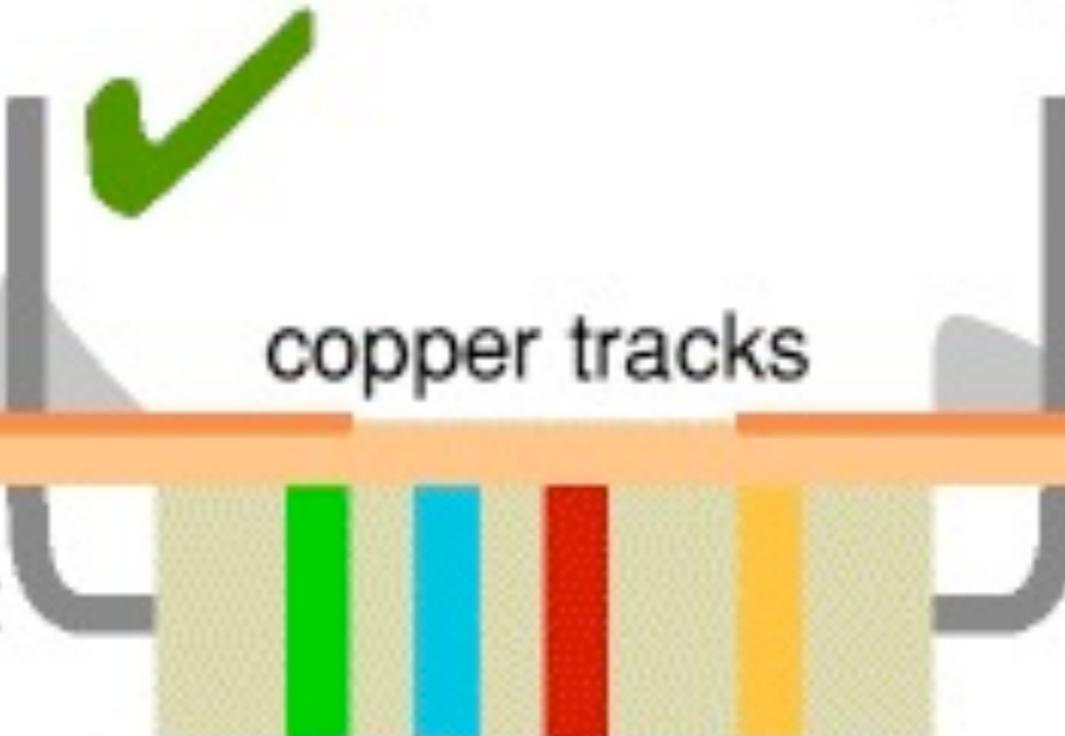
7

Dome

We are looking for nice dome shapes. If it isn't a dome, reheat, add more solder if needed.

GOOD JOINT

(volcano shape)



BAD JOINT

(dry joint)

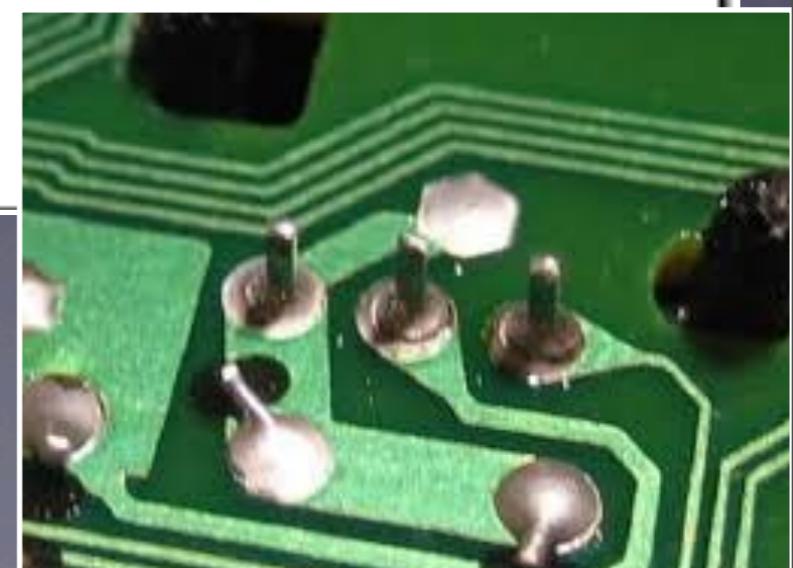


dull solder

PCB or stripboard



component





SynShop

Solder Buildup

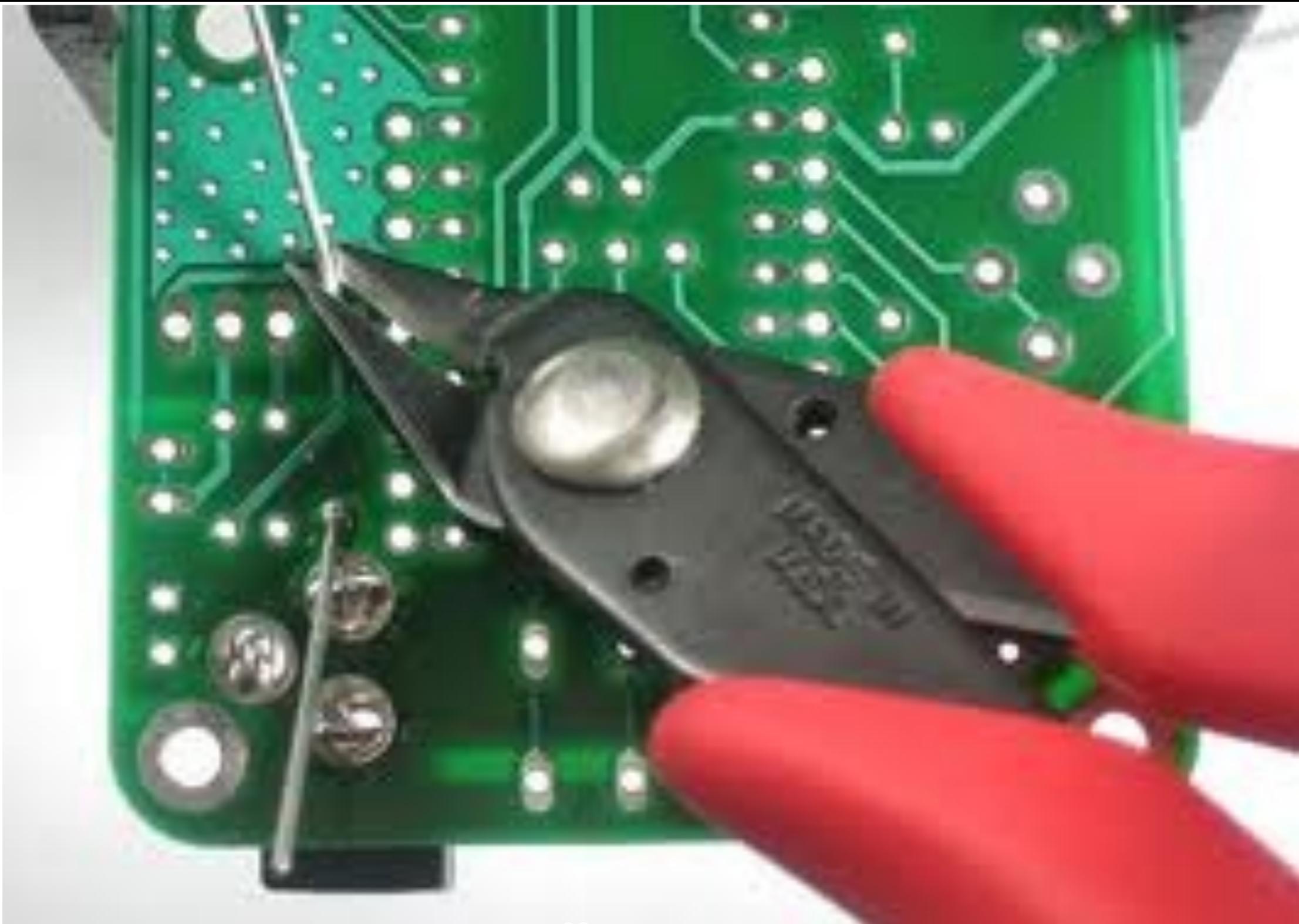
8

Clip

**Lastly clip
the lead
just above
the joint.**

**Do not
clip
through
solder.**

**Hold lead,
don't let it
fly.**





SynShop

Solder Buildup

9

**Keep Tip
Clean**

**Carbon
will
naturally
form on
the tip,
prevents
solder
from
adhering.**





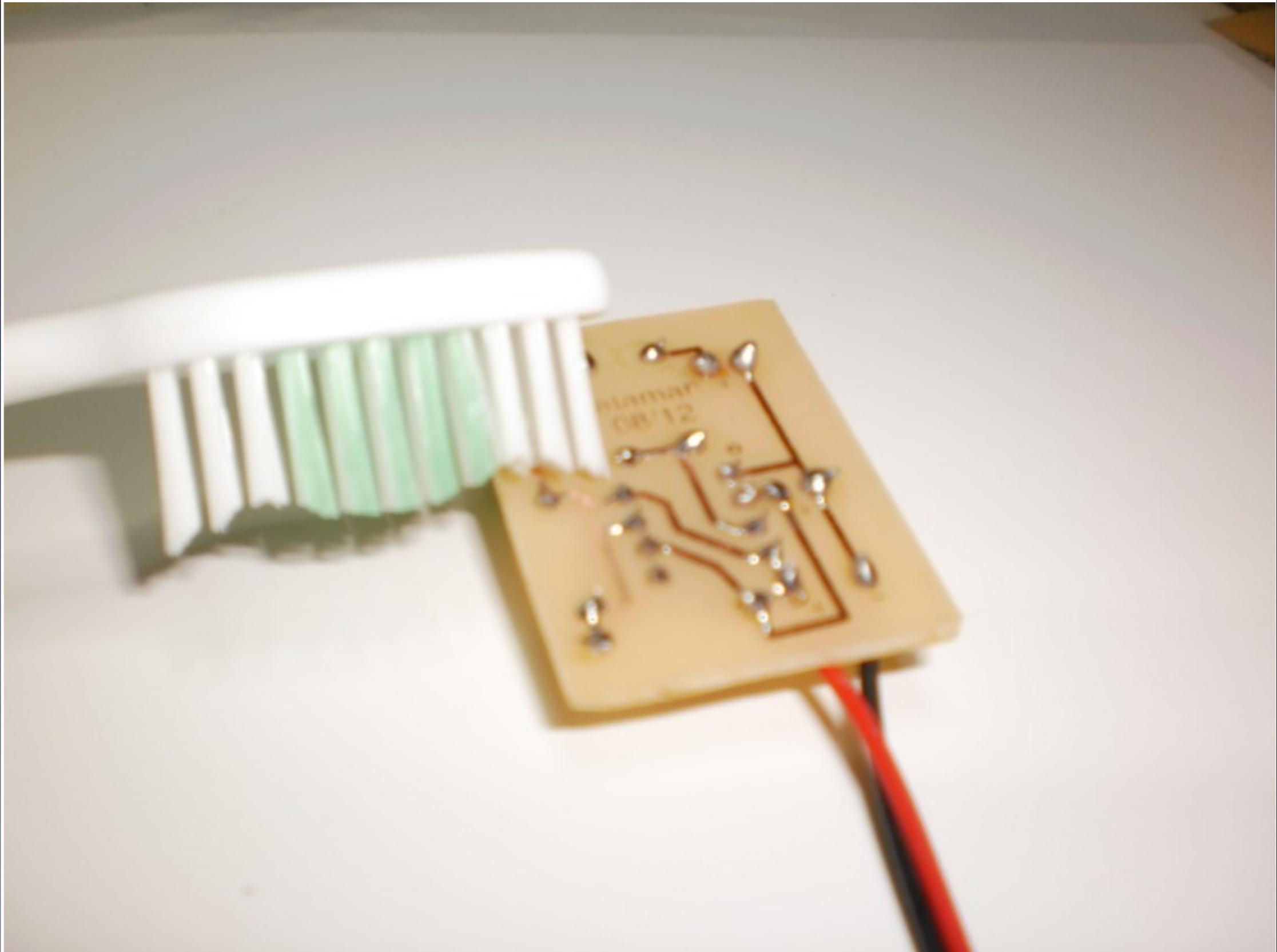
SynShop

Solder Buildup

10

**Alcohol
wash the
board.**

**Flux will
continue
to eat til
removed.**





SynShop

Solder Buildup

Steps to a good solder joint.

- 1) Safety Goggles**
- 2) Be safe**
- 3) 700 degrees F**
- 4) Clean tip**
- 5) Wet tip**
- 6) Proper angle**
- 7) Heat part and joint**
- 8) Solder joint not the tip**
- 9) Make a dome**
- 10) Clip above joint**
- 11) Clean tip**
- 12) Alcohol wash**





SynShop
Solder Buildup

Lead Poisoning

No safe limit

Do not touch

Mouth Hands Nose
wash Hands



SynShop
Solder Buildup

How much
Solder?
Nice Volcanos!
Can you see
light through it?



SynShop
Solder Buildup

**Slide Iron Up
the wire!
Uses up the
Solder... -Claire.**



SynShop Prototyping

Let's see that in action





SynShop Solder Buildup

LED Tester!



SynShop Solder Buildup

Led Tester

To practice what we've leaned we are going to solder a very simple project with 3 main components.

Go slow and don't glop!



SynShop

Solder Buildup

1

**Start with
proto-
board
copper
part facing
table.**



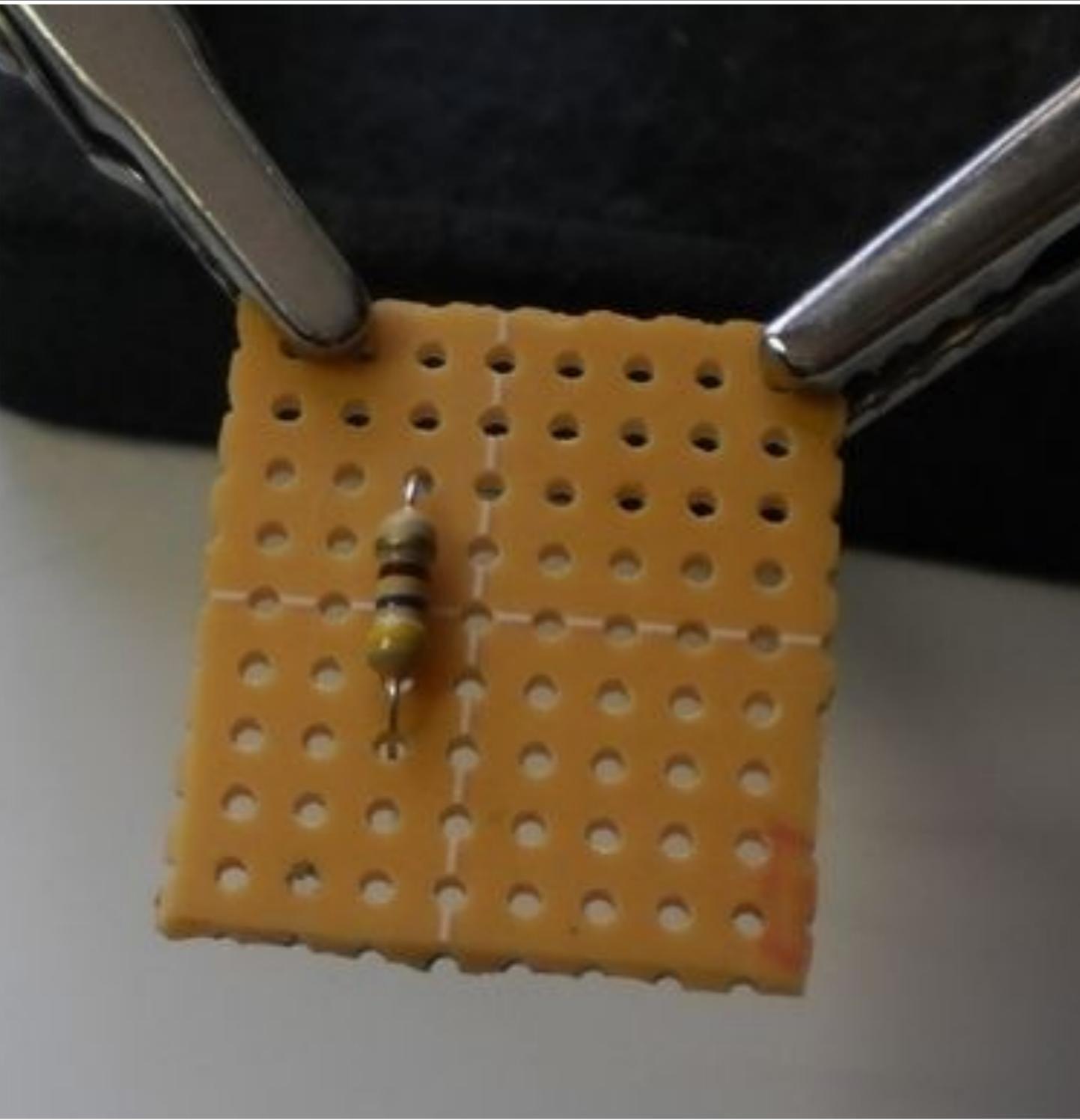


SynShop

Solder Buildup

2

**Place
resistor as
shown. Do
not clip
leads.**



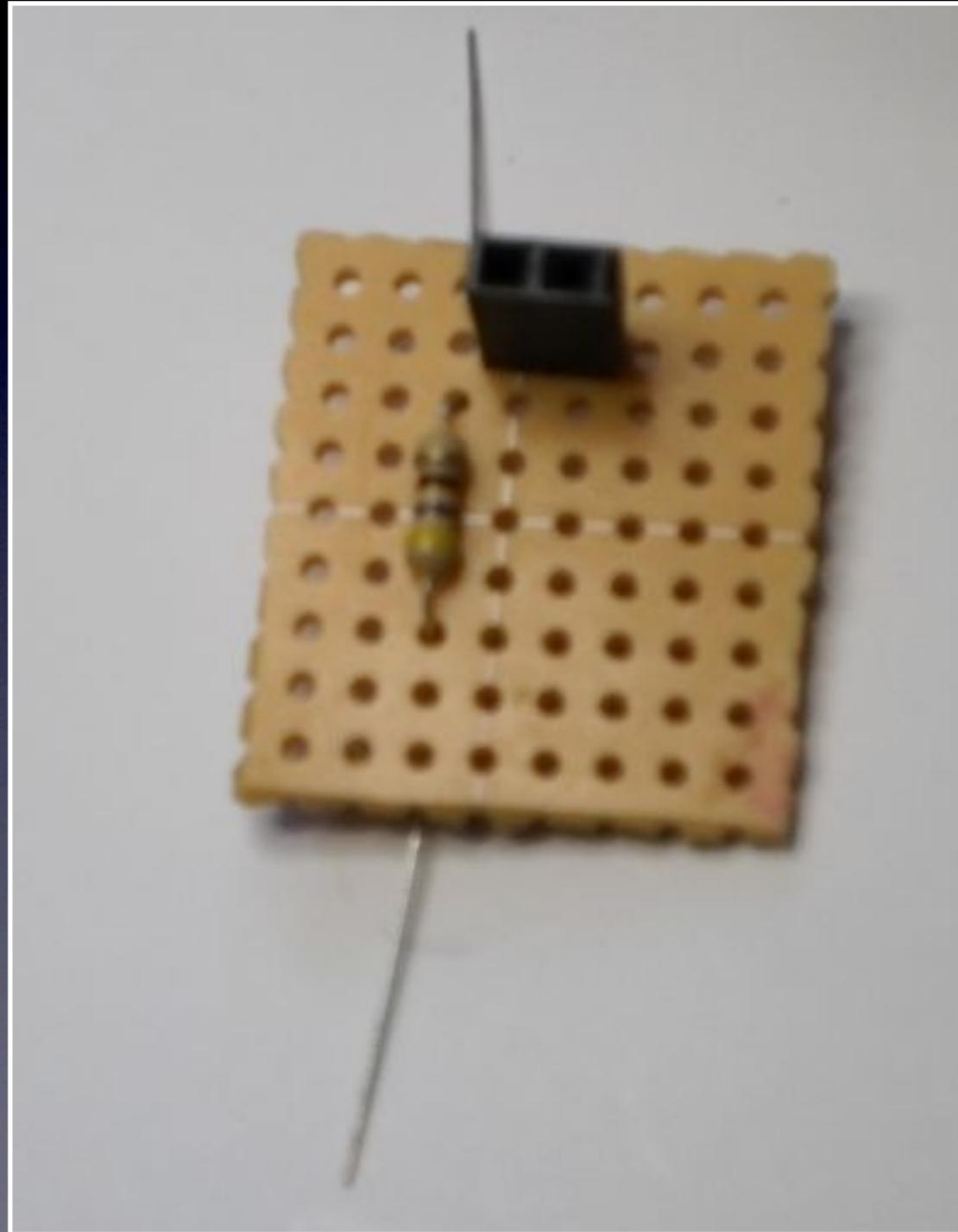


SynShop

Solder Buildup

3

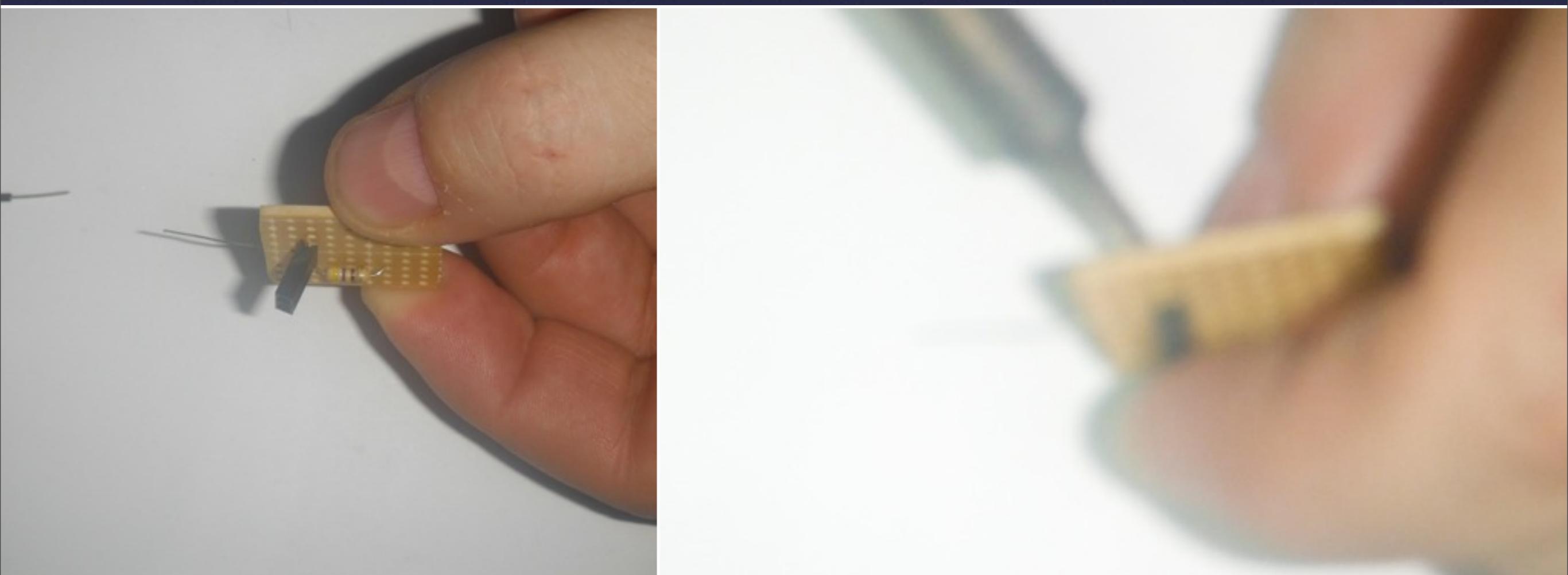
**Place and
solder 2
pin female
header as
shown.**





SynShop
Solder Buildup

Interrupt: The Align the Pins Trick



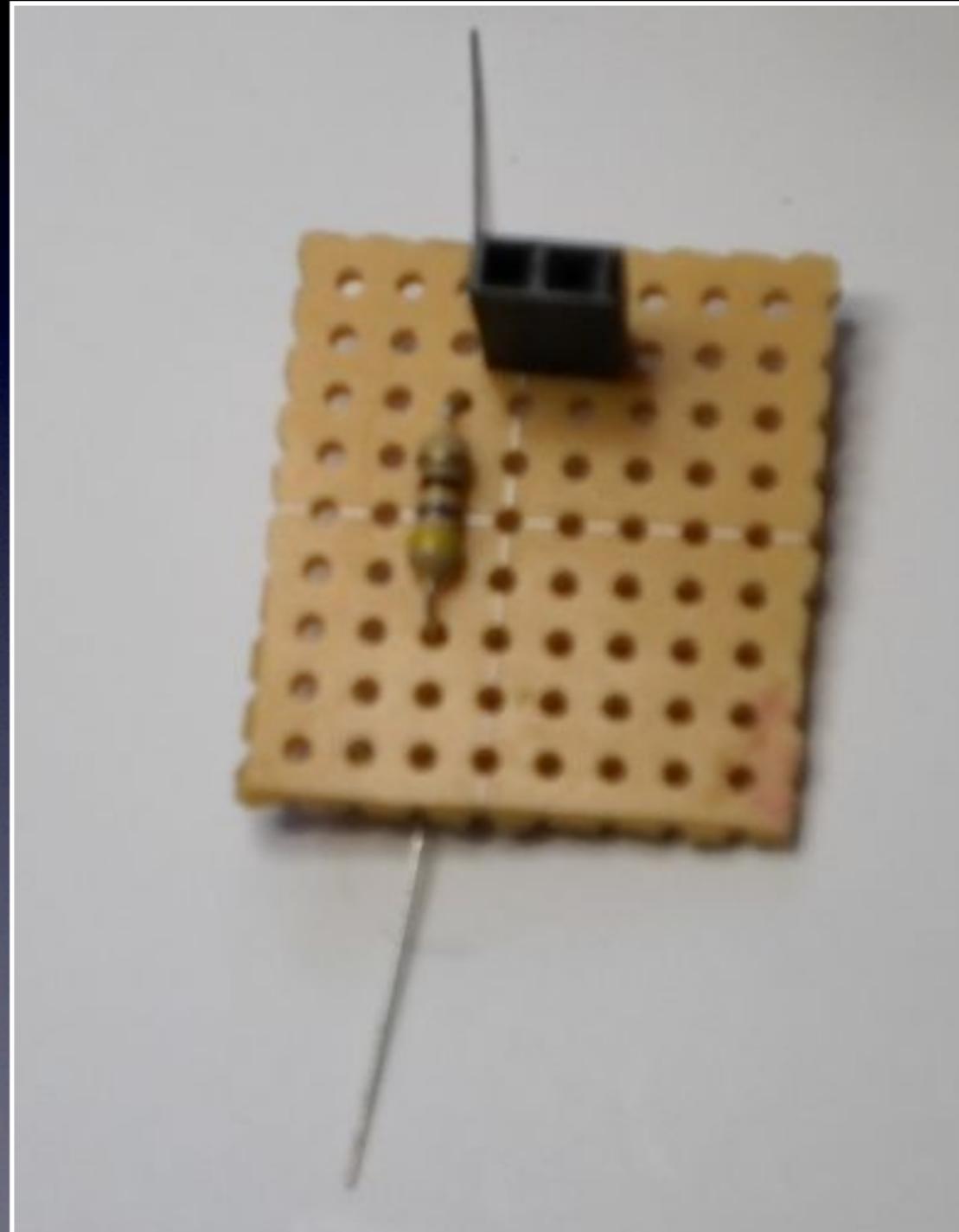


SynShop

Solder Buildup

3

**Place and
solder 2
pin female
header as
shown.**



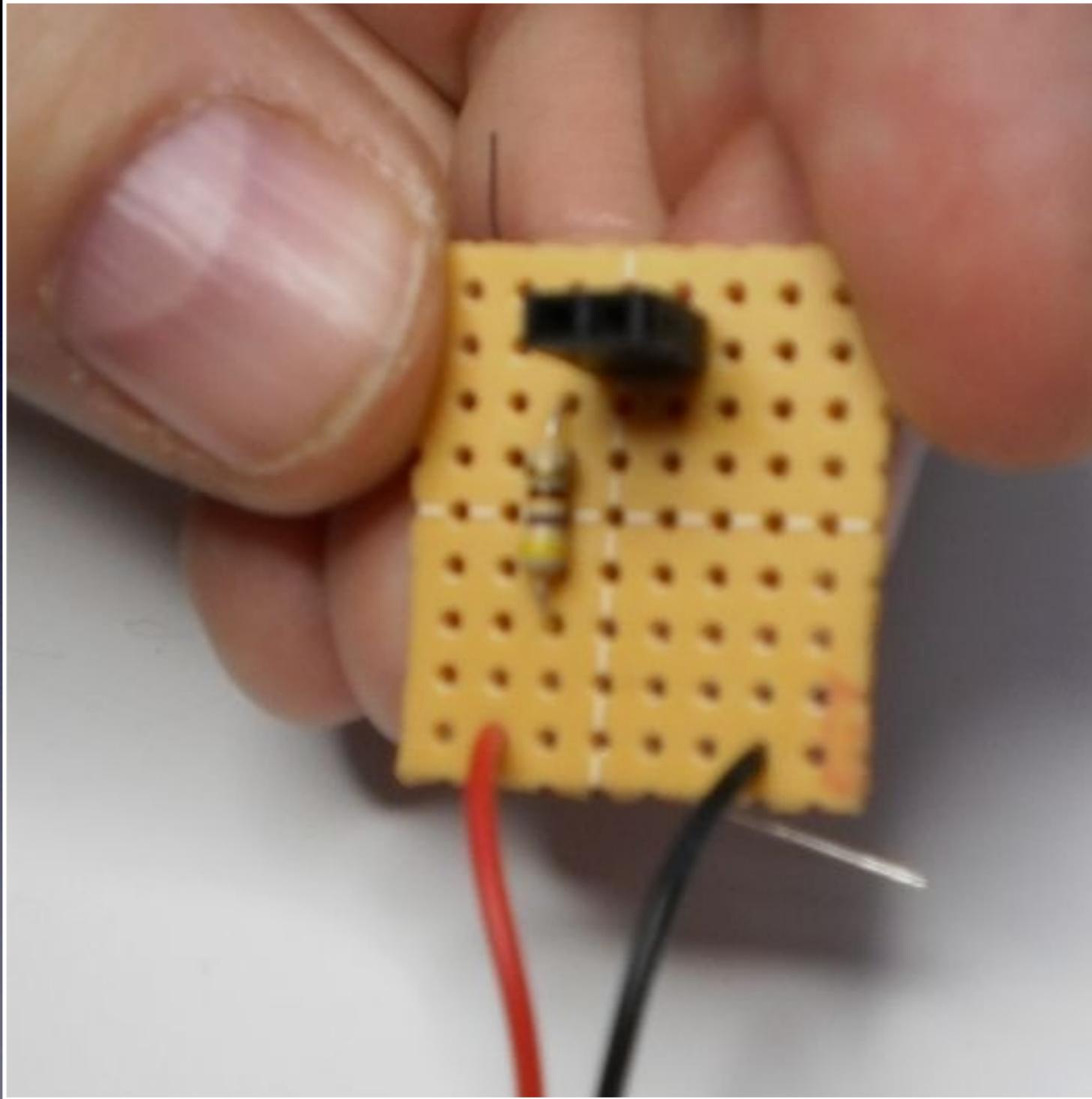


SynShop

Solder Buildup

4

**Place and
solder
battery
clip as
shown.**



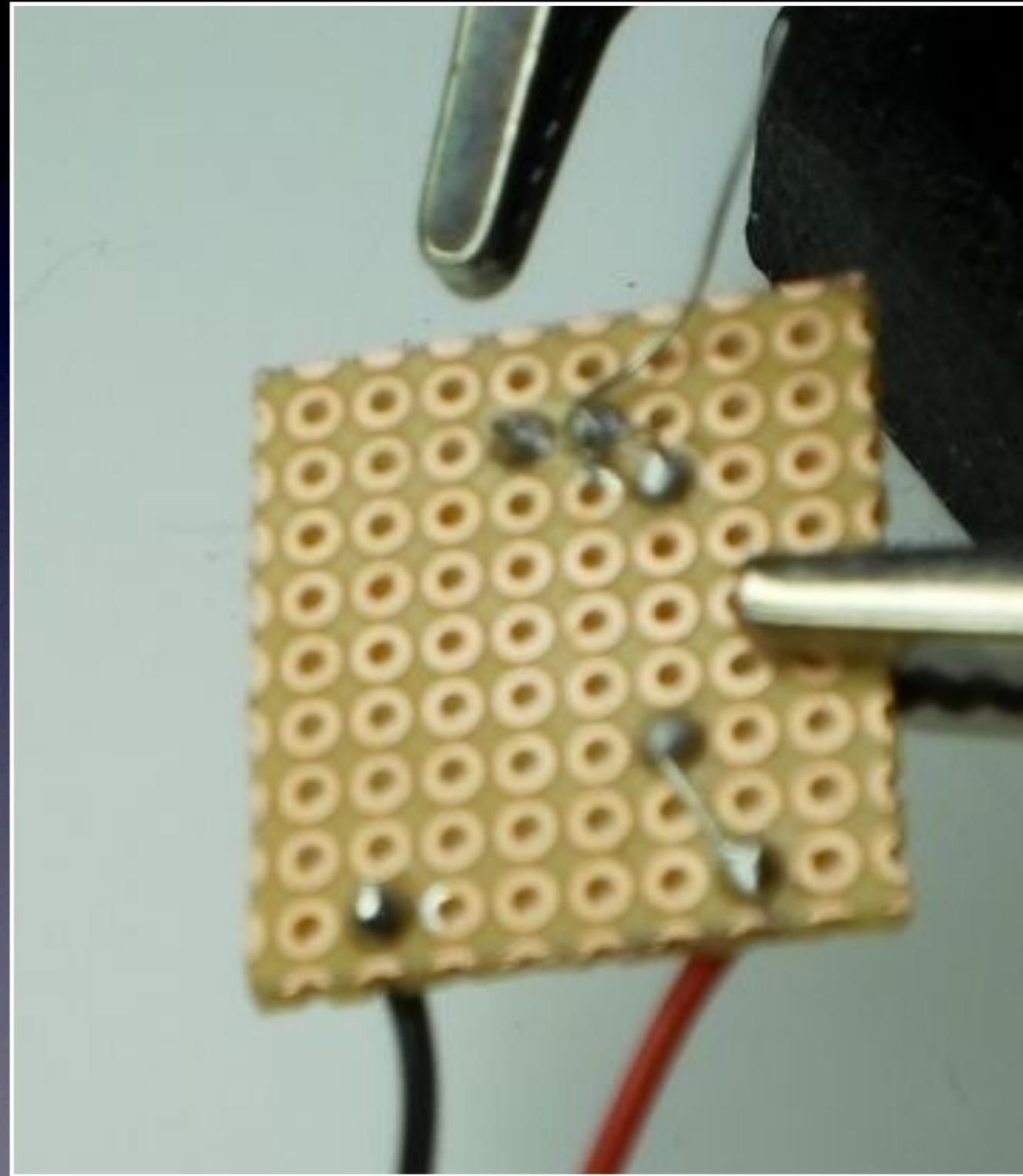


SynShop

Solder Buildup

5

**Working
from the
bottom
side now,
extend
resistor
legs to
positive
lead and
solder.**



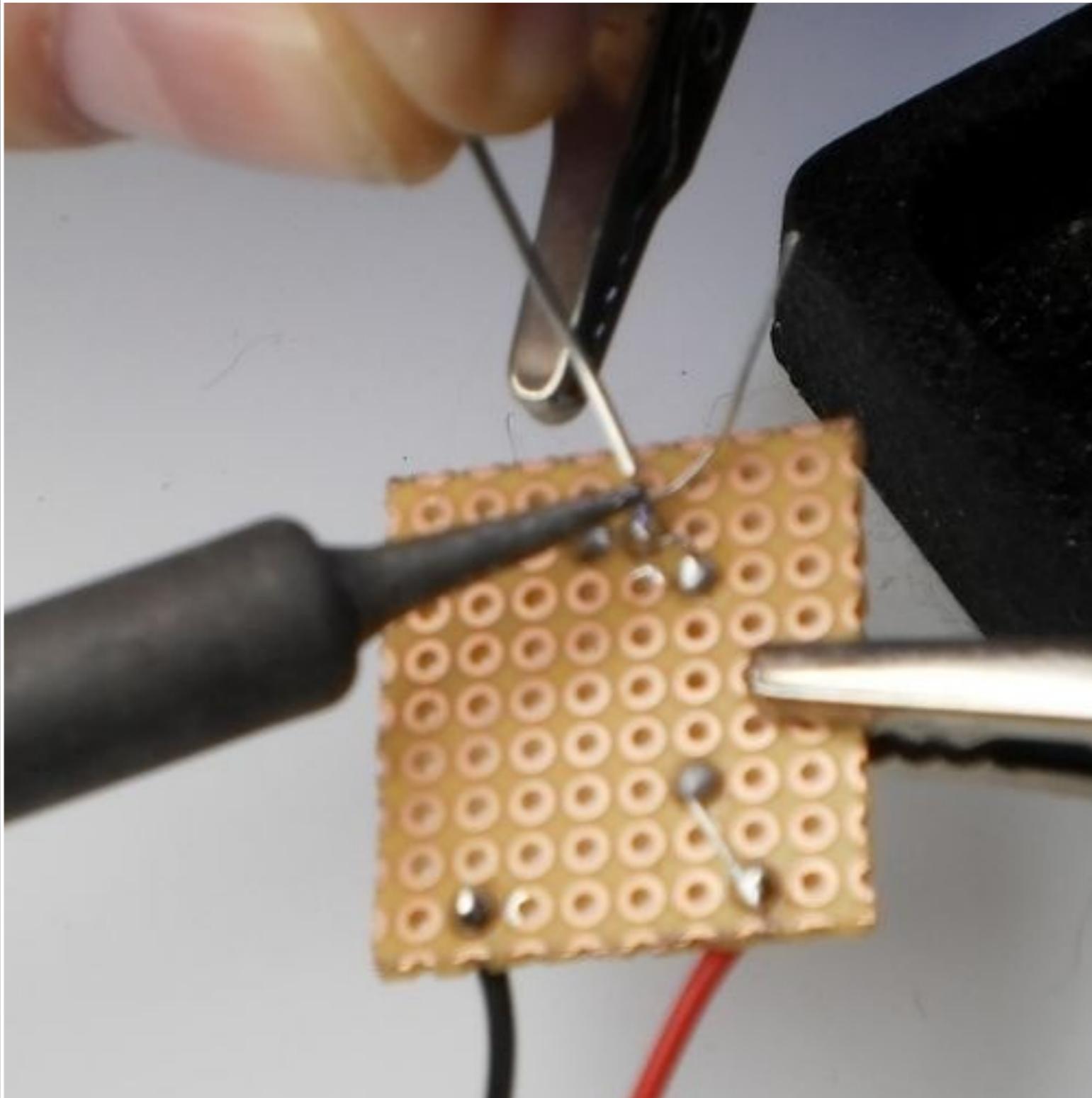


SynShop

Solder Buildup

6

**Solder
remaining
lead to
one side
of two pin
header.**



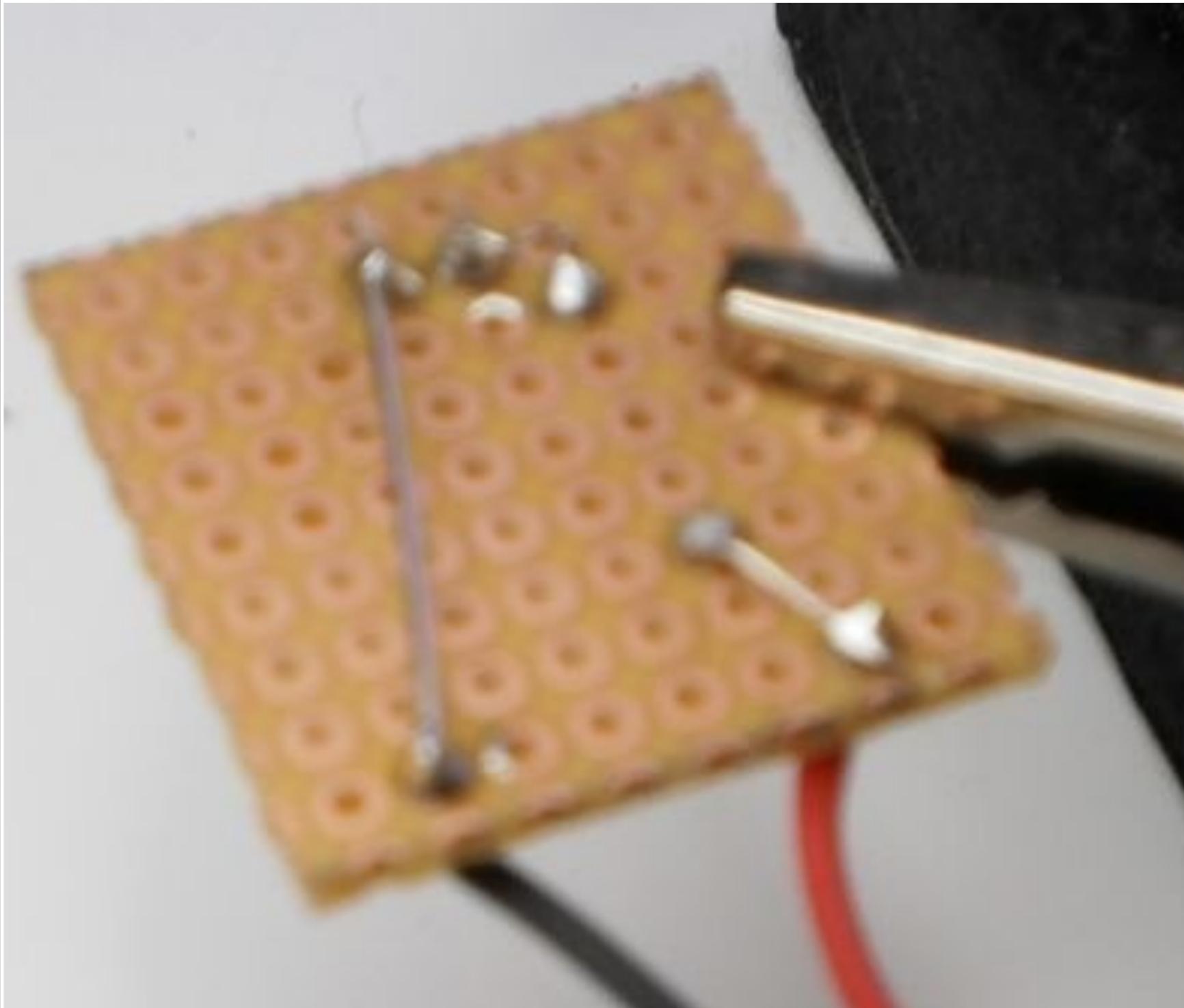


SynShop

Solder Buildup

7

**Solder
jumper
from two
pin header
to positive
lead.**



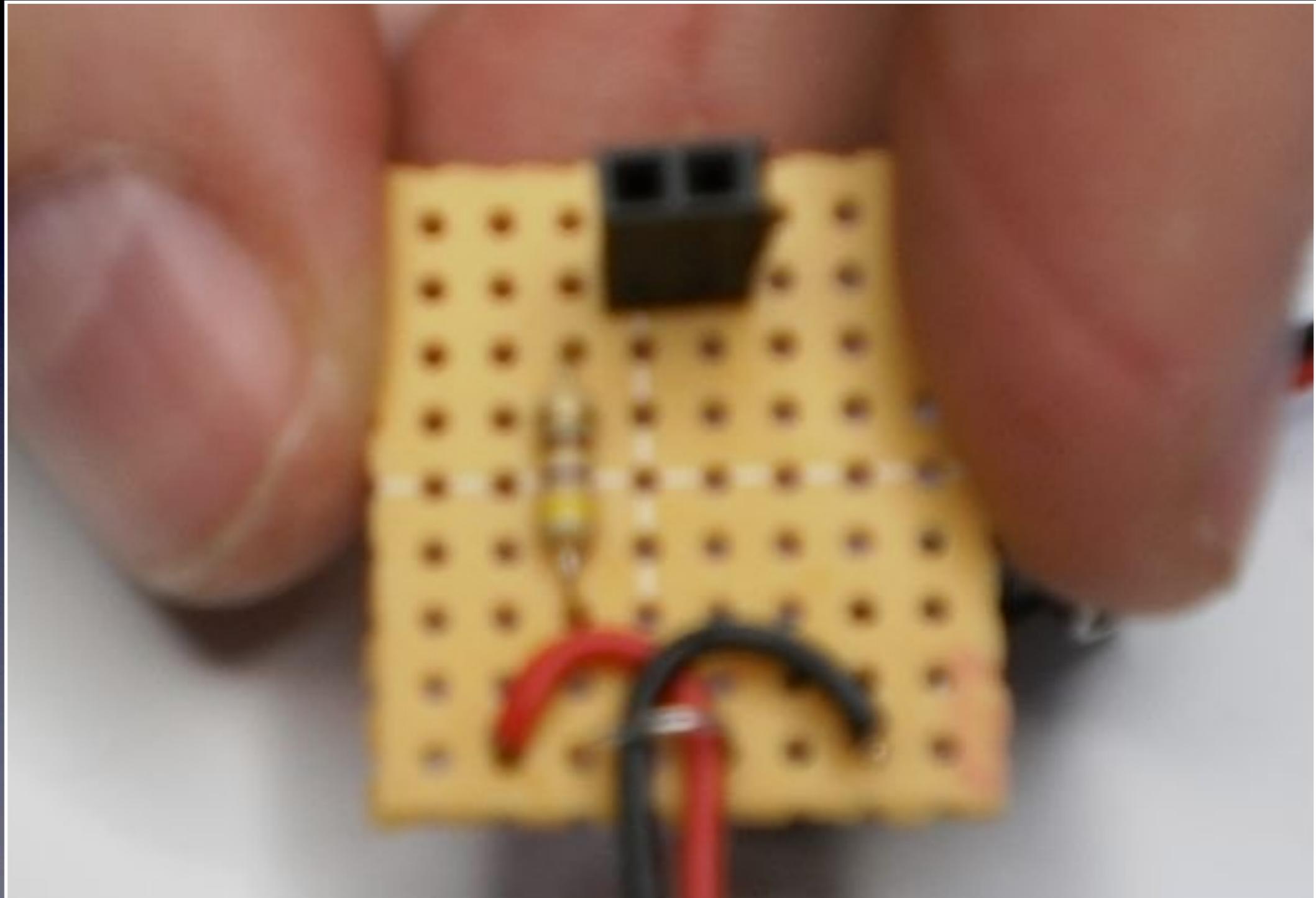


SynShop

Solder Buildup

8

**Add strain
relief as
shown.
Solder in
place.**





SynShop

Solder Buildup

9

Connect
battery
and place
led long
leg into
the right
hole, short
leg into
left hole.

Led
should
light.





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Solder Buildup

10

Reverse
the LED.
LED
should
turn off.





SynShop Solder Buildup

You now have an
**excellent LED
tester.**



SynShop

Solder Buildup

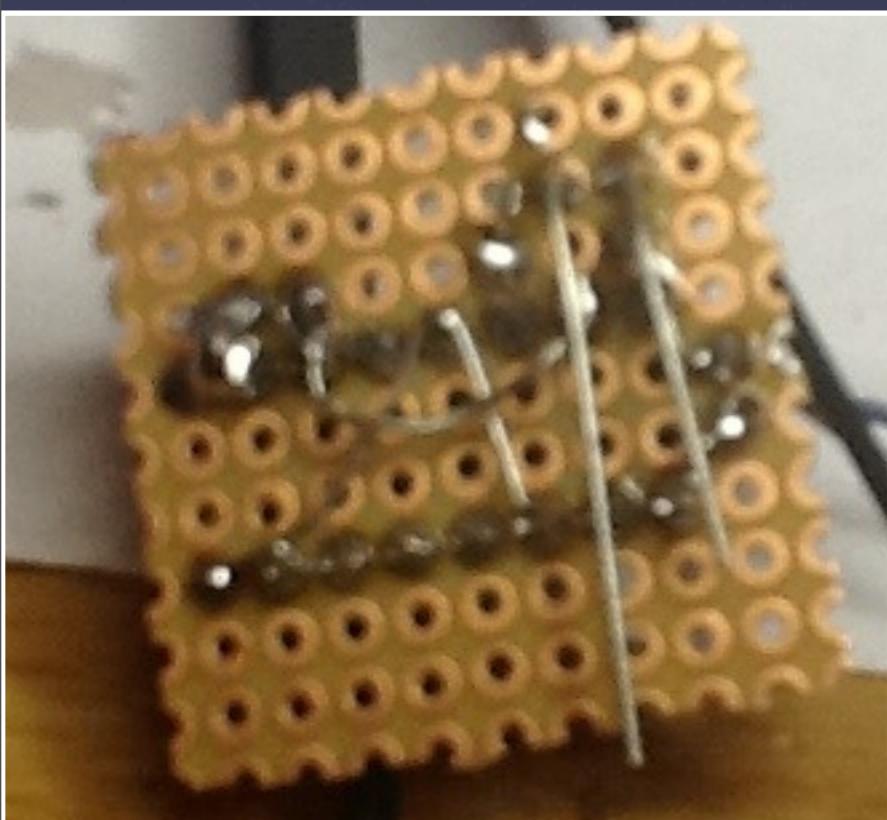
Remove battery.



SynShop

Solder Buildup

Protoboards are great for one of a kind proof of concepts, but quickly get messy.

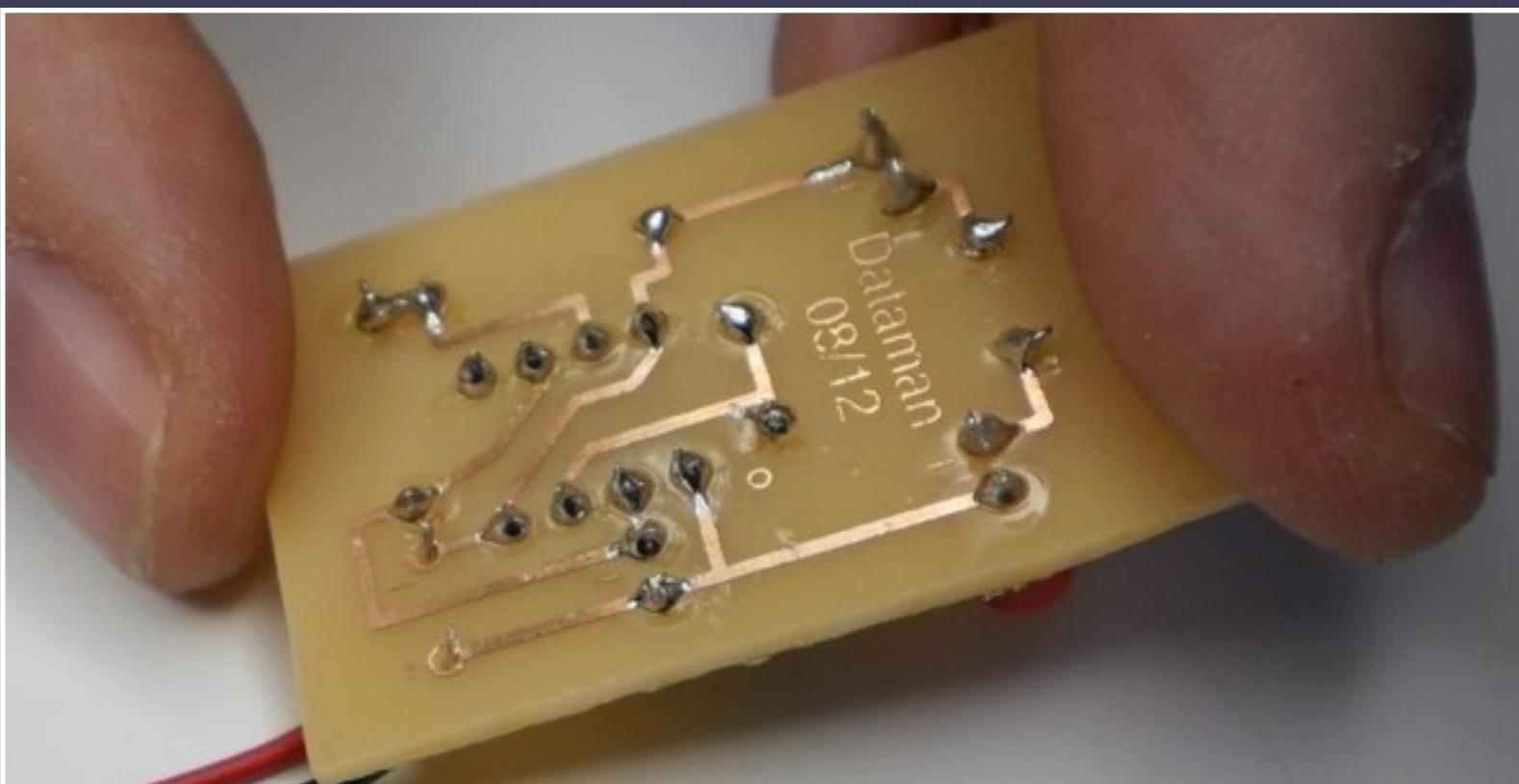




SynShop

Solder Buildup

The next logical step is PCBs. All the connections are already made.

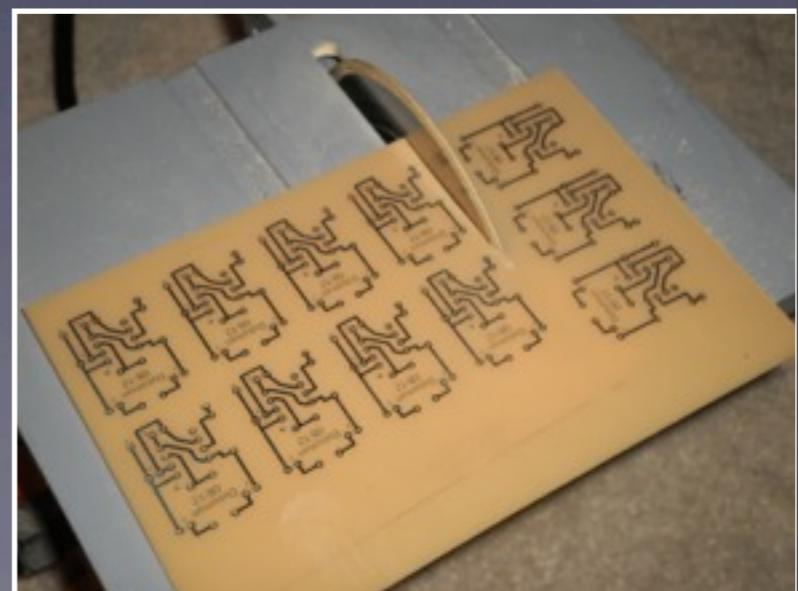
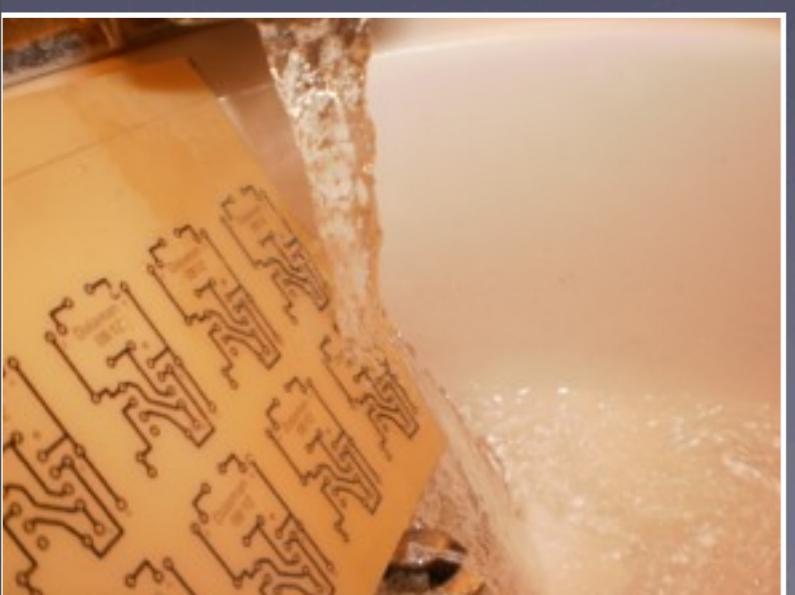




SynShop

Solder Buildup

I learned how to make PCBs at home 3 years ago. It's cheap and simple.





SynShop
Solder Buildup

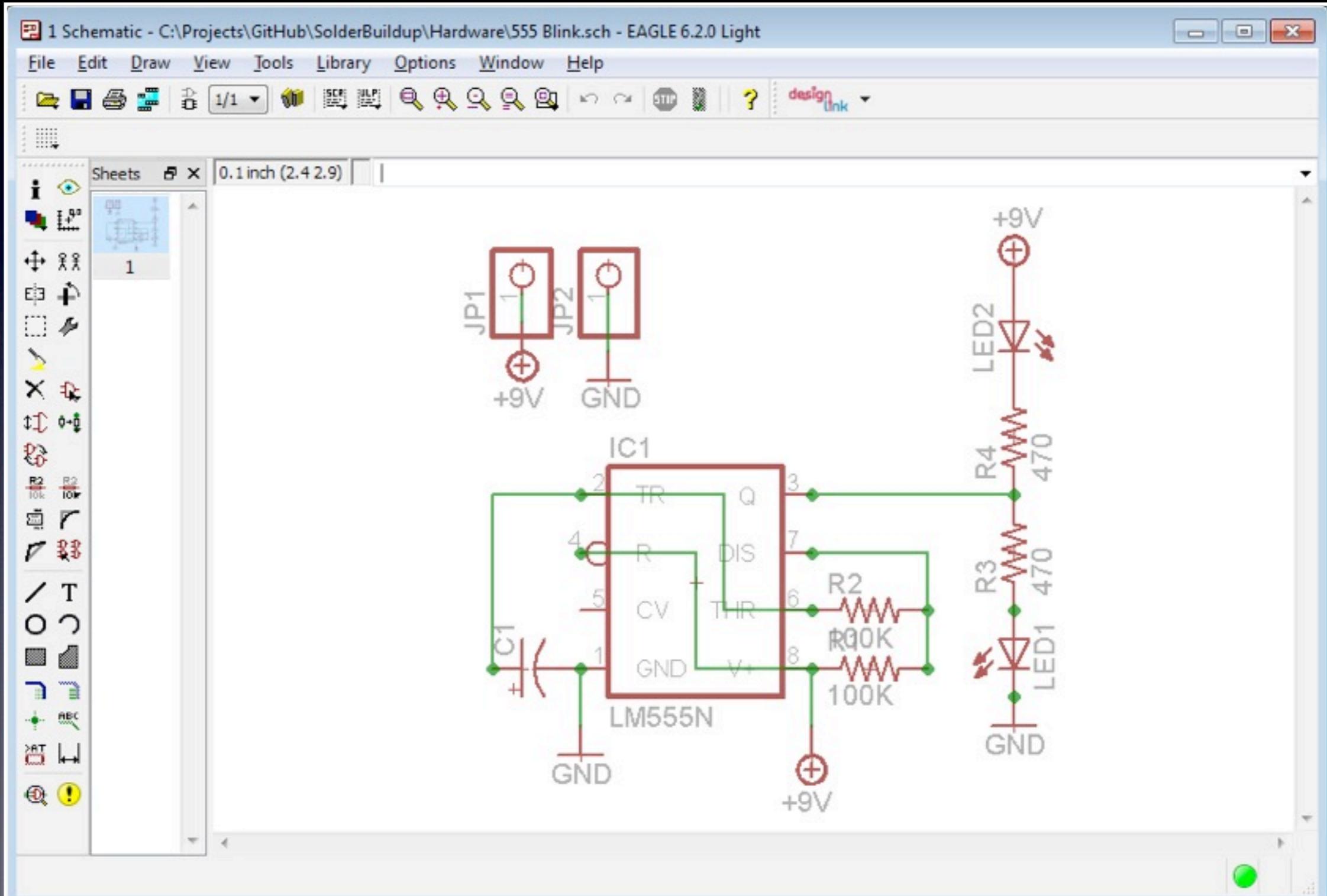
How to make PCBs!



SynShop Solder Buildup

1

Design the
schematic
in
EagleCad.



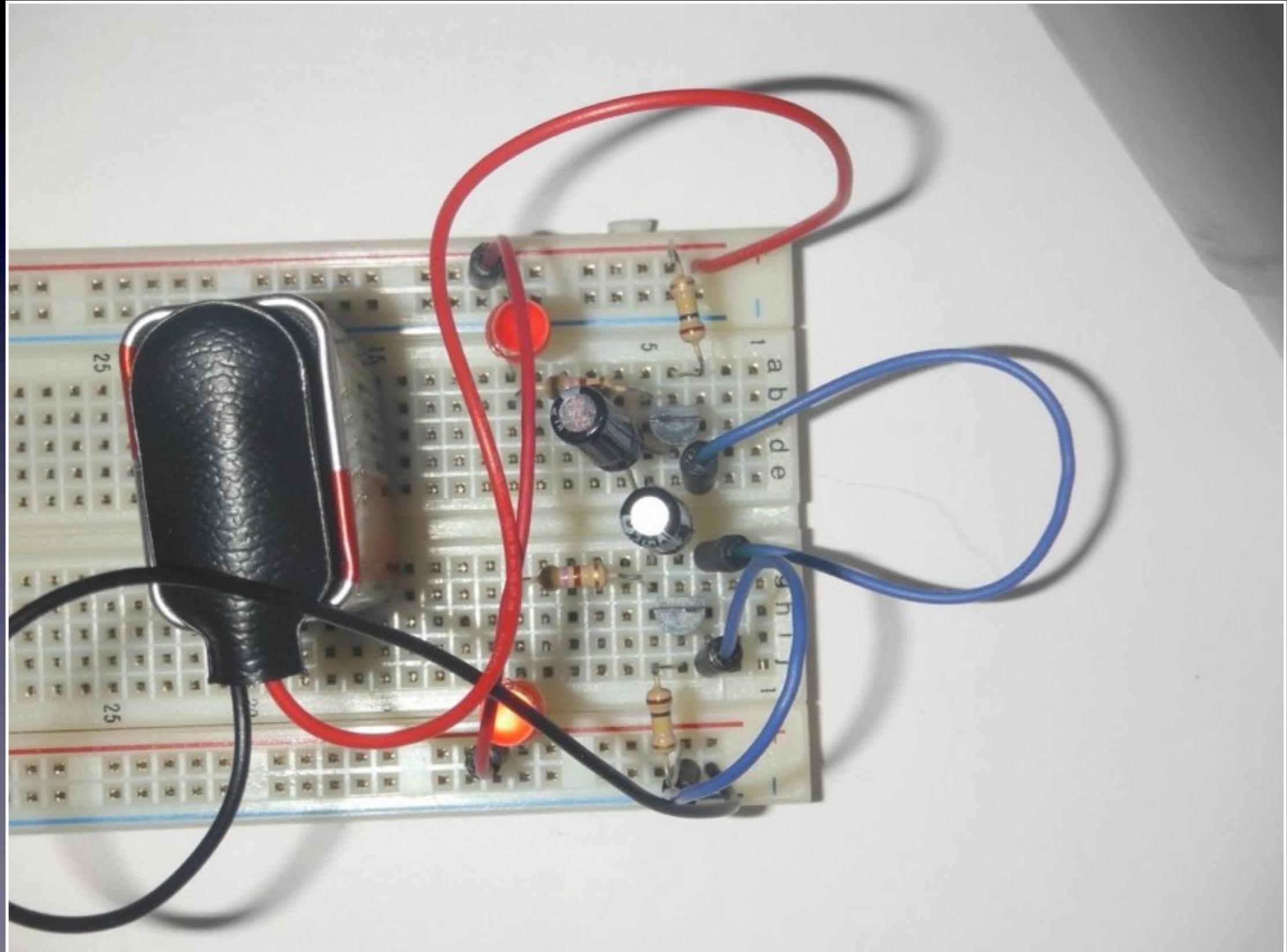


SynShop

Solder Buildup

2

Test the circuit using a breadboard.

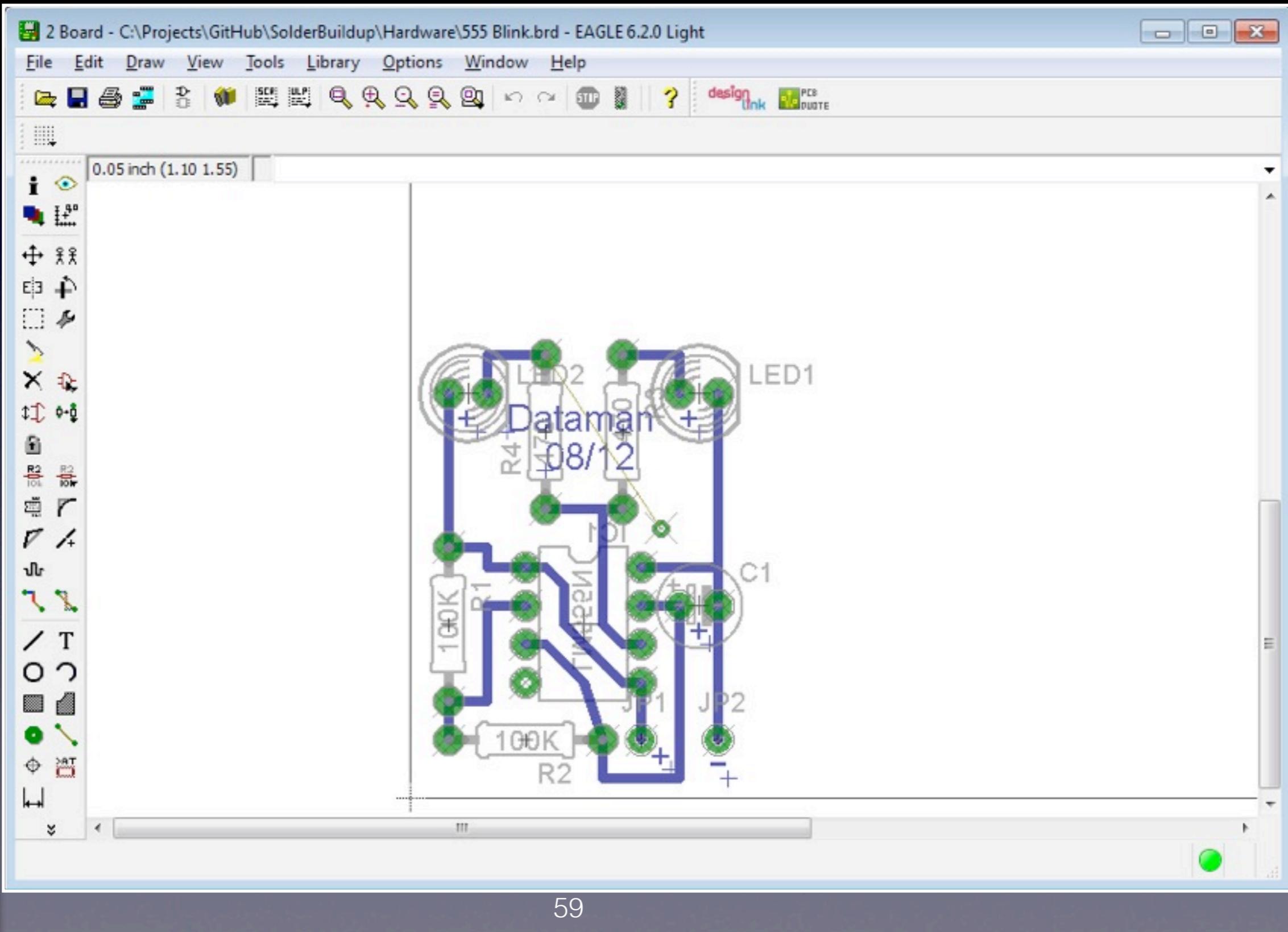




SynShop Solder Buildup

3

Layout board

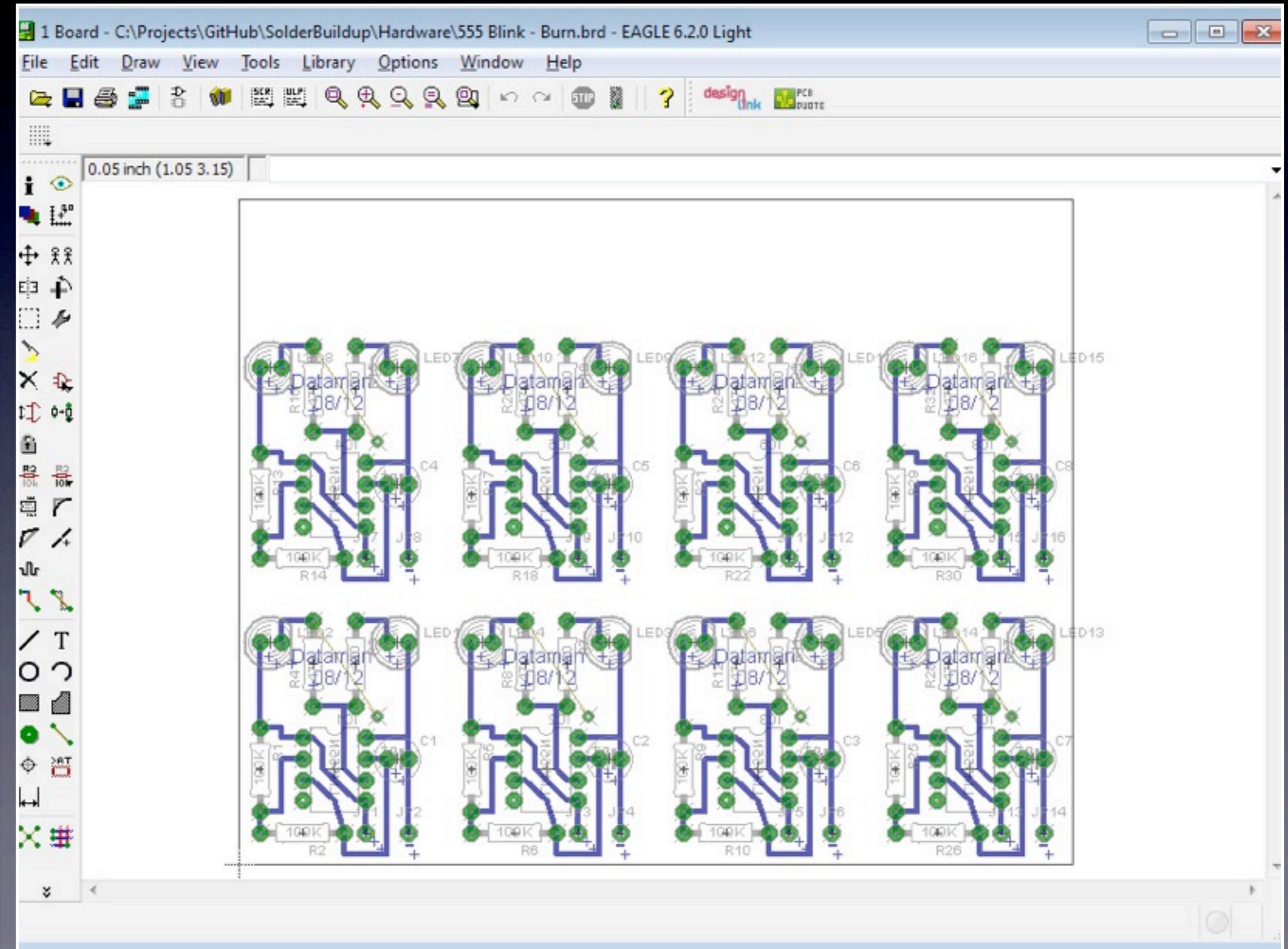




SynShop Solder Buildup

4

Replicate
the design
into a
burn
layout.



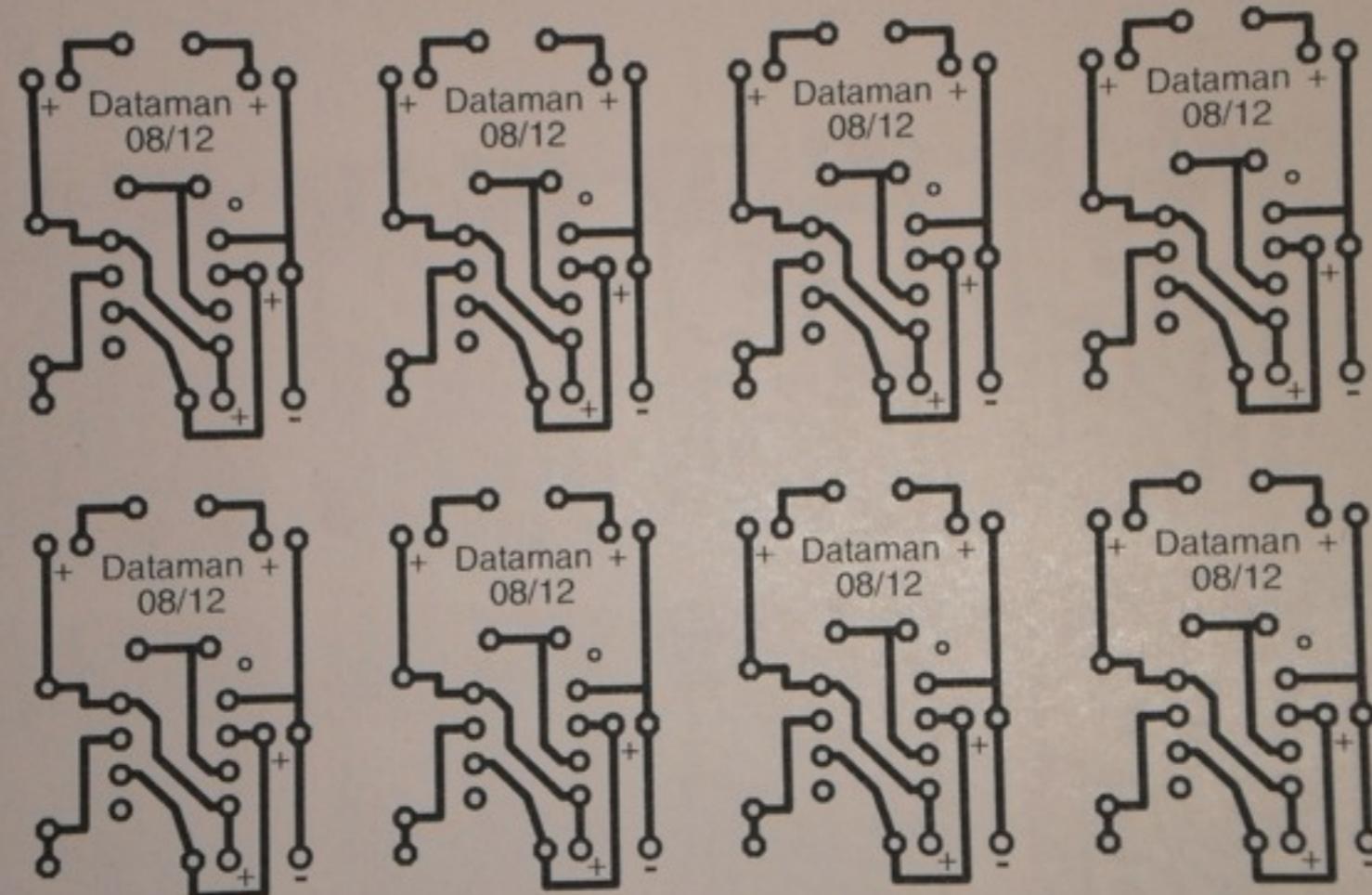


SynShop

Solder Buildup

5

**Print tops,
bottoms,
pads, vias
onto
trans-
parency.**



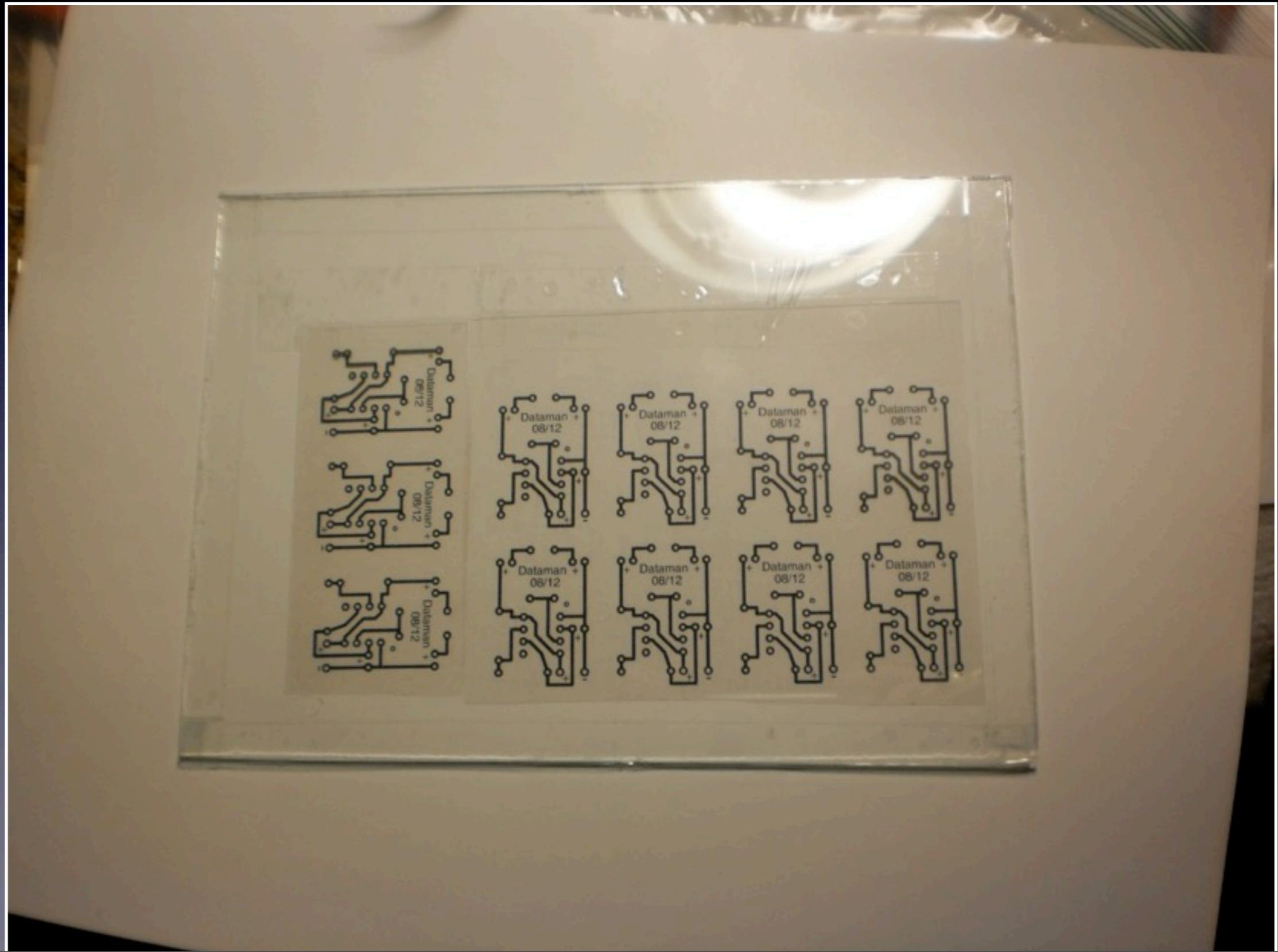


SynShop

Solder Buildup

6

Layout
trans-
parency
on board.



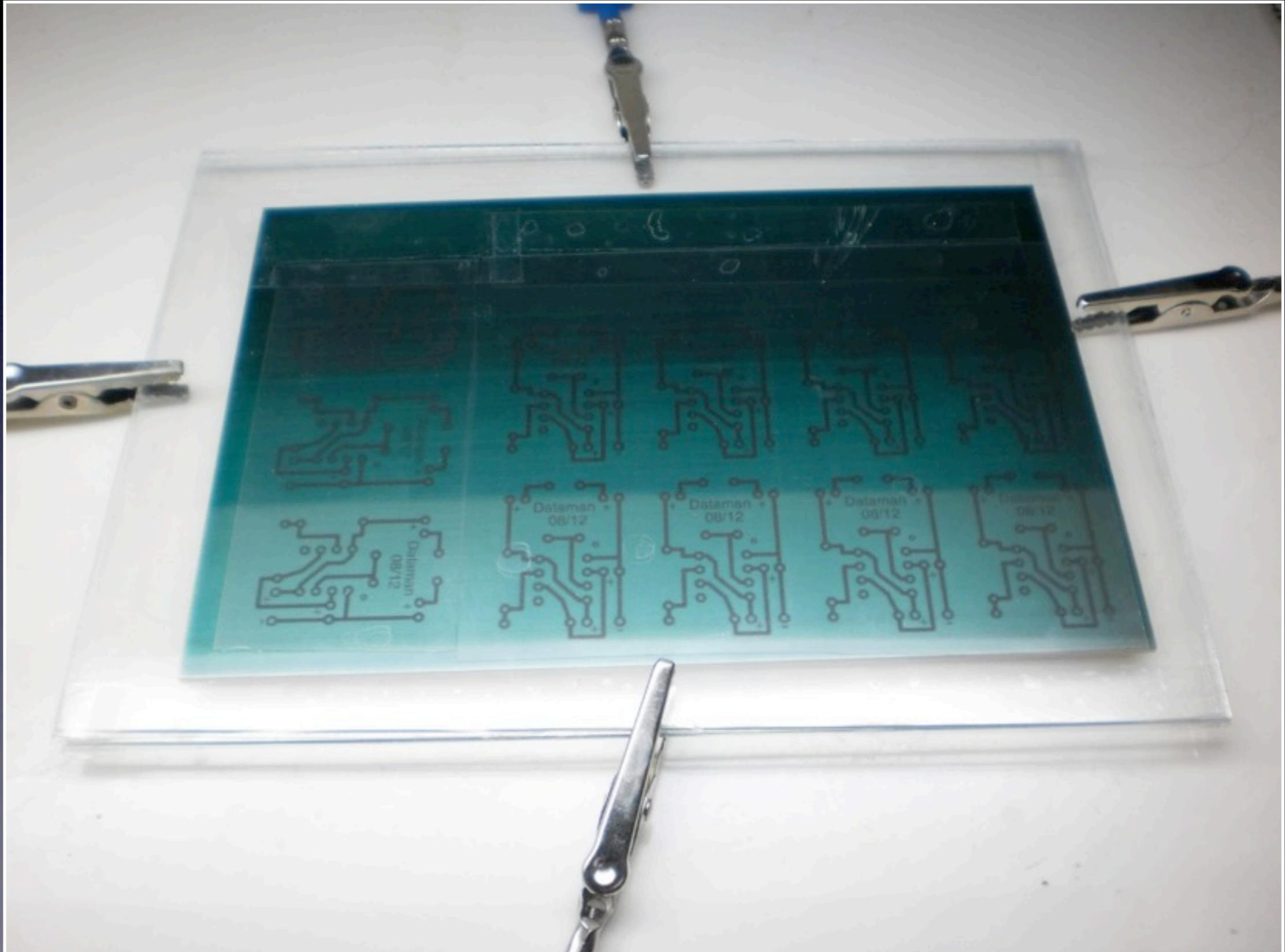


SynShop

Solder Buildup

7

**Remove
protective
layer and
expose for
12
minutes.**



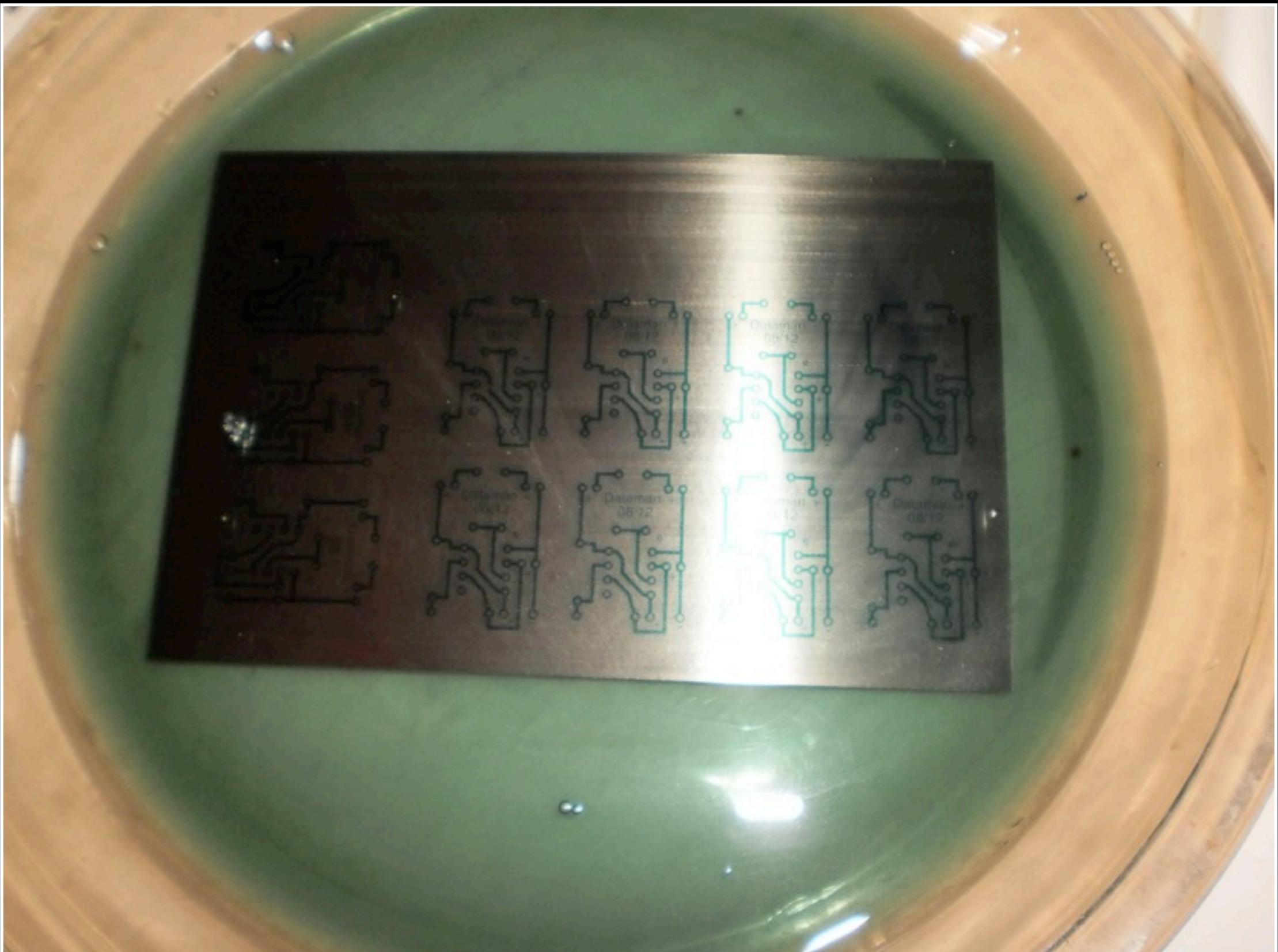


SynShop

Solder Buildup

8

Develop.
Green dye
is
removed,
copper is
exposed.



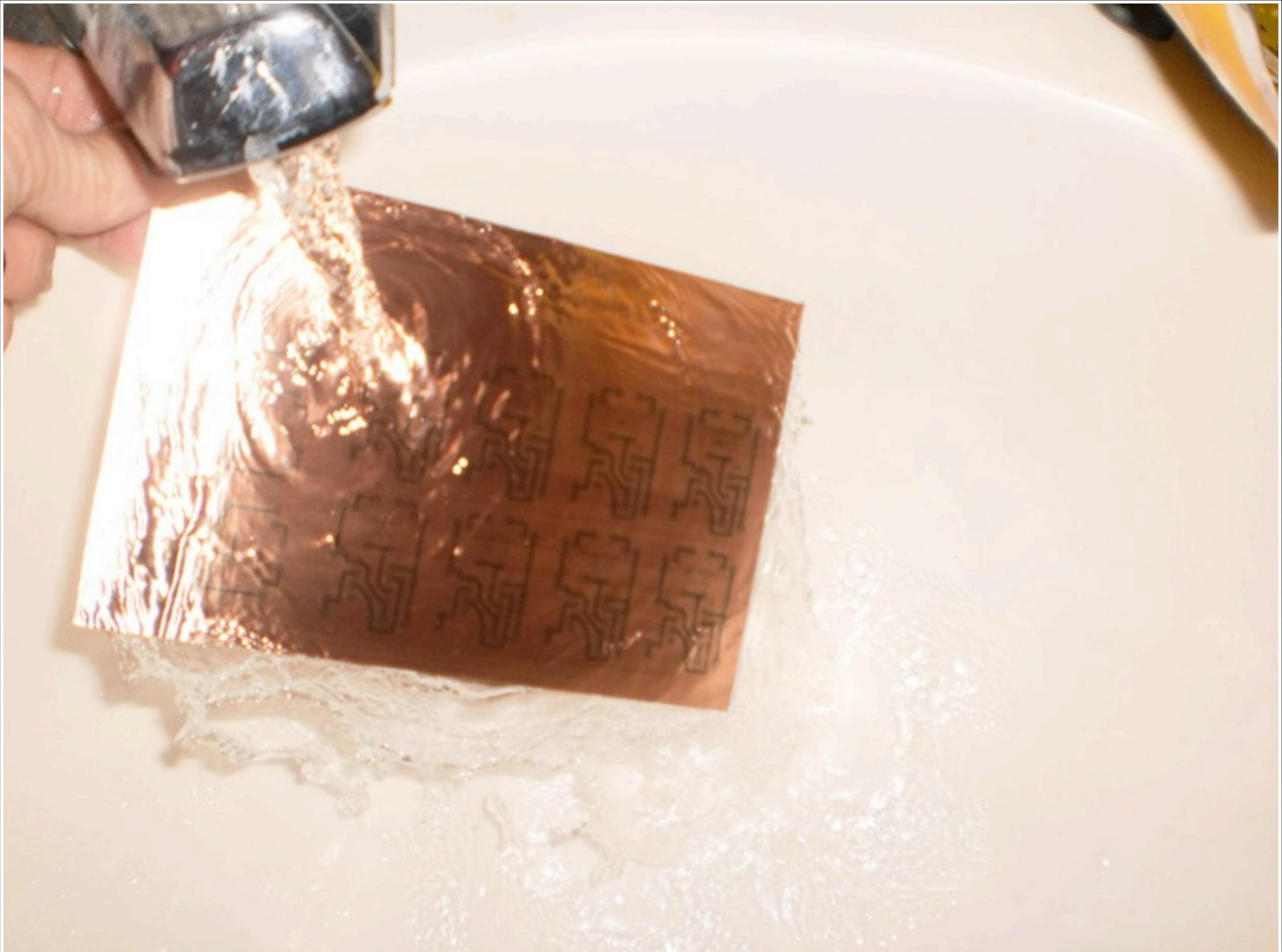


SynShop

Solder Buildup

9

**Fix in cold
water.**





SynShop

Solder Buildup

10

Etch in
hydro-
chloric
acid.





SynShop

Solder Buildup

10

Rinse and
dry.



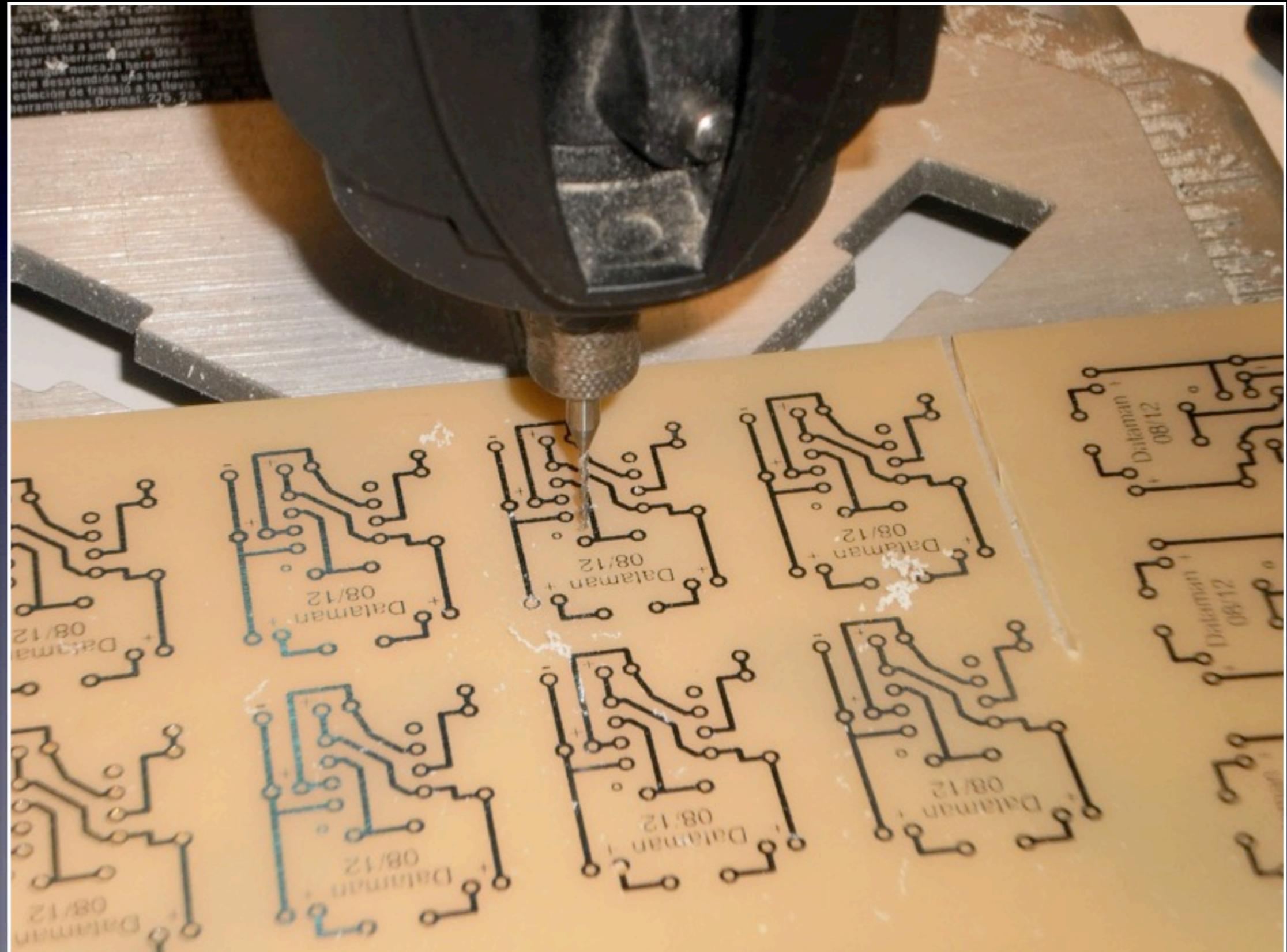


SynShop

Solder Buildup

10

Drill



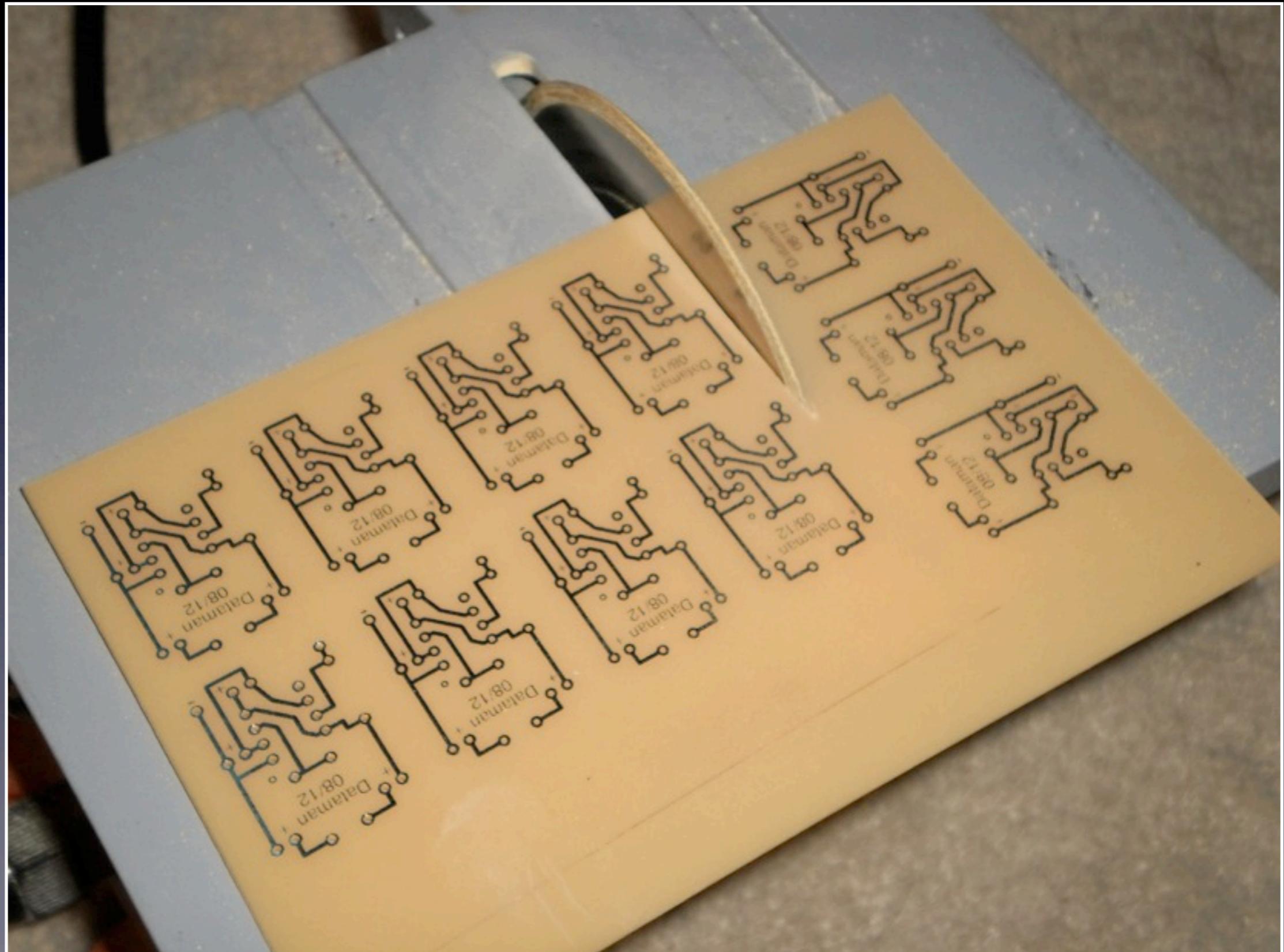


SynShop

Solder Buildup

10

Cut





SynShop

Solder Buildup

10
Shape.



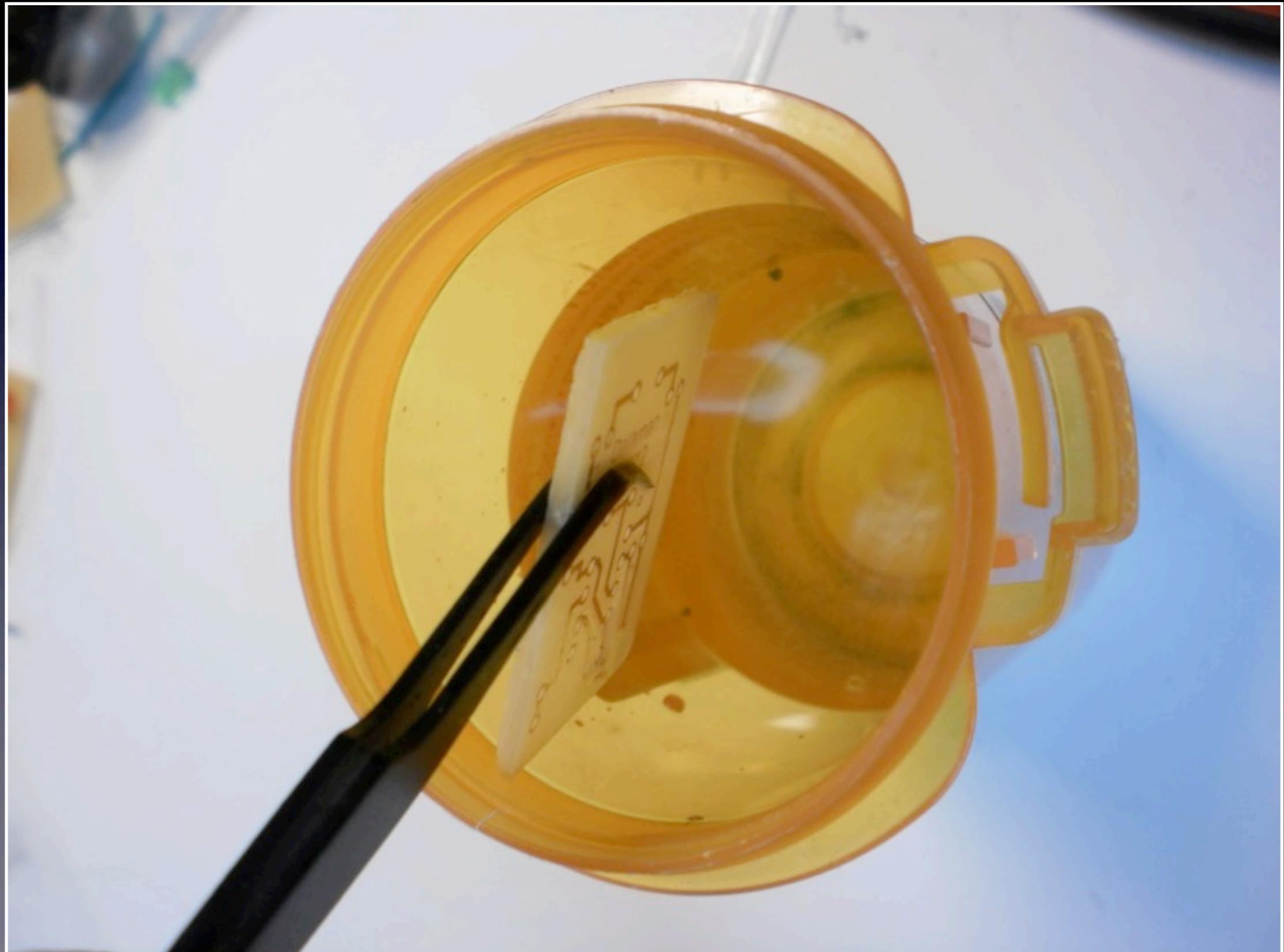


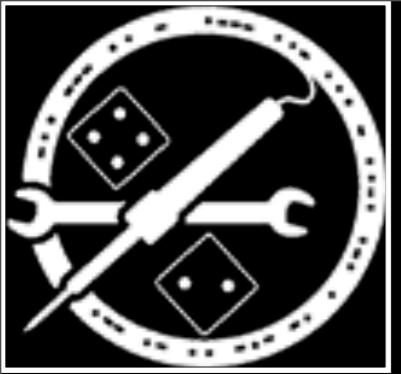
SynShop

Solder Buildup

10

**Clean. Dip
in acetate.**



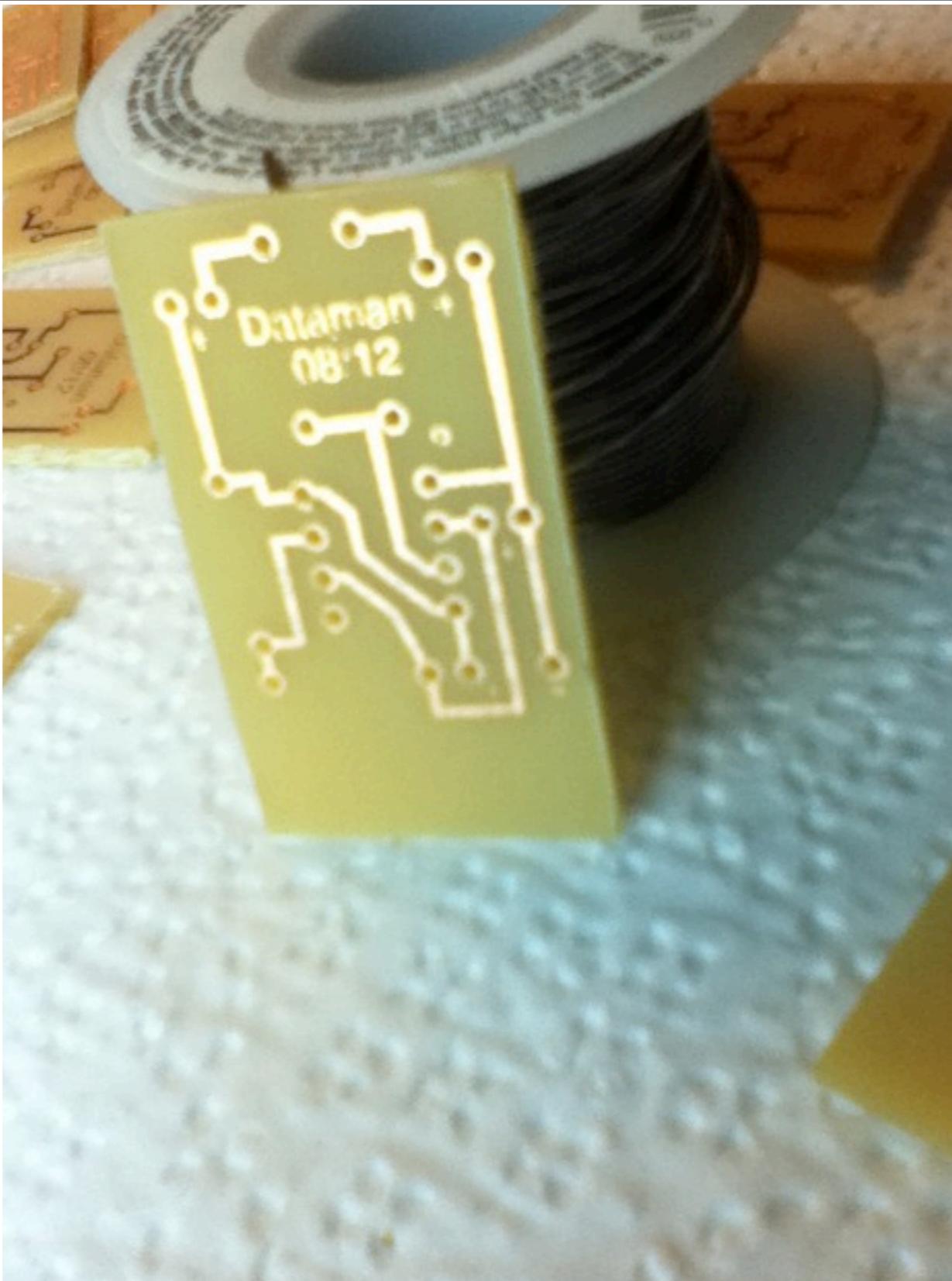


SynShop

Solder Buildup

10

Complete.





SynShop
Solder Buildup

Stop and Go 555 PCB Build

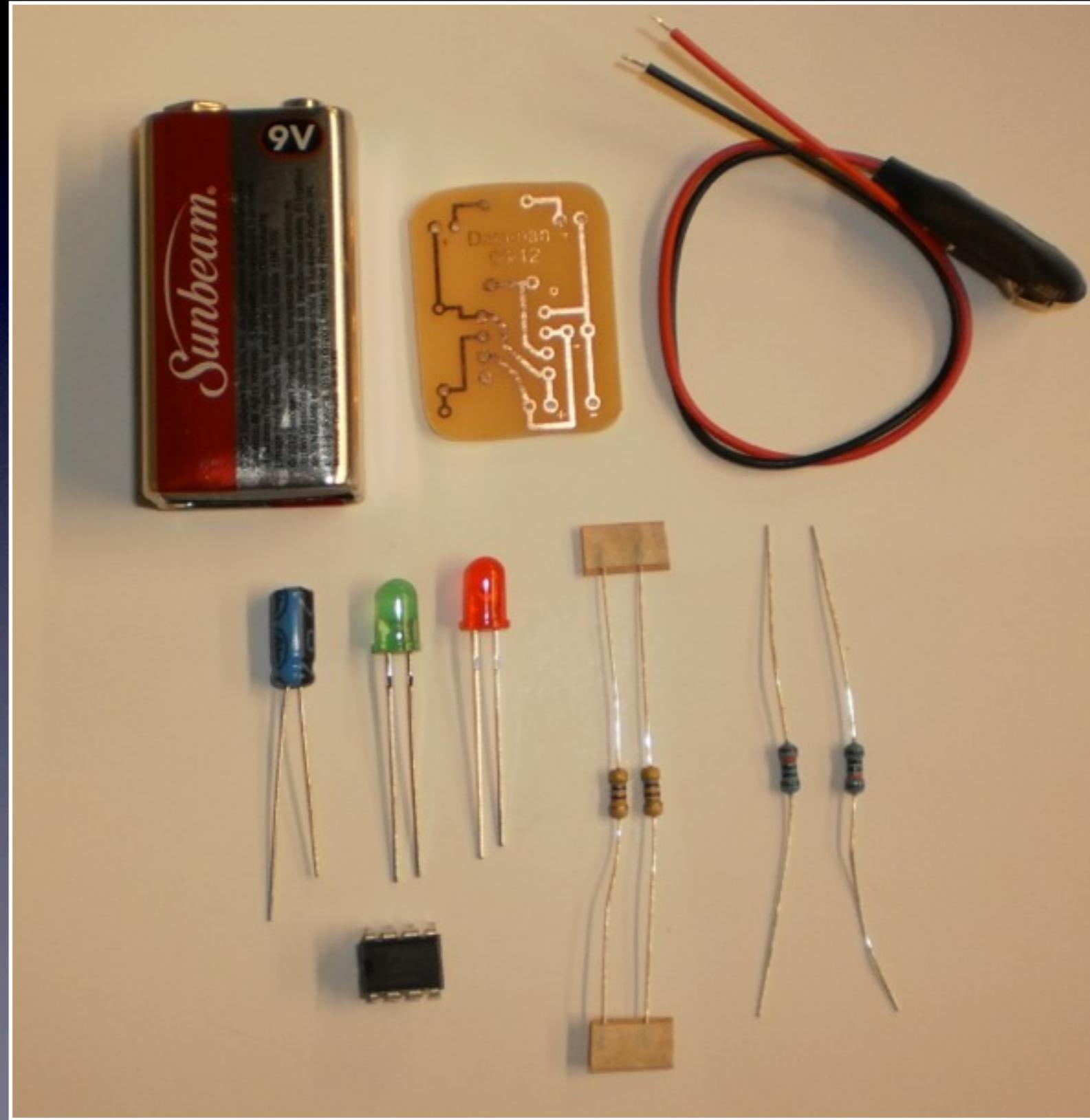


SynShop

Solder Buildup

1

Parts for
the build.





SynShop

Solder Buildup

2

**Solder the
two brown
470 ohm
resistors,
yellow,
violet,
brown.
Orient-
ation is
not
important.**



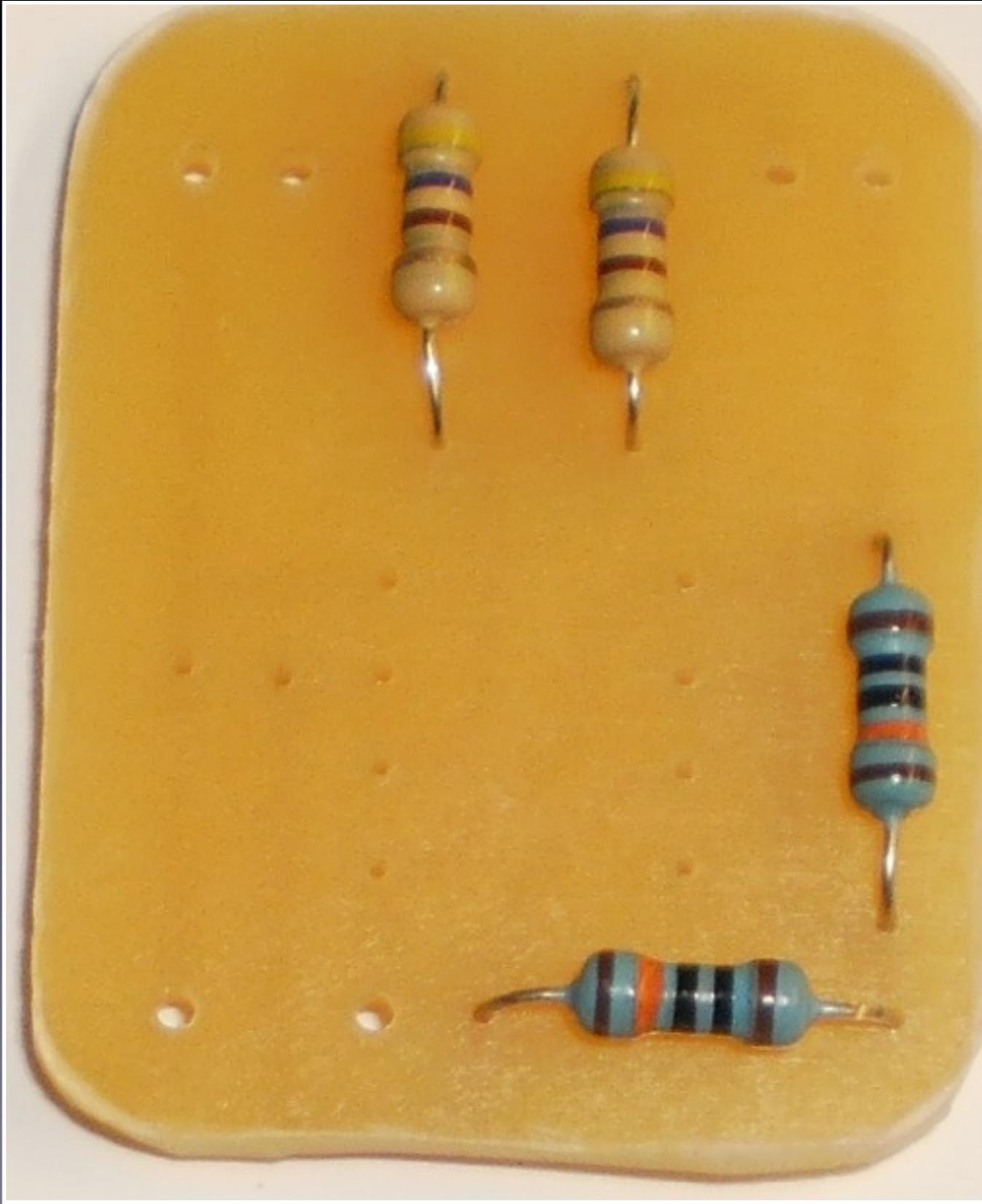


SynShop

Solder Buildup

3

**Next,
solder the
two blue
100k
resistors,
brown,
black,
black,
orange.
Orient-
ation is
not
important.**



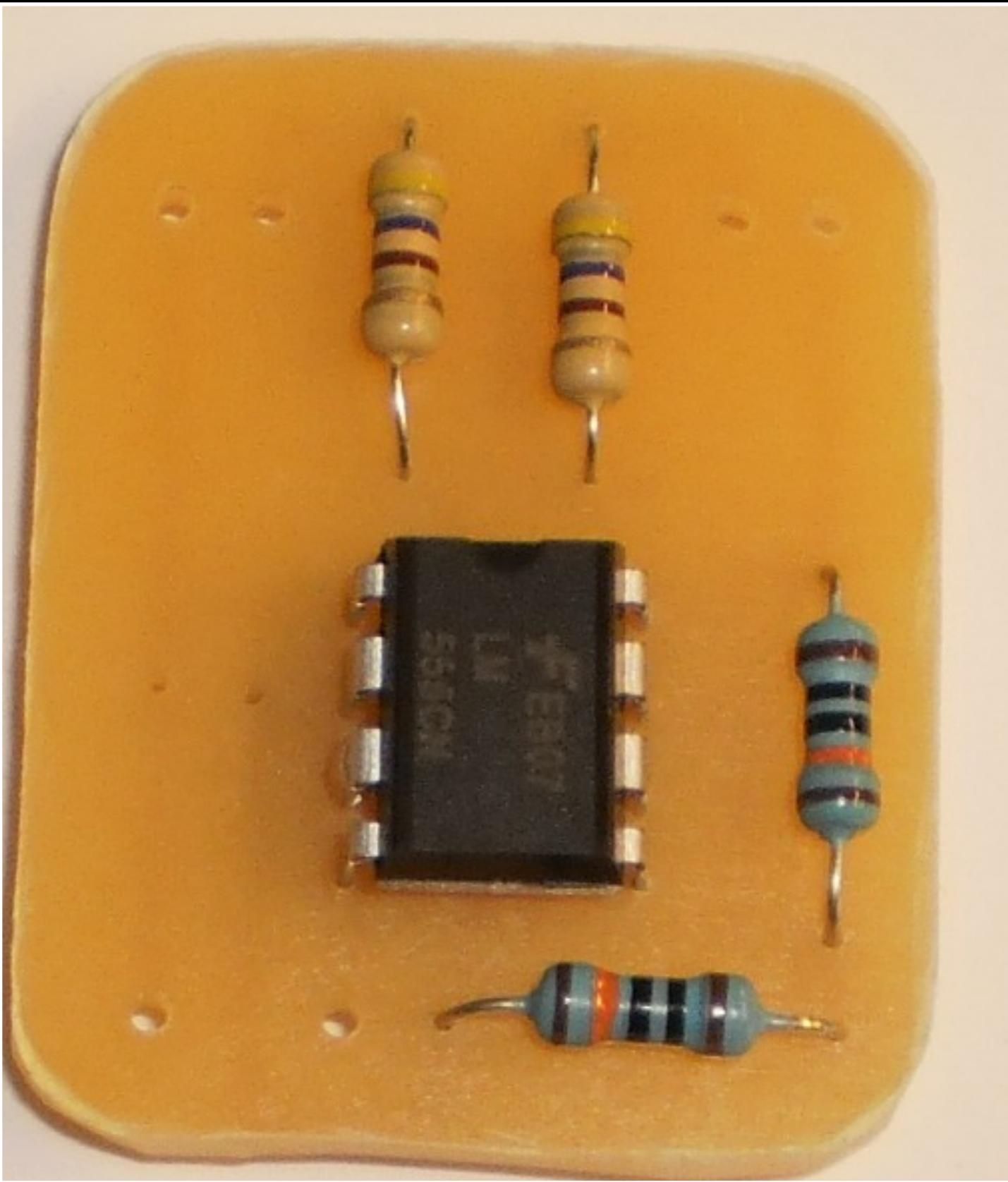


SynShop

Solder Buildup

4

Solder the chip. Note that notch faces up towards the 470 ohm resistors.





SynShop
Solder Buildup

Interrupt: The Roll the Chip Technique



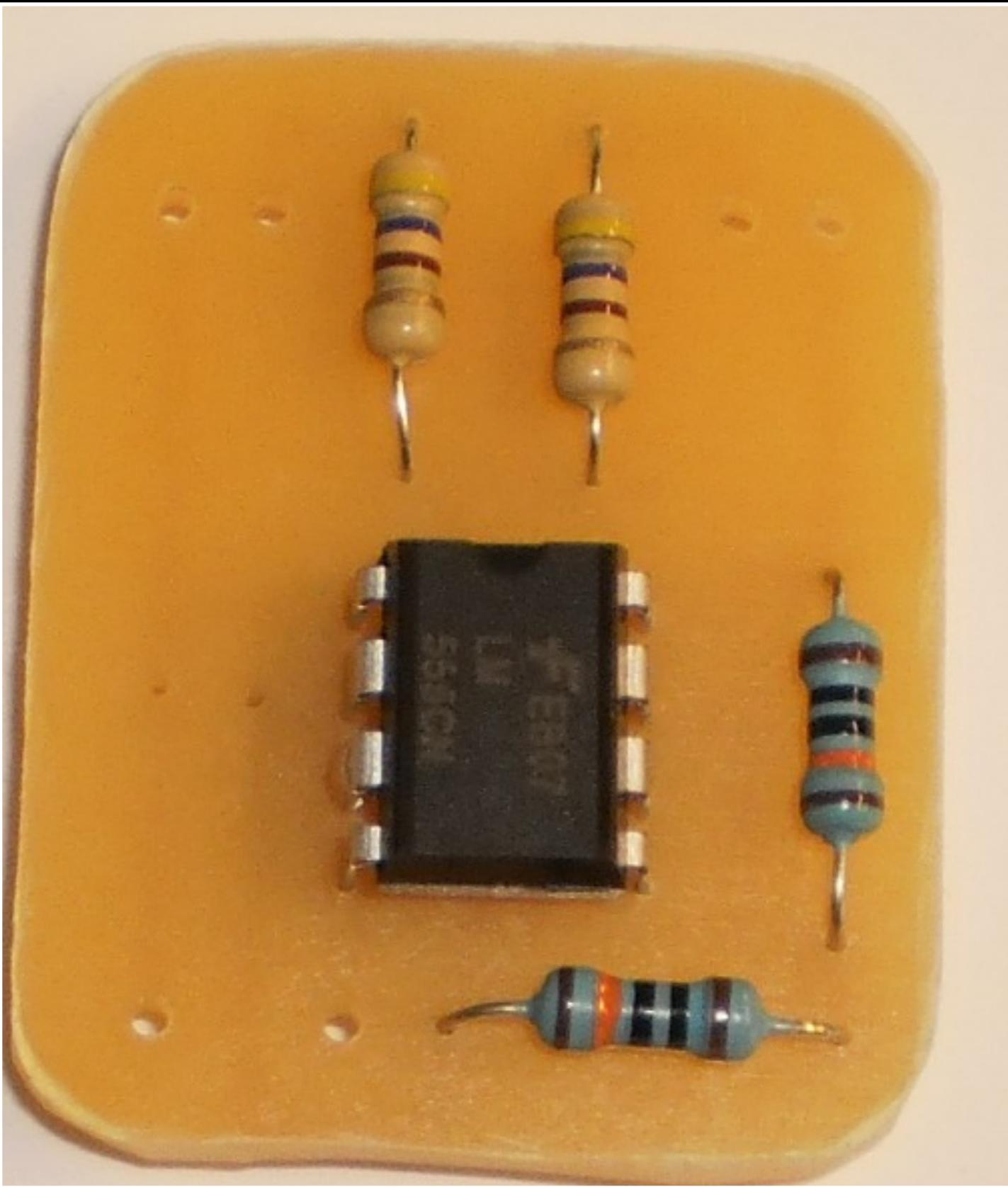


SynShop

Solder Buildup

4

Solder the chip. Note that notch faces up towards the 470 ohm resistors.

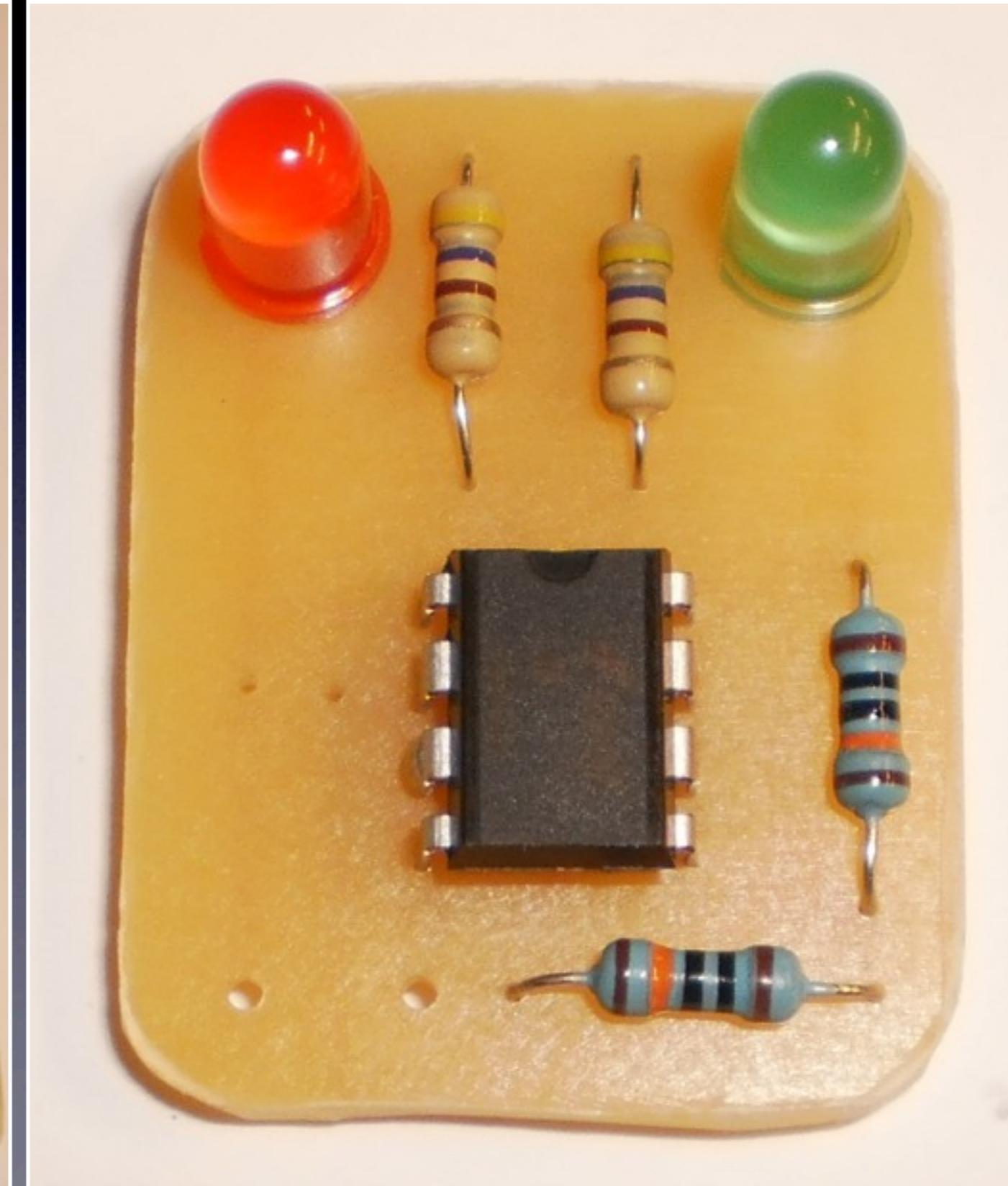
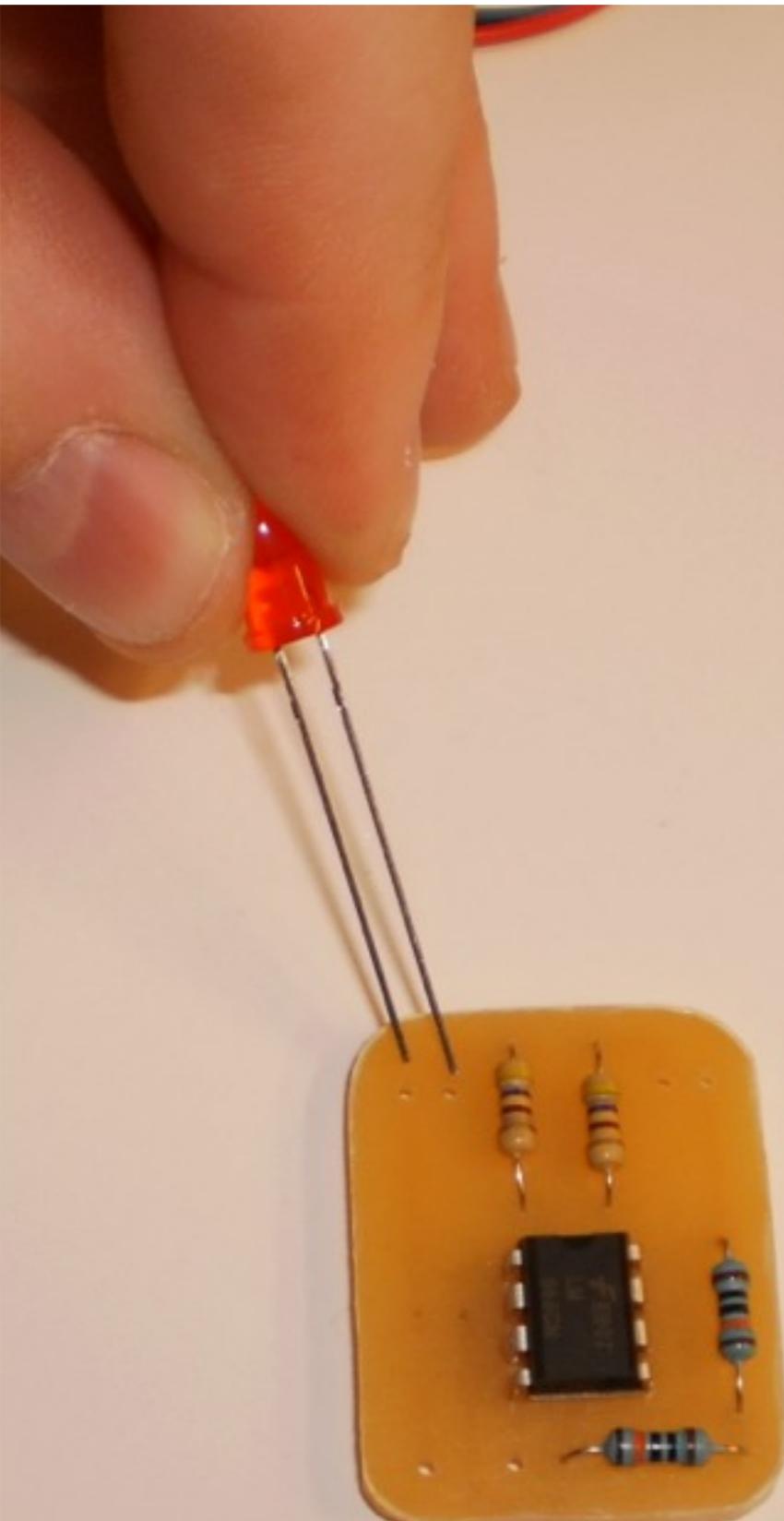




SynShop

Solder Buildup

5
**Next,
solder the
two LEDs.
Long leg
goes into
the right
hole.
Color is
not
important.
Double
check
before
solder.**



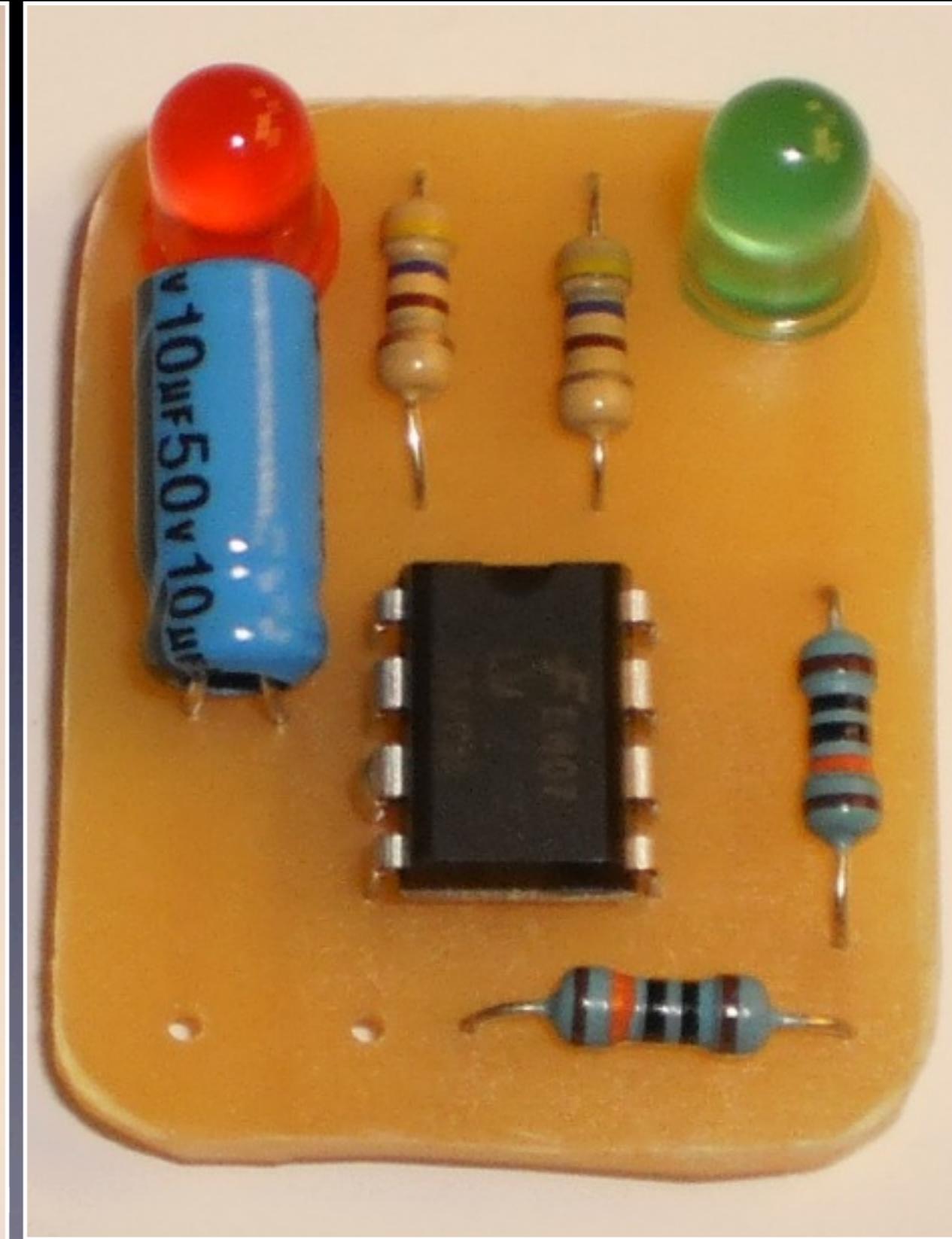
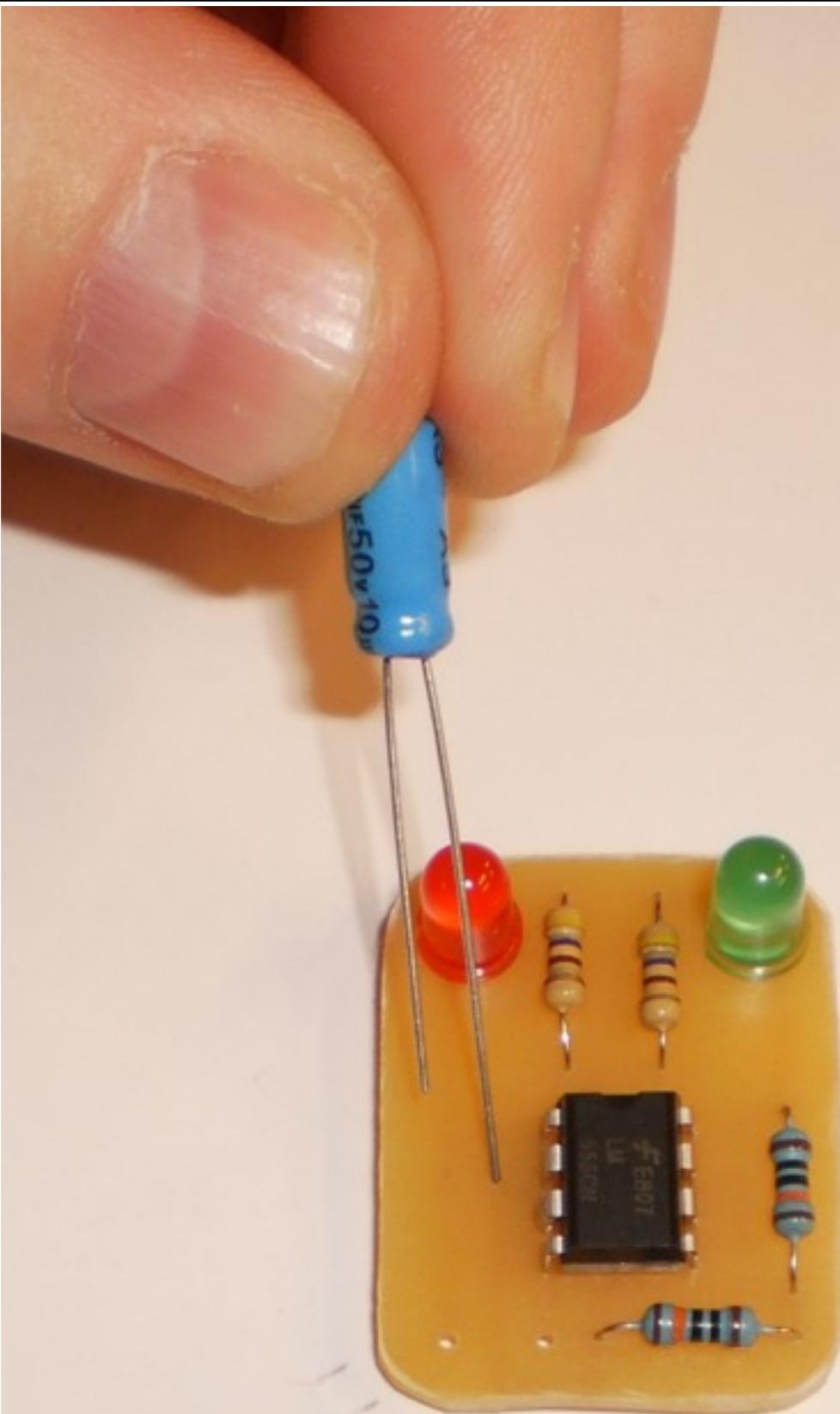


SynShop

Solder Buildup

5

**Next,
place the
capacitor.
Long leg
to the
right. You
may lay
capacitor
flat.
Double
check
before
solder.**



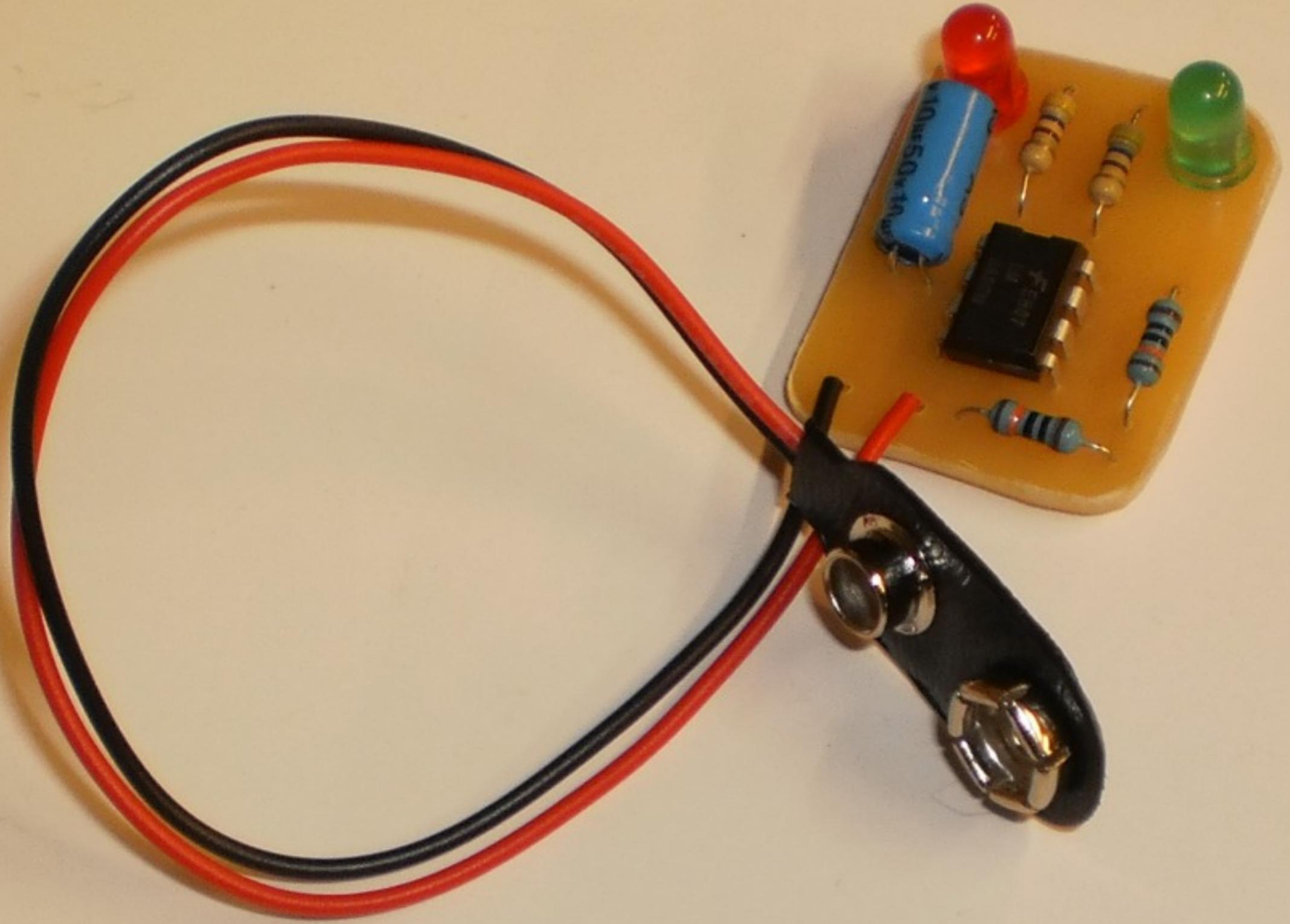


SynShop

Solder Buildup

7

**Solder
battery
clip. Note
the + for
red wire,
top, and -
for
negative
wire on
solder
side.**



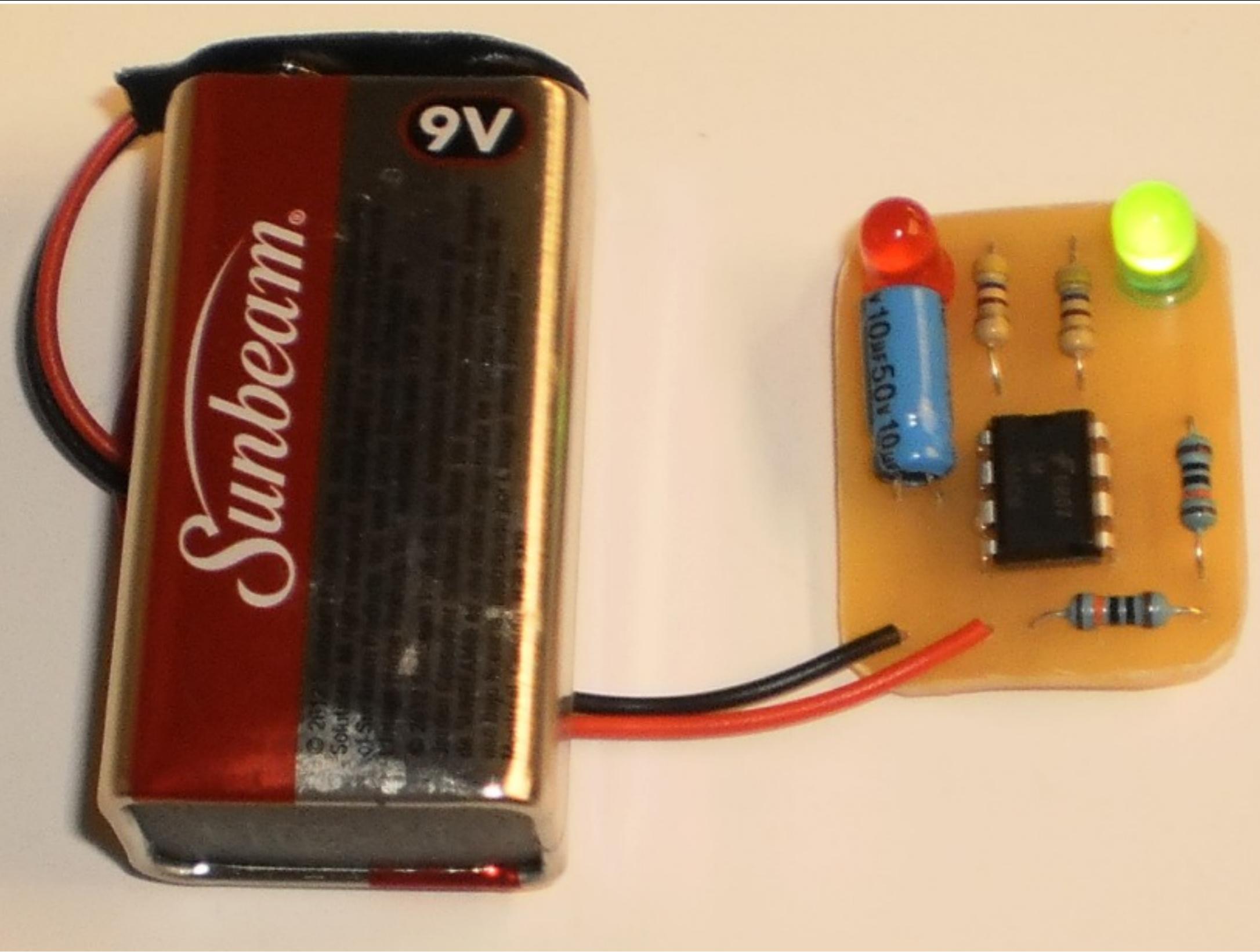


SynShop

Solder Buildup

8

**Attach
battery.
Should
light, then
start
blinking
after a few
seconds.**





SynShop

Solder Buildup

**That was a fun
build!**



SynShop

Solder Buildup

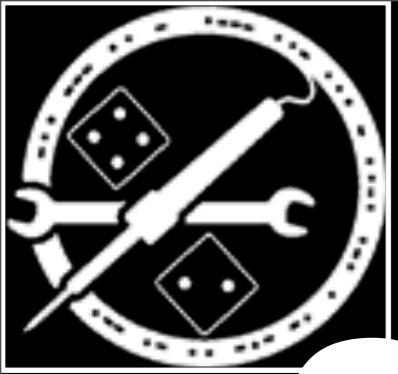
**Where can I find
more easy to build
kits?**



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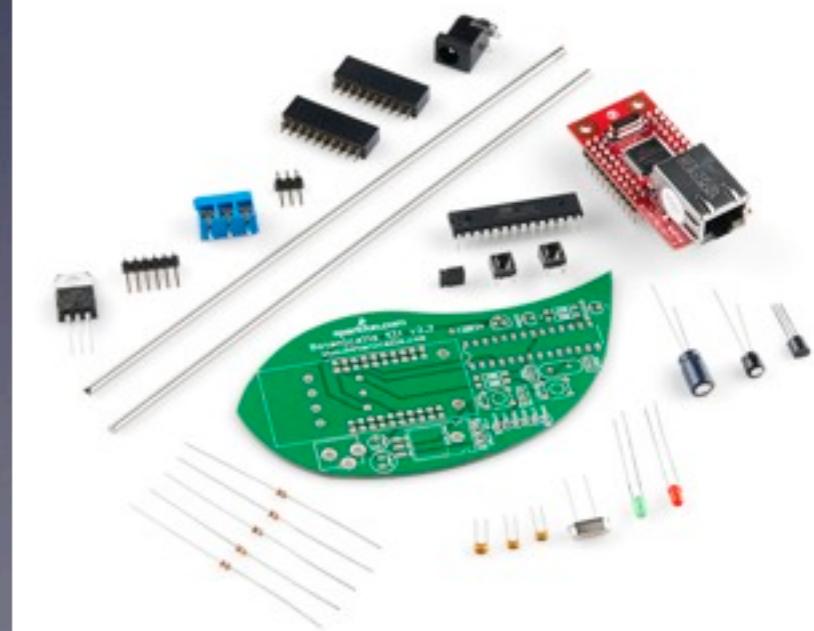
Lady Ada has lots
of great stuff at
AdaFruit.Com





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SparkFun.Com
has lots of cool
stuff



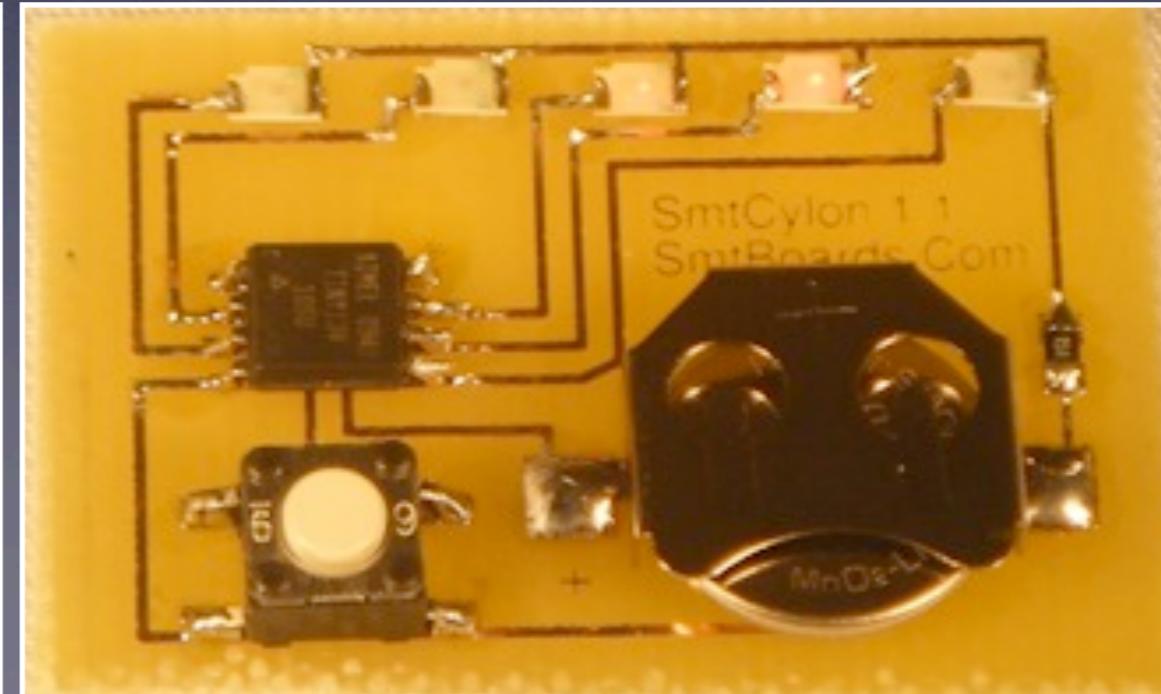


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And even I have designed kits for **SMTboards.com**

The screenshot shows the SMTboards.com website with three main product sections:

- SMTtinyISP**: A micro-sized (1 1/4" x 1") tinyCylon! Our first kit! 14 different modes of operation. 11 parts, about a 20 minutes build. Design Docs, Code, Instructions, Kits, Parts available [here](#).
- SMTtinyCylon**: A micro-sized (1 1/4" x 1") tinyCylon! Our first kit! 14 different modes of operation. 11 parts, about a 20 minutes build. Design Docs, Code, Instructions, Kits, Parts available [here](#).
- SMTTester**: Or, are you really sure about that SMT LED's polarity? This even tinier board measures 3/4" x 1", But oh what power in such a small package. This board adds a temporary ISP port to a Tiny13. Great for programming batches of CPUs. Design Docs, Code, Instructions, Kits, Parts available [here](#).





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**And that's the
class!**



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This entire course is published
github.com/Dataman/SolderBuildup

Or simply go to
github.com/dataman





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Thank You!