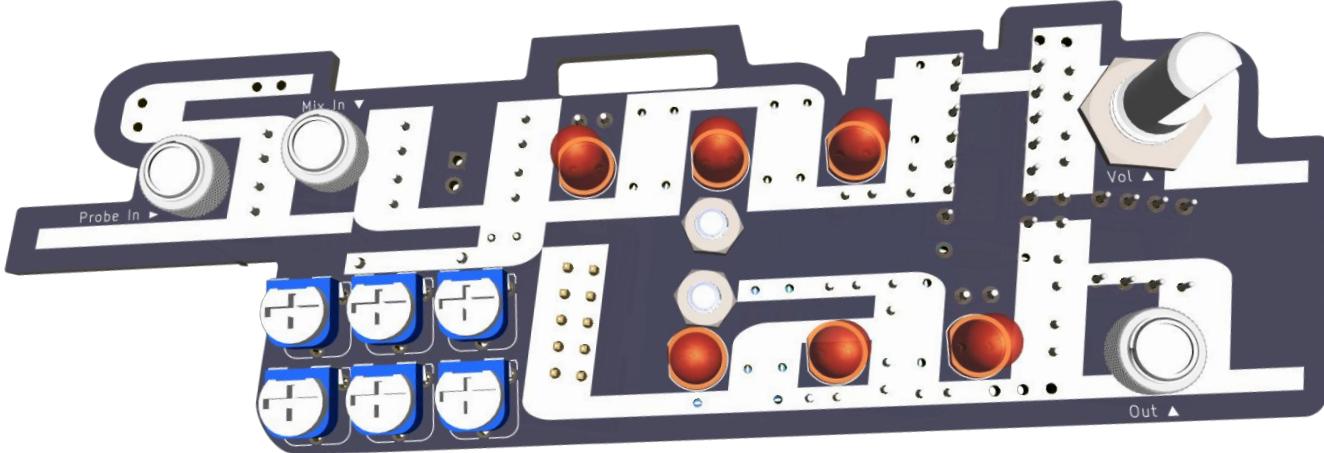
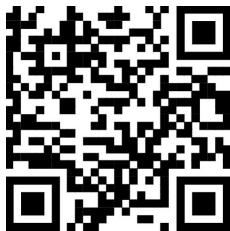


SYNTHLAB BADGE: BUILD GUIDE

CHECK
THE
REPO



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CREATIVE COWORKING

ABOUT THE PROJECT

A LIGHT-TO-SOUND SYNTH-BADGE

- Amplify light frequencies and create your own drone-tones
- Played by waving a DIY photodiode probe over six tunable LED's
- Based on Dylan B's open-hardware [Beam Catcher](#) project

- Comes out of our weekly SynthLab audio hardware meetups at fablab|nk
- Designed to be a first-intro to DIY synthesiser building for new visitors



WEBSITE



DISCORD

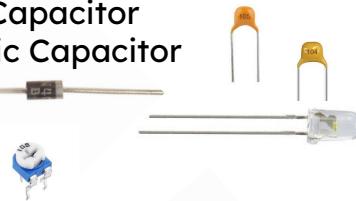


STEP 0: COMPONENT CHECK

What's in the bag? Let's get familiar and check we have everything!

Core Components

- 15 x 1k Resistors - *Brown, Black, Black, Brown, Brown*
- 2 x 100k Resistors - *Brown, Black, Black, Orange, Brown*
- 1 x 10k Resistor - *Brown, Black, Black, Red, Brown*
- 1 x 1.5k Resistor - *Brown, Green, Black, Brown, Brown*
- 1 x 470Ω Resistor - *Yellow, Violet, Black, Black, Brown*
- 1 x $1\mu F$ (105) Ceramic Capacitor
- 9 x $100nF$ (104) Ceramic Capacitor
- 1 x 1N5817 Diode
- 6 x 5mm Yellow LEDs
- 6 x 1M (105) Trimpots



Eurorack Only Components

- 1 x 22uF Electrolytic Capacitor
- 1 x 2x5 Pin IDC Box Header



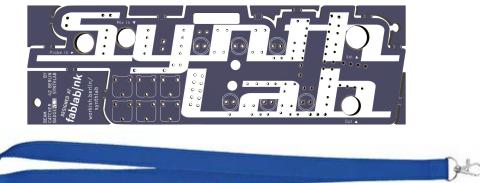
Jack Sockets and Pot

- 3 x PJ-301M 3.5mm Jack Sockets (with nut)
- 1 x A100K Potentiometer (with washer & nut,
- 4 x lengths of red/black wire (1 x 3cm, 3 x 4cm)



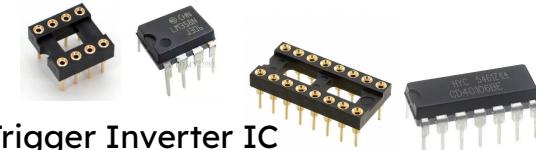
Core

- 1 x Printed Circuit Board
- 1 x Lanyard



Integrated Circuits (IC's) and Sockets

- 1 x 8-Pin DIP Socket
- 1 x LM358 Op-Amp IC
- 1 x 14 Pin DIP Socket
- 1 x CD40106 Schmitt Trigger Inverter IC



Probe

- 1 x PJ-301M 3.5MM Jack Socket (with nut)
- 1 x 5mm photodiode
- 1 x 3.5mm mono cable



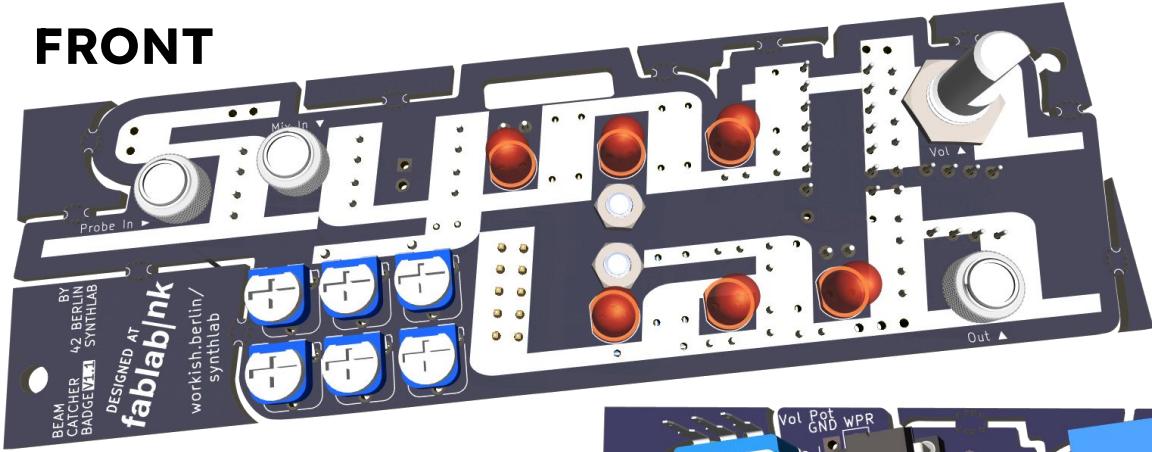
Battery-related

- 1 x 9V Battery
- 1 x 9V Battery Clip
- 2 x M3x8 screws (with nuts)
- 1 x 3D printed 9V Battery Mount



FINISHED BUILD (HOW IT WILL LOOK AT THE END)

FRONT



Point-to-point wiring and
battery stuff not shown! →

Don't worry, we'll come to
these later :)

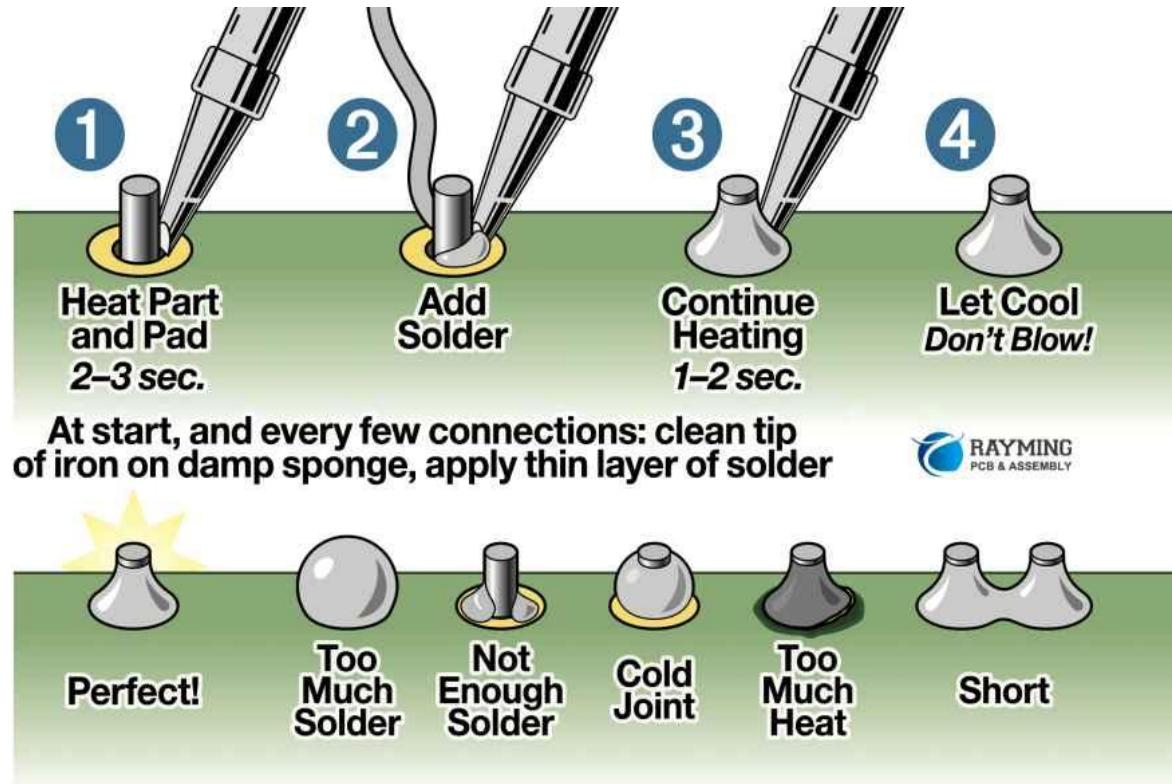
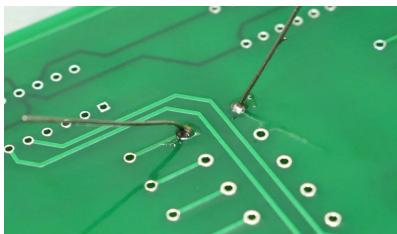
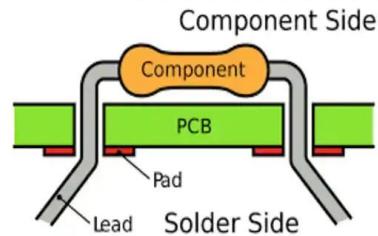
Two build options:

1. Leave whole for the Eurorack mountable version (as shown on left)
2. Break-out with pliers for the badge-version

BACK



HOW TO SOLDER

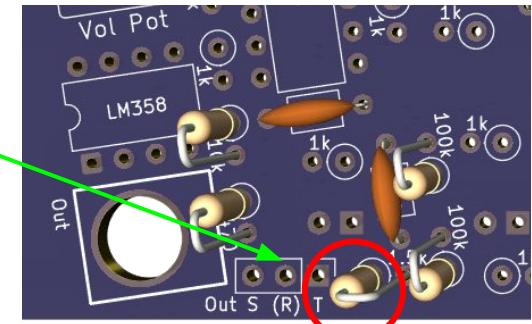


IMPORTANT STUFF!

Miss this info at your peril!

COMMON FAIL POINTS

- Mistake on board: this resistor should read 1.5k (not 1k)
- Don't confuse the LEDs and the photodiode
 - They look identical
(so we mounted the photodiode in foam to differentiate)
 - Double-check for a black square when viewed from top
- Trimmer potentiometers are quite fragile - don't overturn!



BUILD STAGES

We'll build in three stages

- *Steps 1-5:* Soldering all through-hole components onto the board
- *Steps 6-8:* Mounting and wiring the jack sockets, potentiometer and battery
- *Steps 9-10:* Making the probe and testing

STEP 1: BACK SIDE *CERAMIC CAPACITORS & DIODE*

Diode orientation matters!

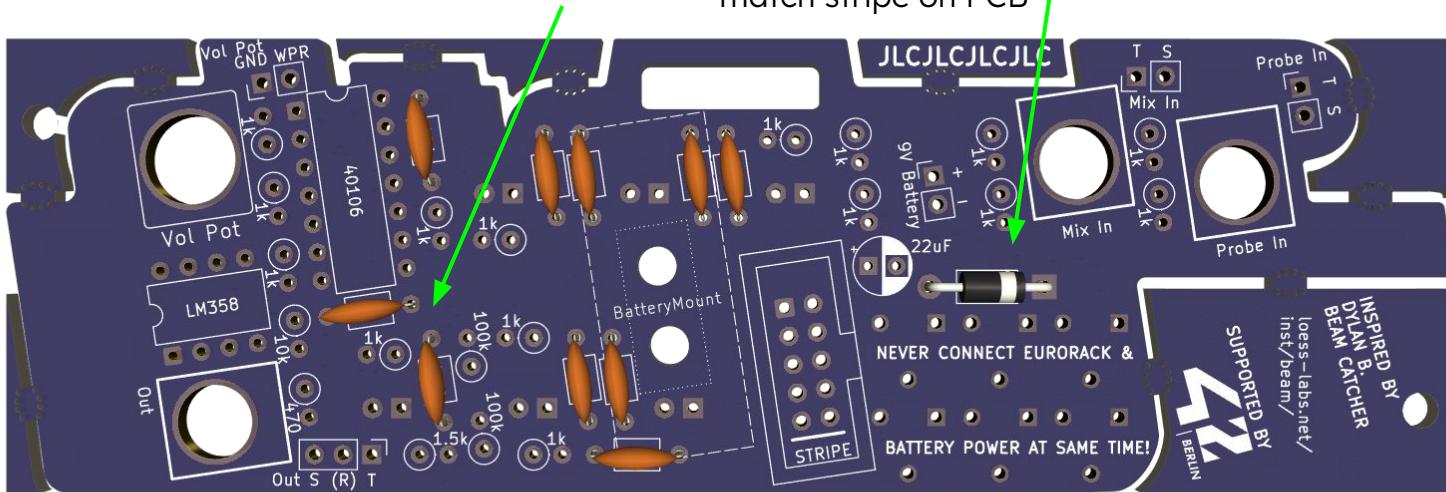
Diode orientation matters!

105 Capacitor (1 μ F)

The special one - place first!

1N5817 Diode

Stripe on diode should
match stripe on PCB



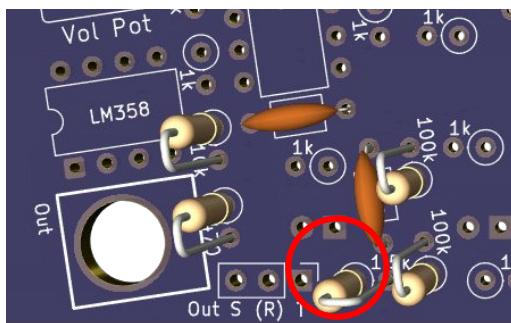
All the other ceramic capacitors (nine of them) are 104's (.1 μ F)

SOLDER LIKE THIS:



1. Place the 'error' resistor first (highlighted in red)

The 1.5k resistor should go here: *Brown, Green, Black, Brown, Brown*



2. Next the rare resistors (bottom left of board)

One 10k Resistor: *Brown, Black, Black, Red, Brown*

One 470Ω Resistor: *Yellow, Violet, Black, Black, Brown*

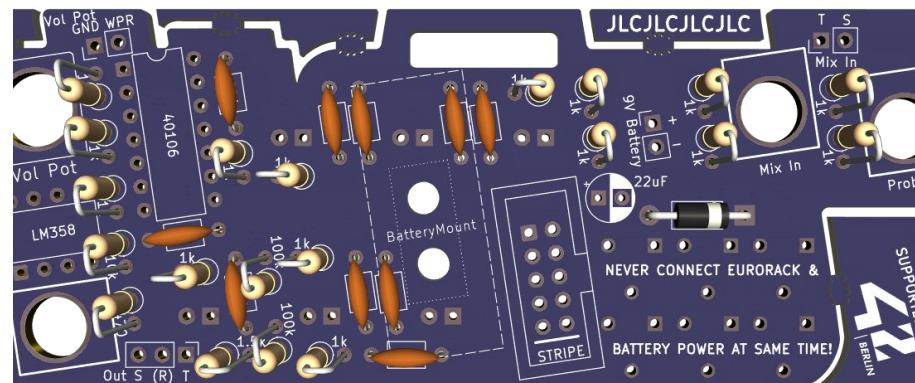
Two 100k Resistors: *Brown, Black, Black, Orange, Brown*

STEP 2: BACK SIDE RESISTORS (x 20)

Insert according to values marked on board

Because space is tight - solder upright!

Take care not to confuse resistor & LED holes

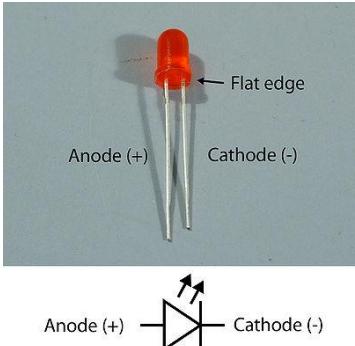


3. All the others are 1k resistors (fifteen of them)

Brown, Black, Black, Brown, Brown

STEP 3: FRONT SIDE LEDS & TRIMPOTS

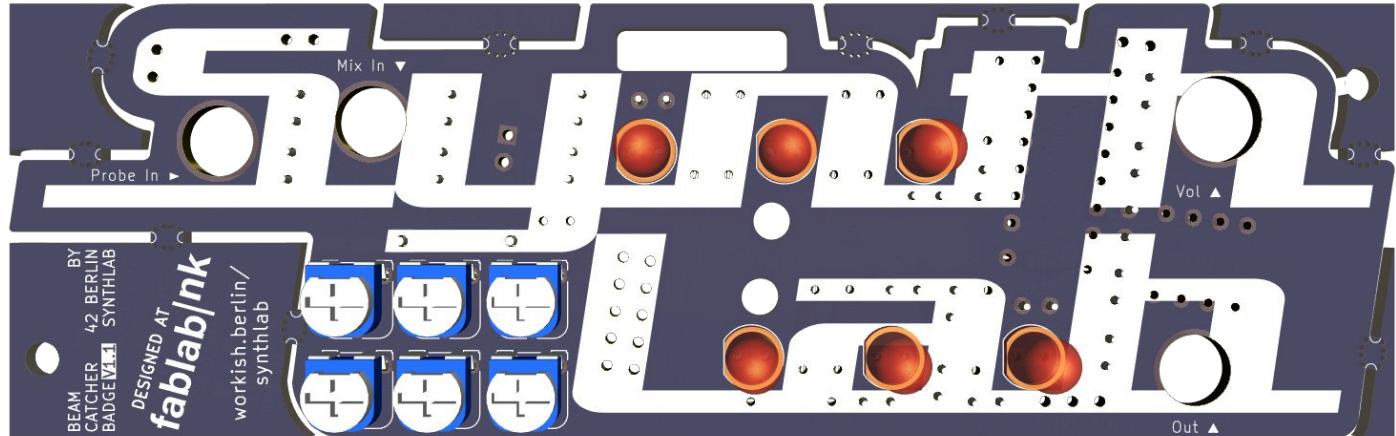
Orientation of LEDs matters! Don't confuse LEDs with photodiode



Don't trust flat side
of our LEDs, they
were manufactured
wrongly!

6 x LEDs

- insert short leg (cathode, negative) in square pad
- insert long leg (anode, positive) in round pad

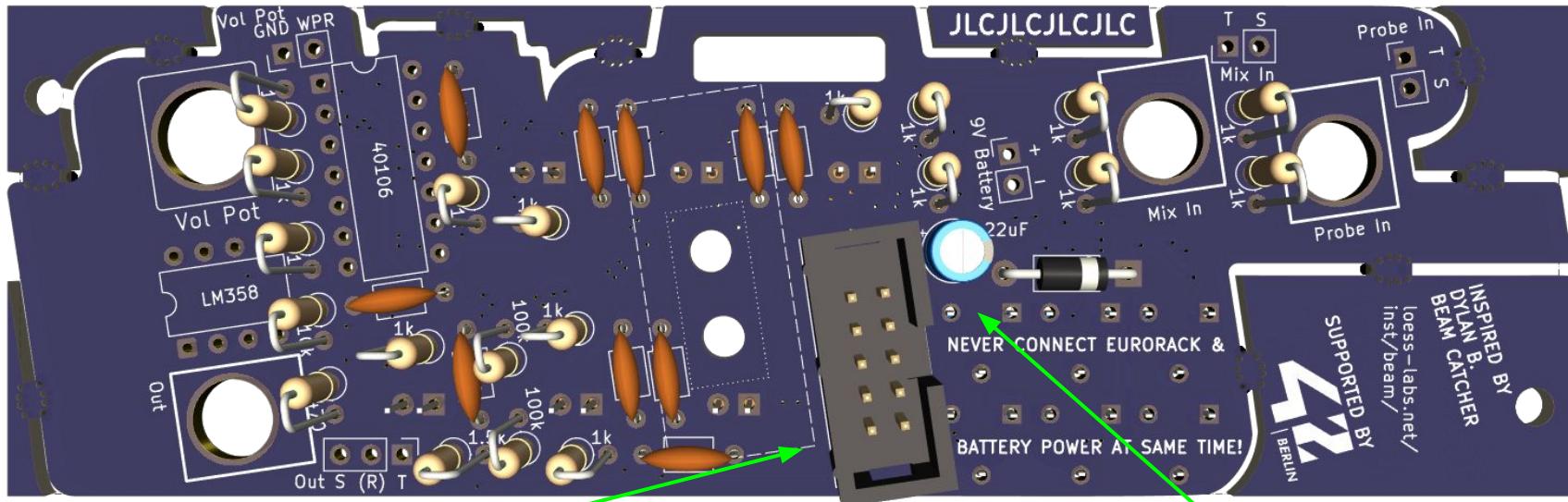


6 x TrimPots

- each has three legs
- can only be inserted one way

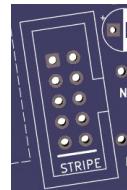
STEP 4: BACK SIDE OPTIONAL EURORACK COMPONENTS

You only need to solder these if you plan to use your badge as a Eurorack synthesiser module



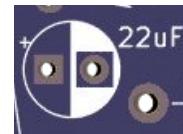
2x5 Pin IDC Box Header

- 'keying' to right (as shown on board)



22μF Electrolytic Capacitor

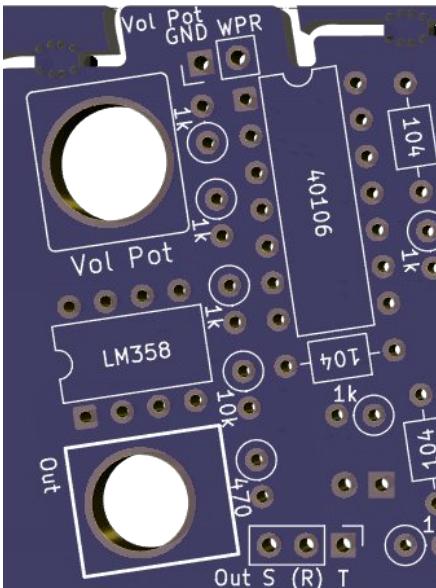
- match it's stripe (cathode/negative/short leg) with stripe on board



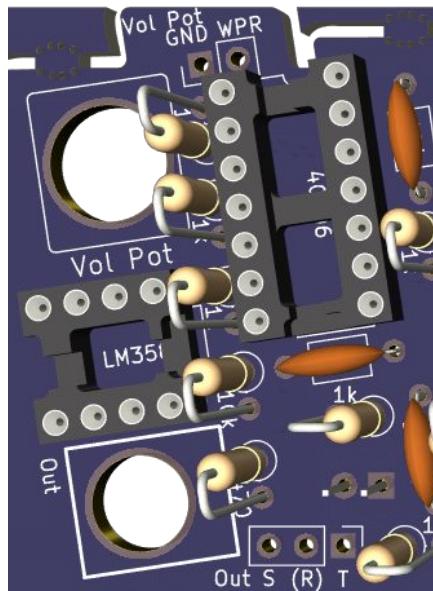
STEP 5: BACK SIDE SOLDER & MOUNT IC SOCKETS & IC'S

Sockets are indented at one end. Match this with the U shape shown on the board

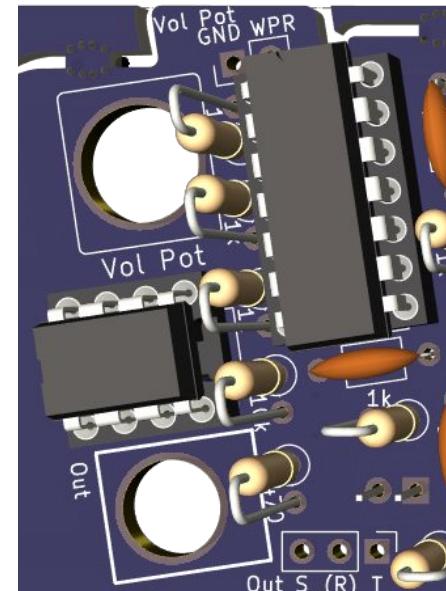
BOARD ONLY



SOCKETS



SOCKETS & IC's



Prop up sockets to
keep them flush (as
resistors are taller!)

Solder one pin first,
then check alignment
(with all pins soldered
it's hard to correct)

When inserting IC's

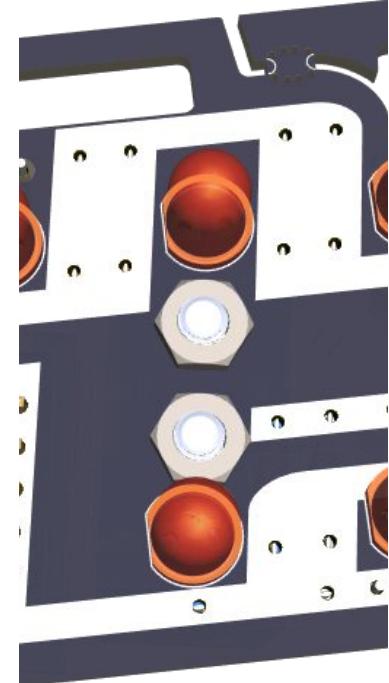
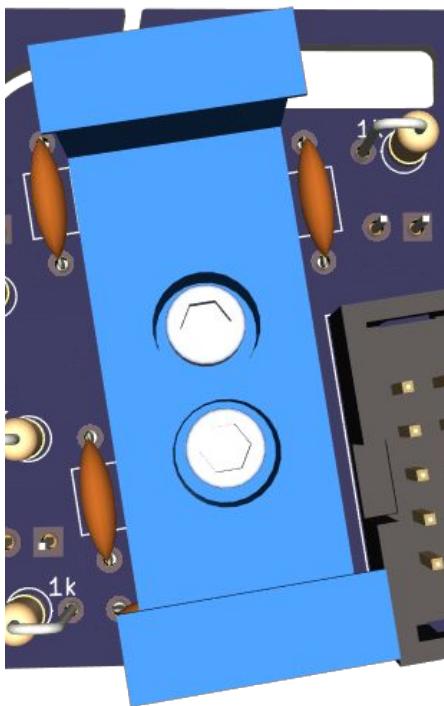
- CD40106 faces up
- LM358 faces left



STEP 6: BACK SIDE MOUNT BATTERY HOLDER

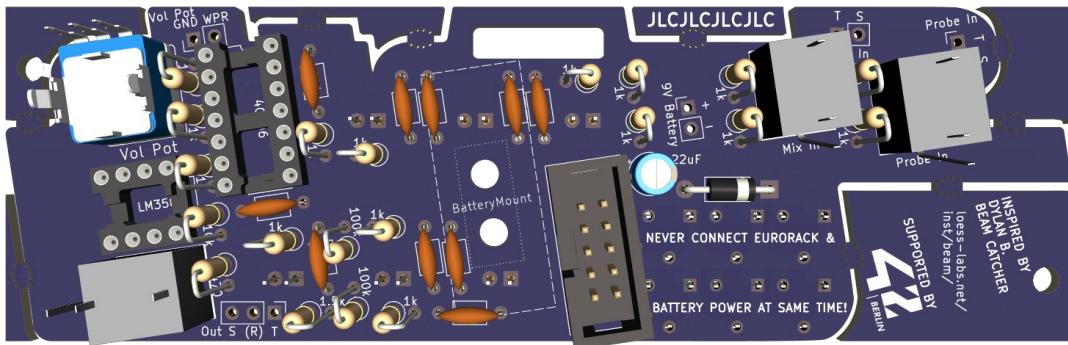
The nice 3D printed part we gave you :)

- Ensure it's the right way up (size should match dotted line)
- Capacitors underneath may need 'squashing' to one side
- Place screws in the holes of the mount & screw on nuts from front
- Place 9V battery in the mount & centre it (left to right)



STEP 7: FRONT SIDE MOUNT JACK SOCKETS & POT

Insert from back and mount on front of PCB using nuts provided. Orient as in the images

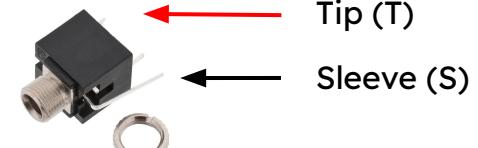


Potentiometer (pot)

- On front: place washer then nut
- On back: three pins should point up

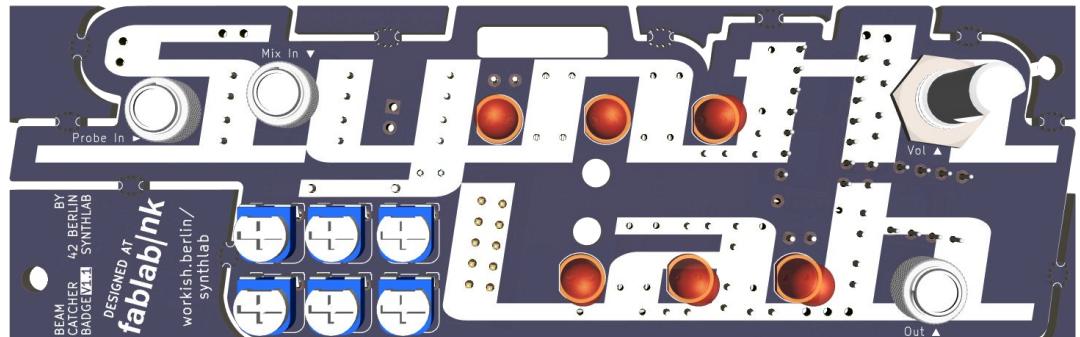
Use pliers to hold nuts in place if needed

Jack sockets



Pay attention to the leg that sticks out (sleeve)

← and match with how they're shown here



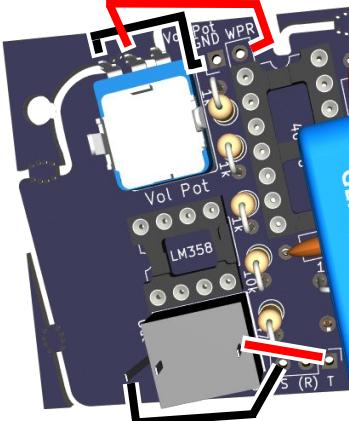
- Cut wire to length
- Strip 3mm of each wire at each end
- Twist together & tin with solder
- Insert through holes from back
- Bend at front to keep in place



STEP 8: BACK SIDE POINT-TO-POINT WIRING

Solder small lengths of wire from jack sockets, potentiometer & battery clip to designated holes on the board

LEFT: POT & JACK SOCKET



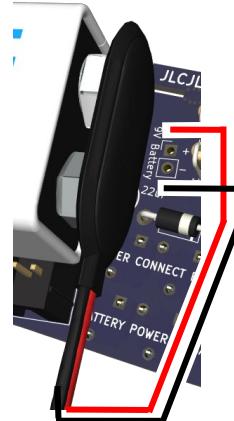
Vol Pot: use short 3cm wire

- pad marked GND to left pin
- pad marked WPR to middle pin

Audio Out: use 4cm wire

- T to tip
- S to sleeve
- leave (R) disconnected

MIDDLE: BATTERY CLIP



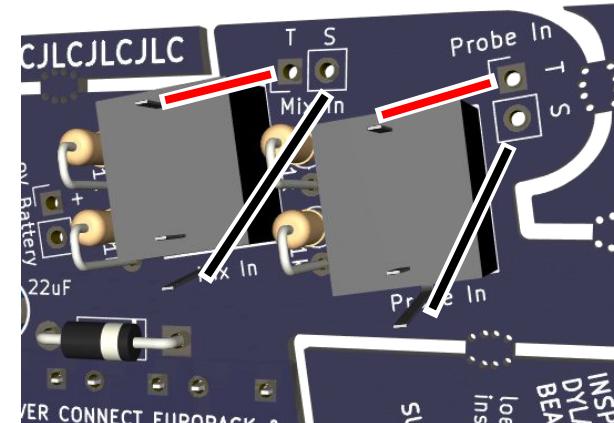
- Attach clip to measure & cut wire

Detach battery clip before soldering!!

Solder as follows:

- Positive (red) goes to + hole
- Negative (black) goes to - hole

RIGHT: 2 x JACK SOCKETS



Mix In: use 4cm wire

- T to tip (red wire)
- S to sleeve (black wire)

Probe In: use 4cm wire

- T to tip (red wire)
- S to sleeve (black wire)

STEP 9:

BUILD THE PROBE

We need this photodiode probe to play our instrument

The probe consists of:

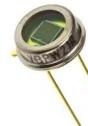
- A 3.5mm audio cable...
- ...inserted into a 3.5mm jack socket...
- ...soldered to a photodiode



Double check it really is a photodiode (not an LED)

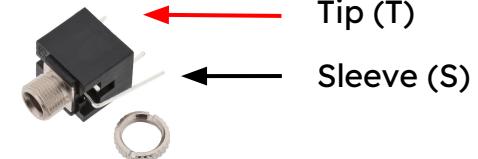
1. It should be mounted in foam packing in your kit
2. Look for a black square when viewed from the top

Looks like this inside →



Then solder...

- long leg (anode, positive) of photodiode to jack tip
- short leg (cathode, negative) of photodiode to jack sleeve



STEP 10: TESTING TIME

Insert the battery into the holder and attach the battery clip connector...then...

1. Check the LEDs

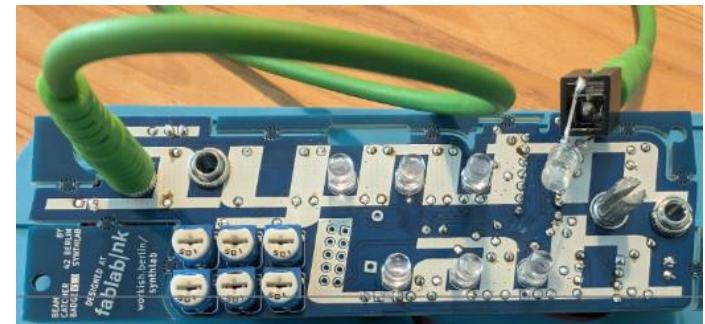
- Do all light? To a similar brightness?
- Does flicker rate change when turning the trimpots from right to left?
 - Take care: the trimpots are quite fragile beyond their limits - don't overturn!
 - Trimopots operate right to left! Clockwise LOWERS frequency

2. Test the probe, potentiometer and audio output

- Connect AUDIO OUT to headphones or a speaker
- Connect the probe to PROBE IN
- Turn the potentiometer up to the right
- Hover the probe close to the LEDs & adjust tuning
 - If you hear sound, congratulations! :)

3. (Optional) Test the mix input

- Get together with a neighbour
- Plug the output of their badge into input of yours



Thanks for building, we
hope you had fun!