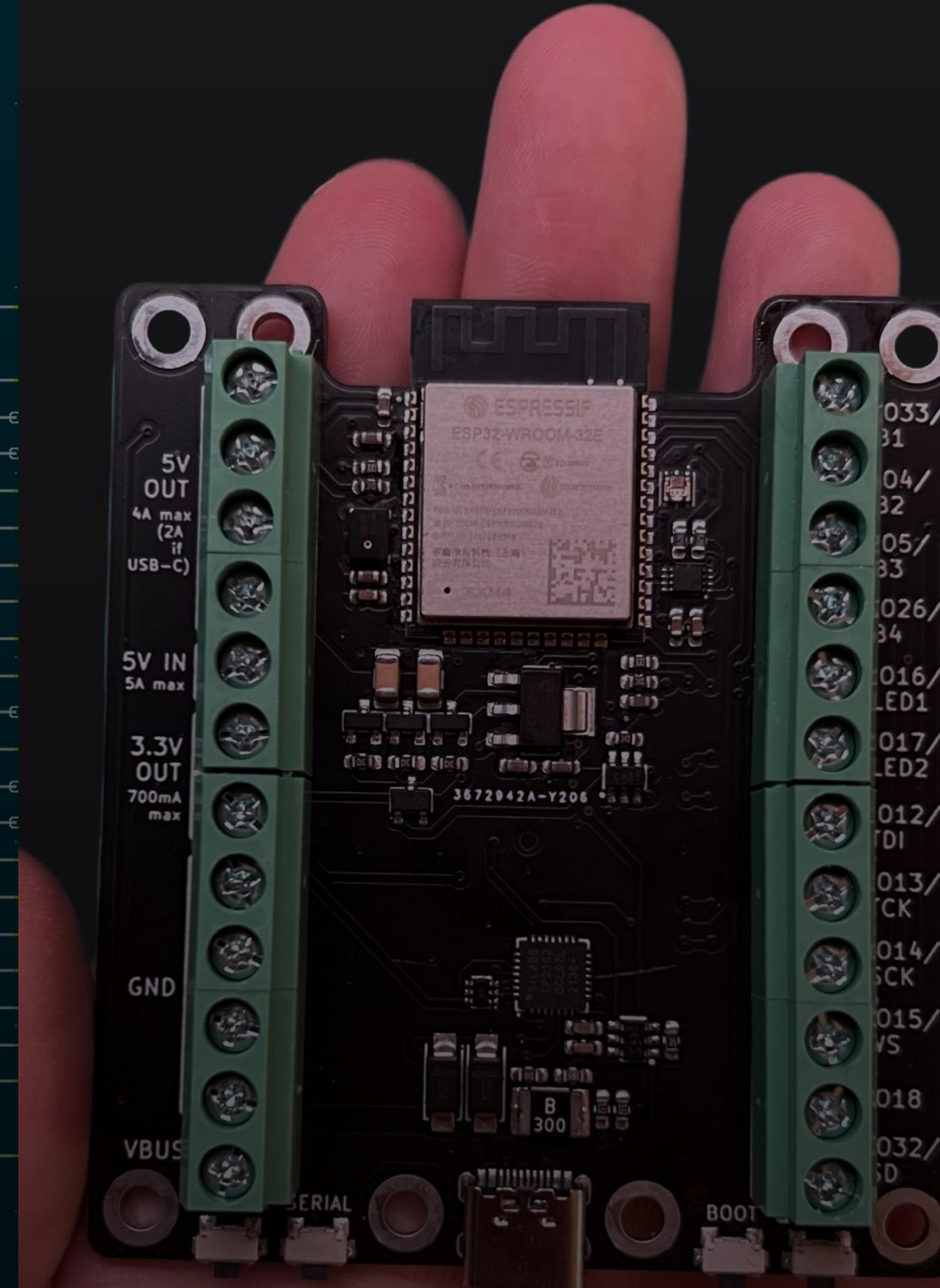
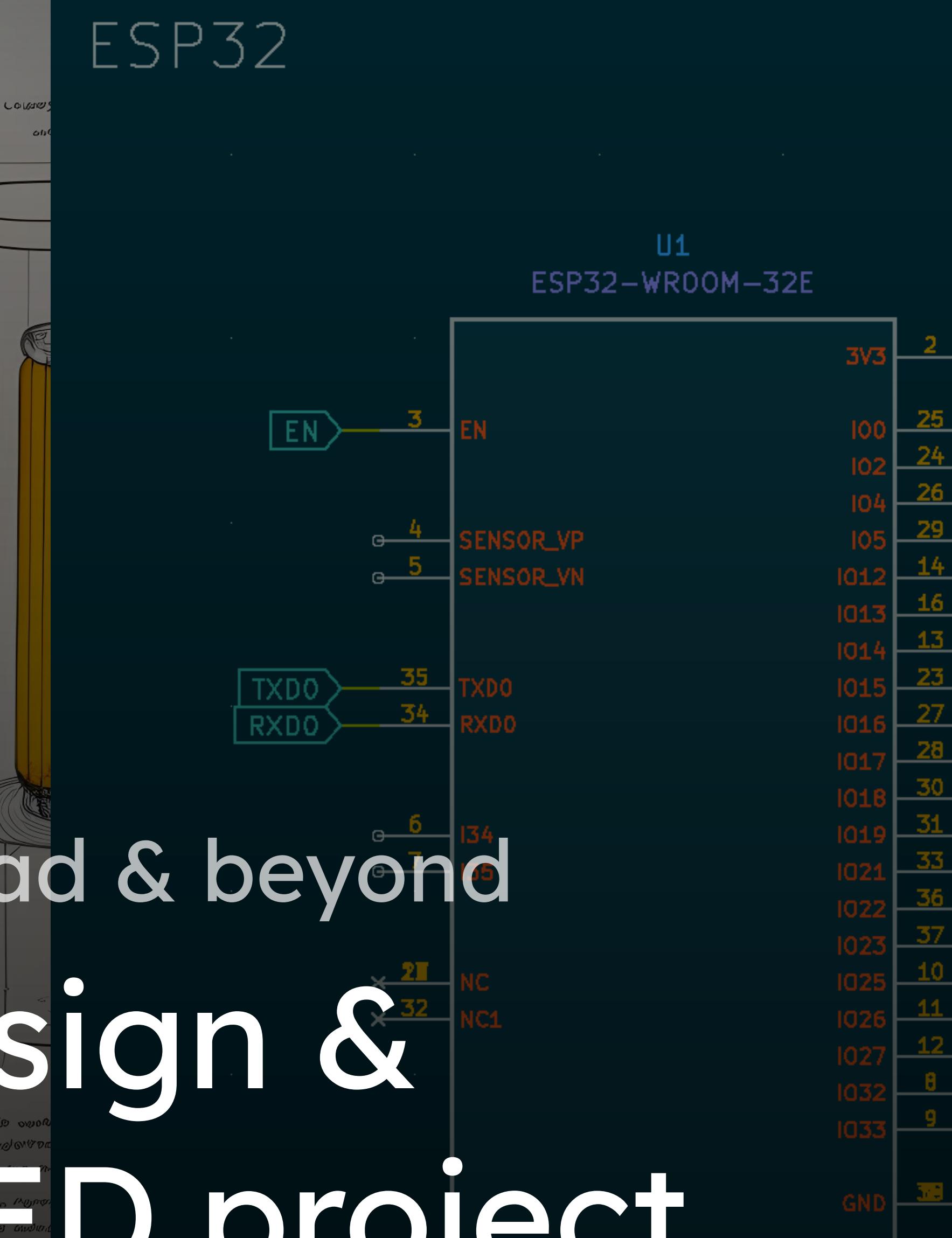


From idea to KiCad & beyond

How to design & build an LED project



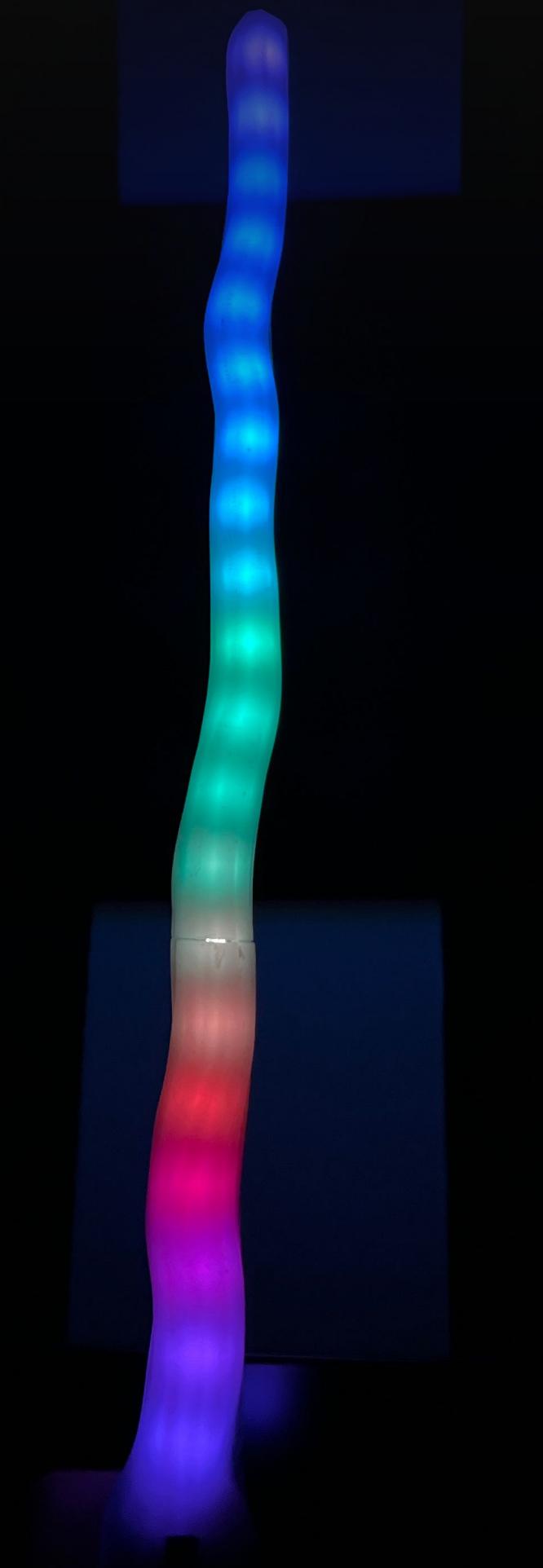
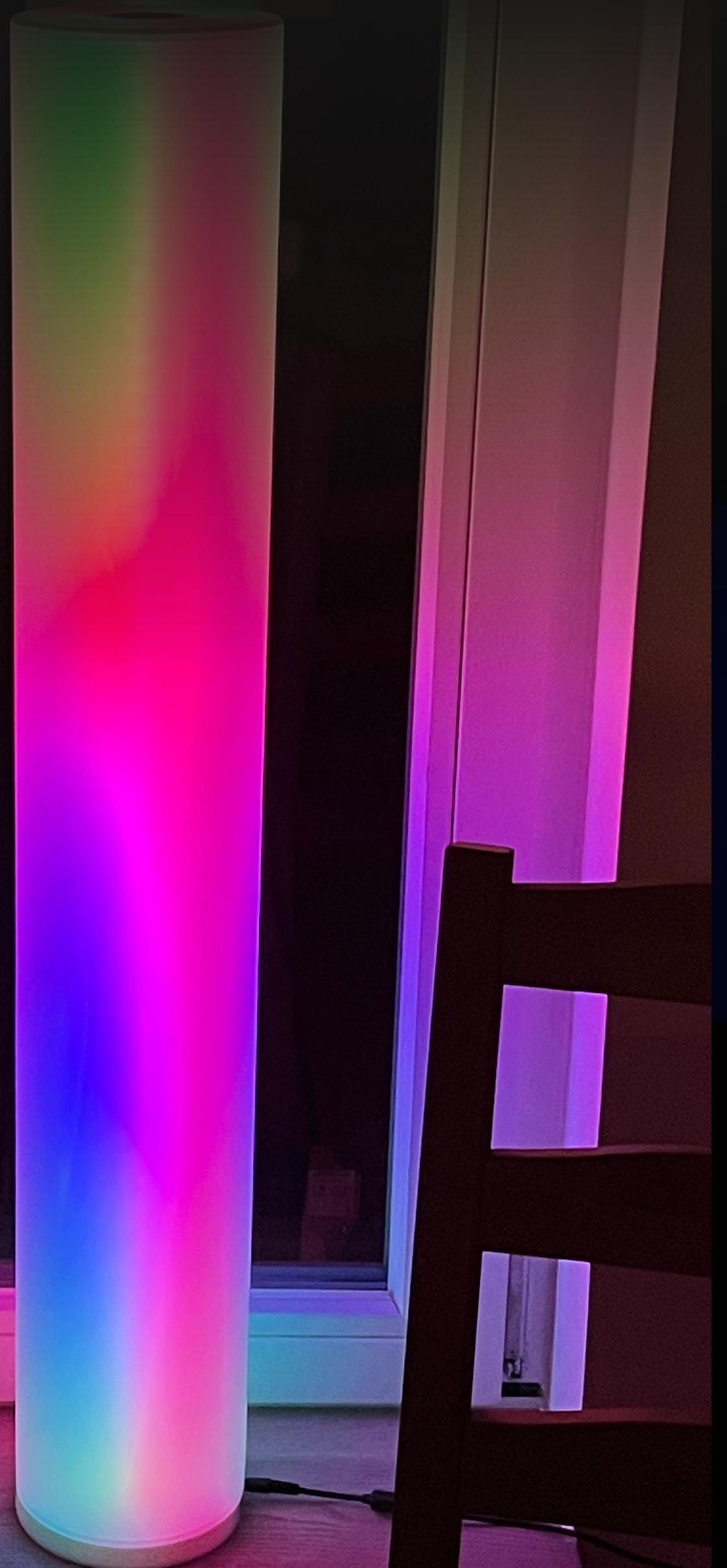


-  marco@glowingkitty.com
-  git.glowingkitty.com
-  events.glowingkitty.com

glowingkitty



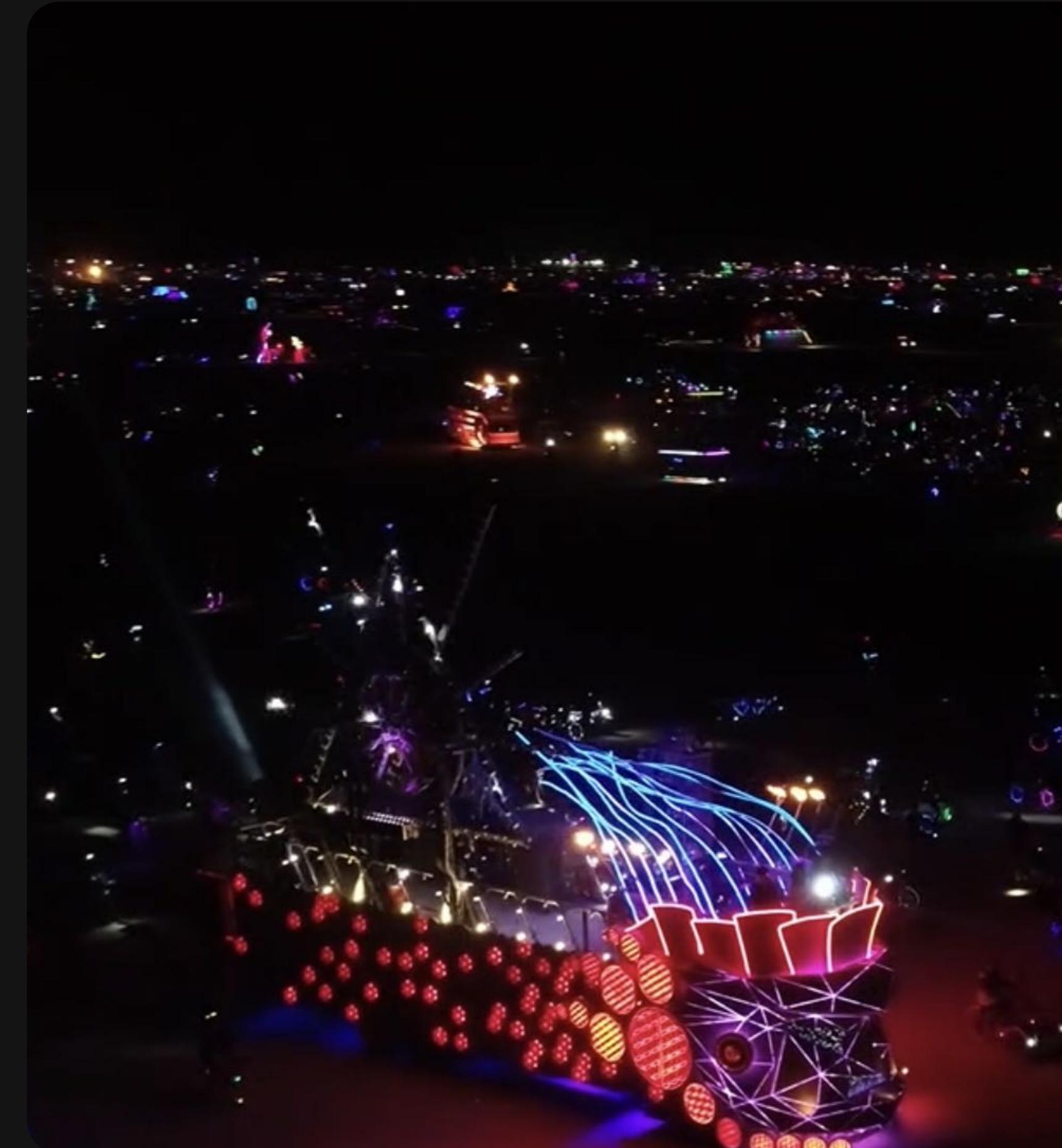
glowingkitty



How I got into LEDs



hackspaces
2016
&
Burning Man
2018



Getting more professional has been a long process

2019



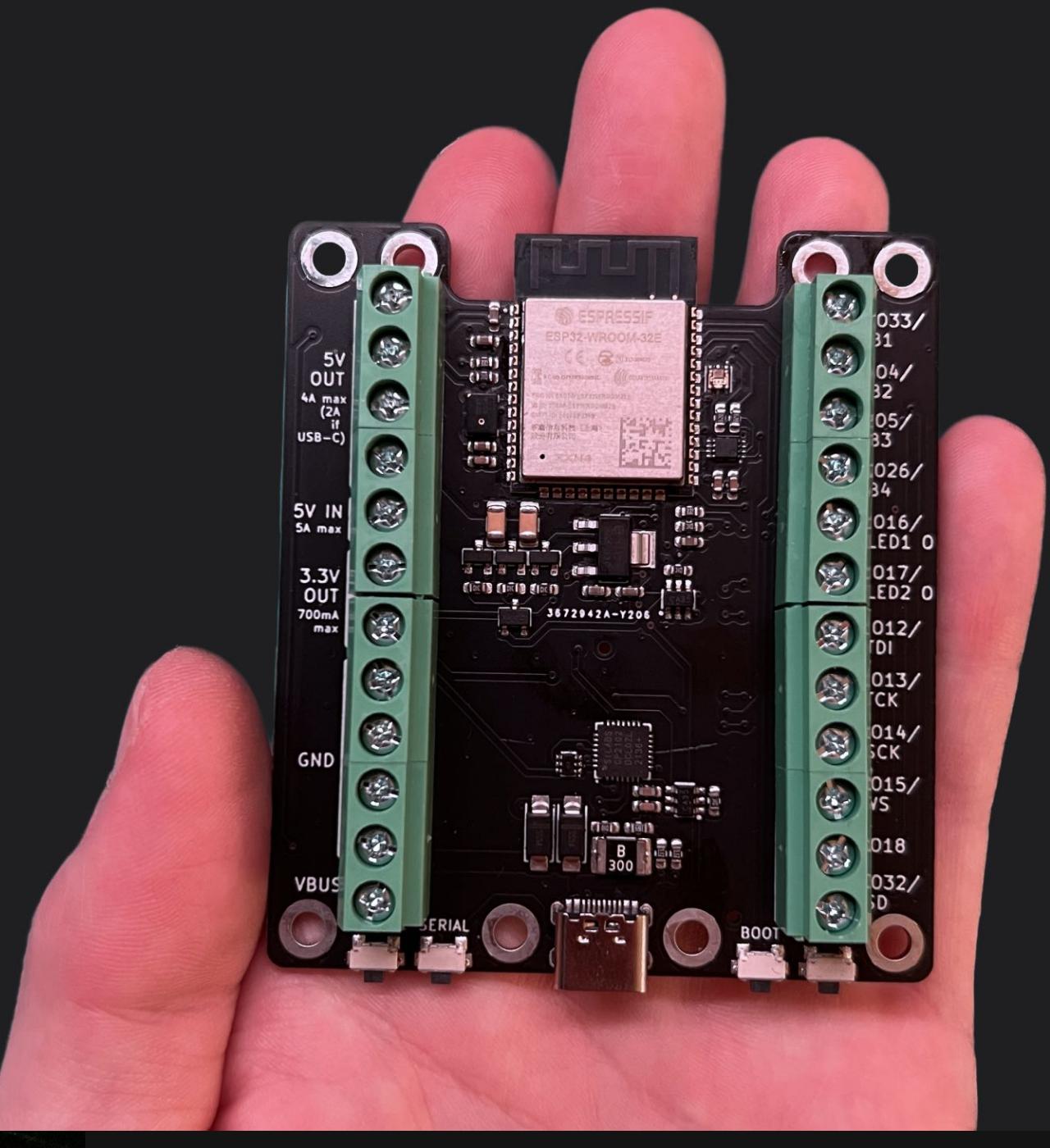
2020



2021



2022



Getting more professional
~~has been~~ a long process

is



- lot of failures
- lot of successes
- lot of frustration
- lot of joy



Sharing is caring

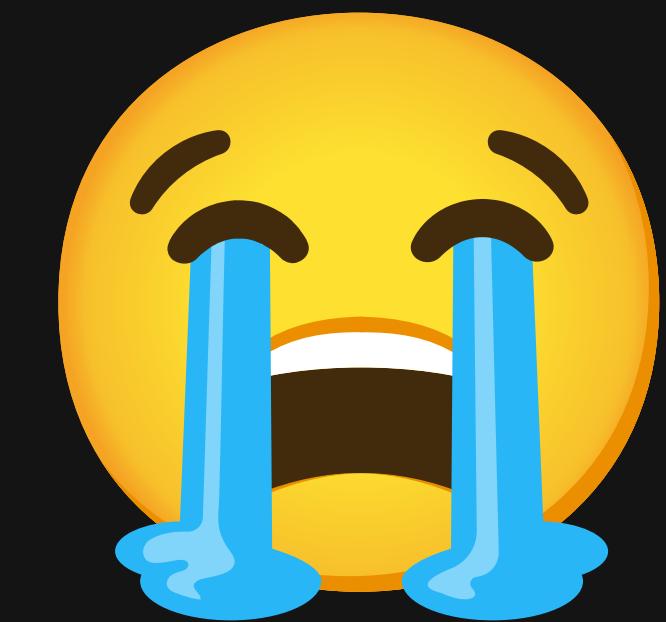
My topics today:



- my recommended development process
- incl. key learnings I made

Spoiler alert

Learning something new means you also
gonna do mistakes. That's normal.



Spoiler alert

Learning something new means you also
gonna do mistakes. That's normal.

But more important:

IT'S FUN!





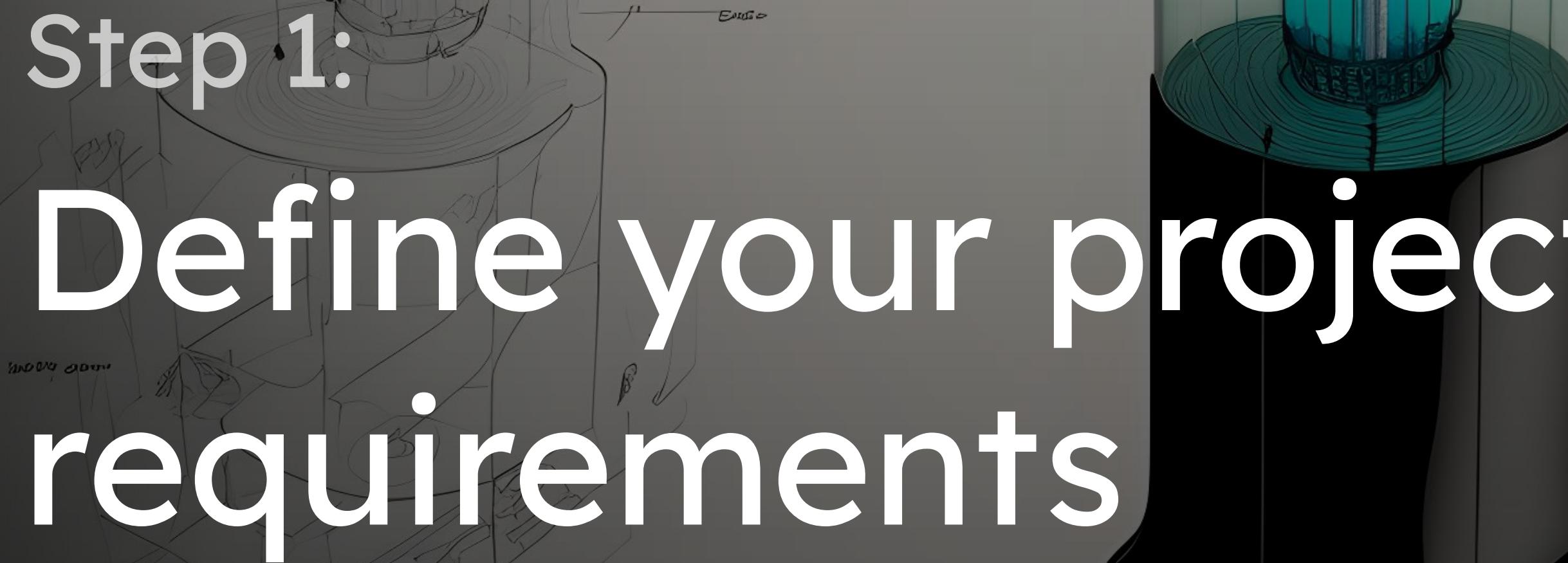
Good news:
You are not the first one!

So you don't need to reinvent the wheel

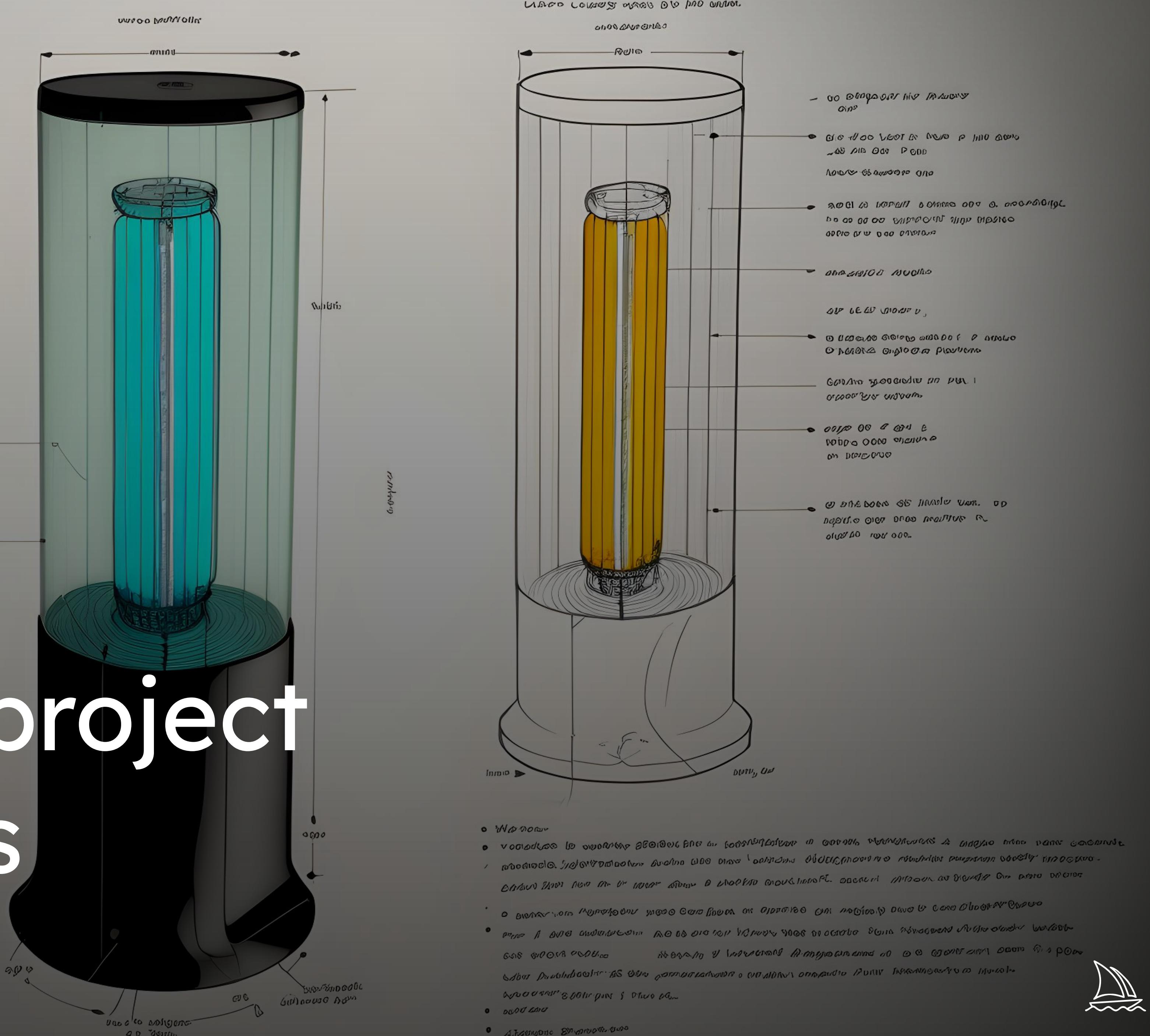
Simplified, in a few steps:

My development process, for building LED projects

That involves custom PCB designs
(Don't , it's easier than you think!)

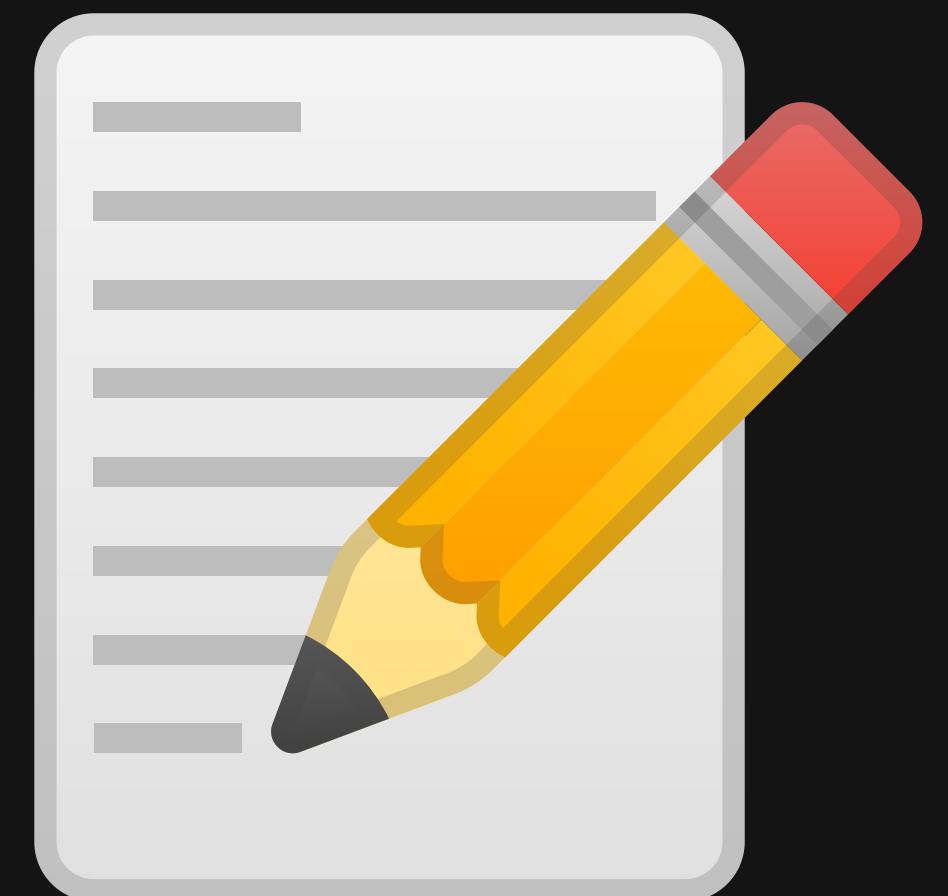


Step 1: Define your project requirements



Define your project requirements

- write them down, maybe even make sketches
- you can't have it all (prioritize core features)
- think about use cases
- ask other people



Define your project requirements

Make use of AI:

Ask ChatGPT

 openai.com/blog/chatgpt



list important product requirements for an LED wristband that people use for dancing during raves in a club setting.



Here are some important product requirements for an LED wristband that people use for dancing during raves in a club setting:

1. Durability: The wristband should be able to withstand the rigors of a club setting, including constant movement, sweating, and contact with other people.
2. Brightness: The LED lights should be bright enough to be visible in a crowded club setting.
3. Battery life: The wristband should have a long battery life so that it can last through the entire event without needing to be replaced.
4. Easy to use: The wristband should be easy to put on and take off, and the LED lights should be easy to turn on and off.
5. Water resistance: The wristband should be able to withstand sweat and accidental spills without malfunctioning.
6. Comfortable to wear: The wristband should be comfortable to wear for long periods of time.
7. Variety of colors and patterns: The wristband should offer a variety of colors and

Define your project requirements

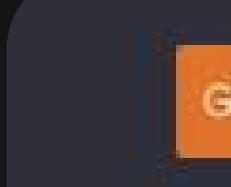
Make use of AI:

Ask ChatGPT

 openai.com/blog/chatgpt

But always remember:

AI will never be 100% right.



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Define your project requirements

Make use of AI:

Use  Midjourney for
inspiration

 midjourney.com

“RGB LED lamps with beautiful diffuser”:





Step 2:

Plan the diffuser & case



Plan the diffuser & case

Diffuser:

acrylic



3D print (FDM/SLA)



epoxy resin



& more

- silicone
- cotton
- fabric
- hot glue

Plan the diffuser & case

Case:

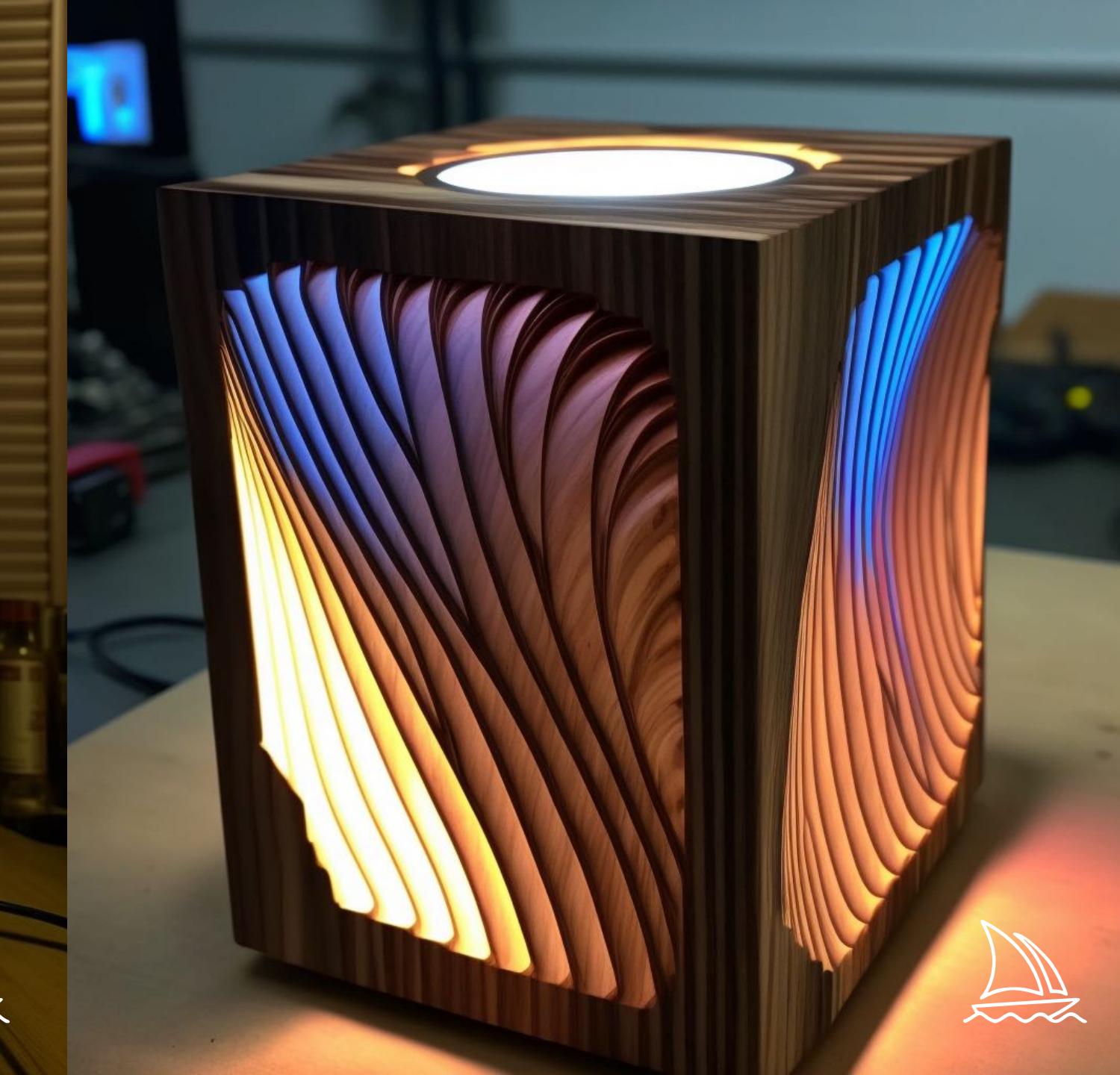
lasercut:
wood/acrylic



3D printed:
FDM/SLA



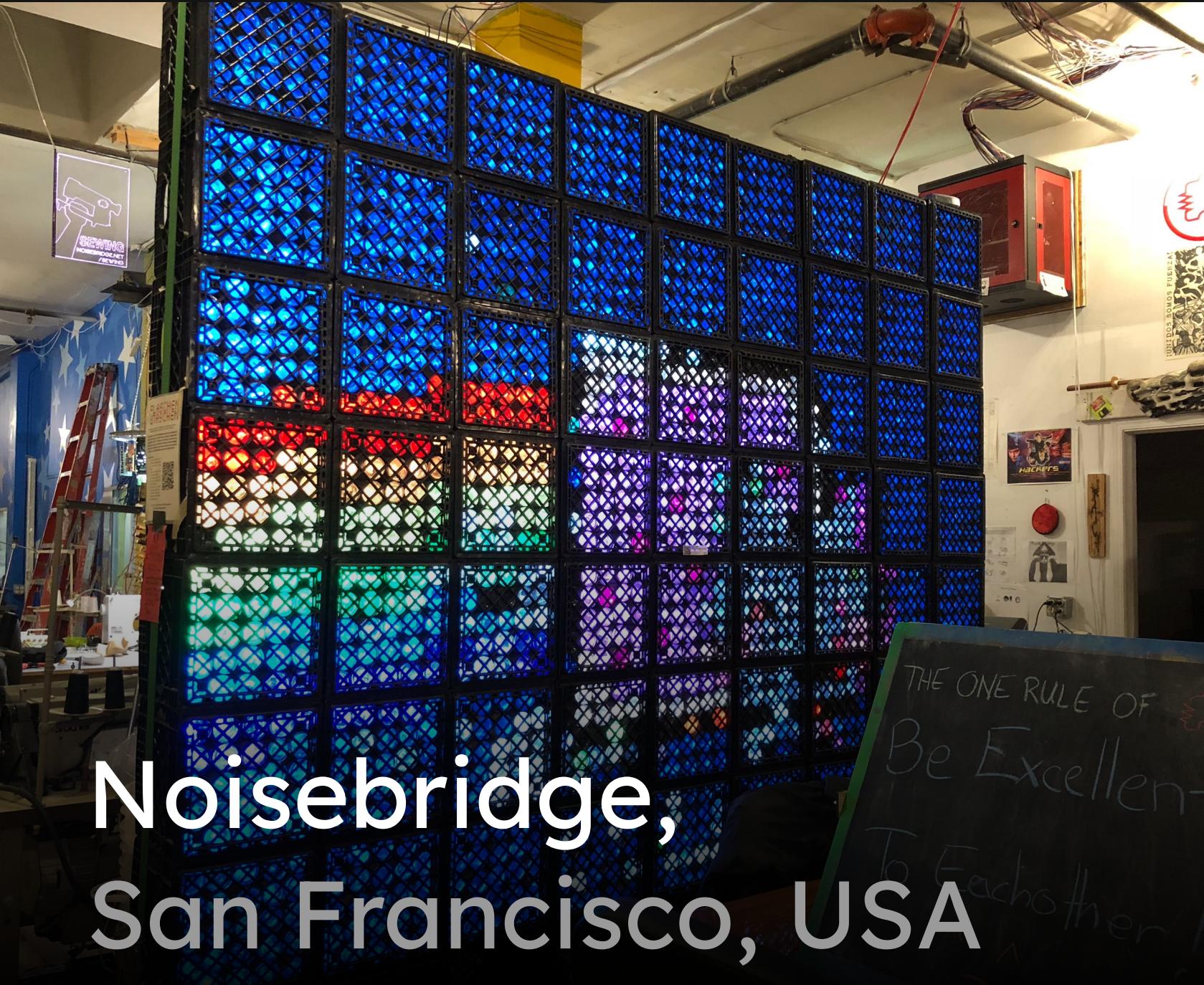
CNC milled:
wood/aluminum ...

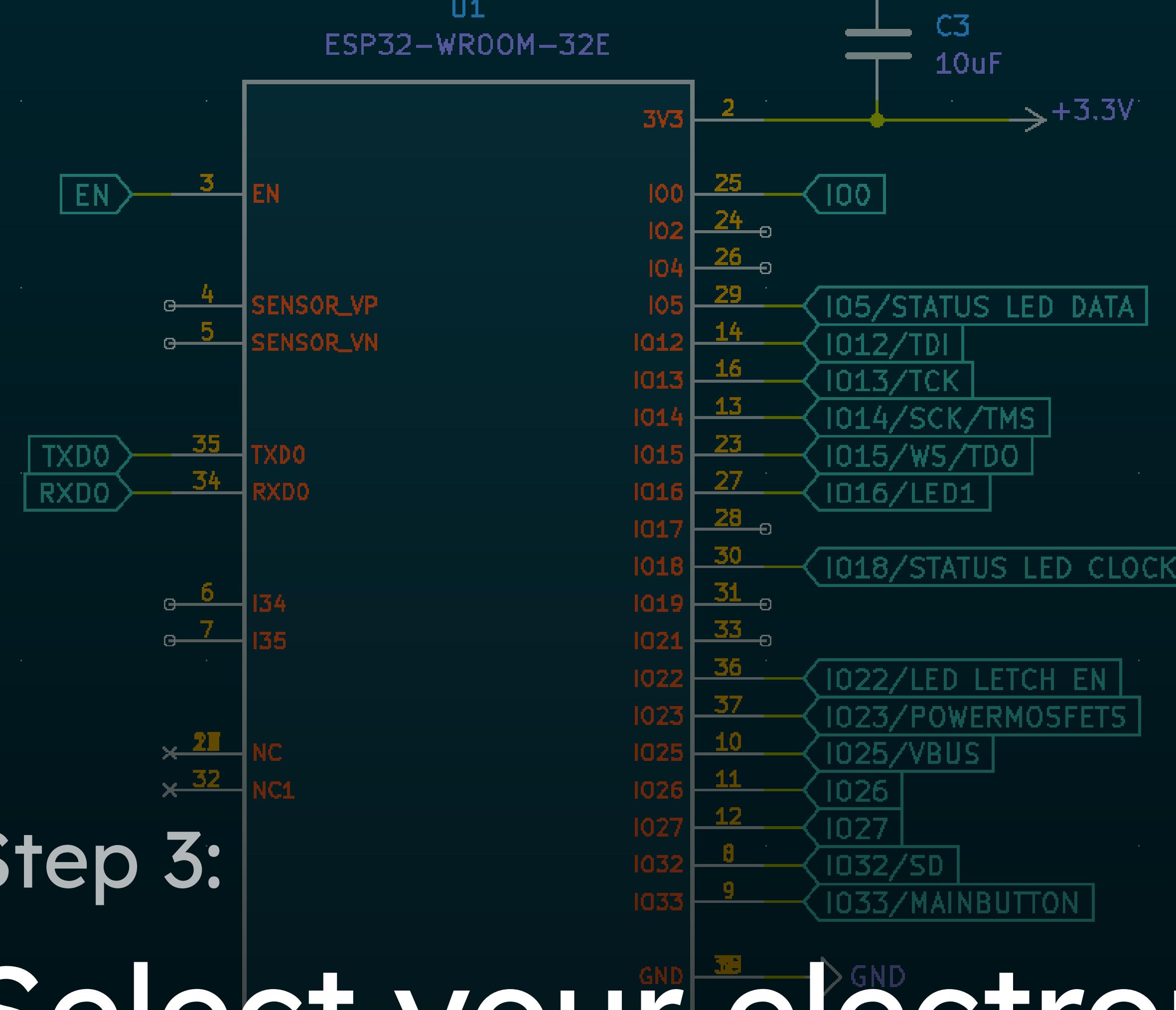


& more

Plan the diffuser & case

More inspiration?
Check out hackspace!





Step 3: Select your electronic components

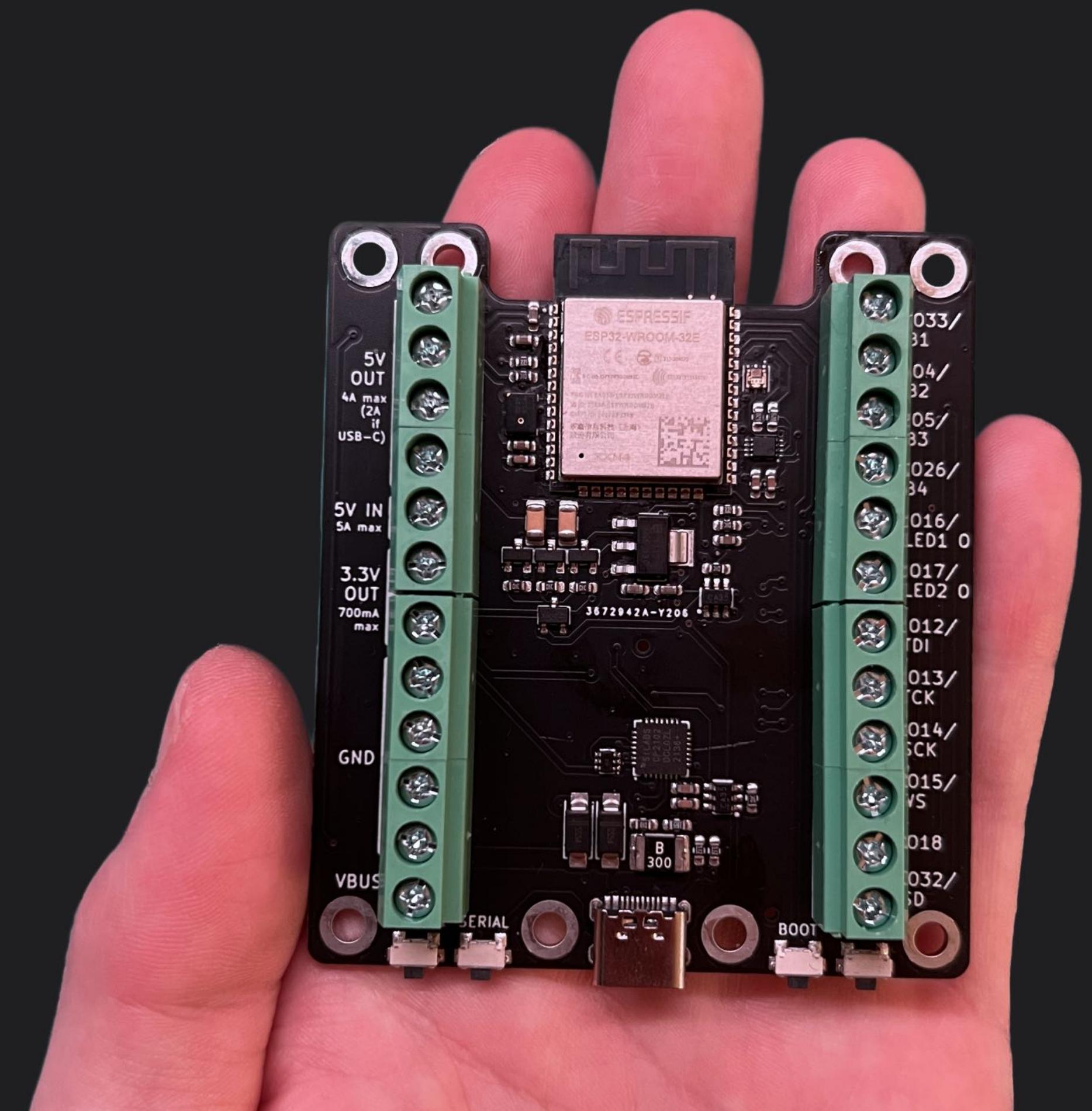
LED levelshifter

Select your electronic components

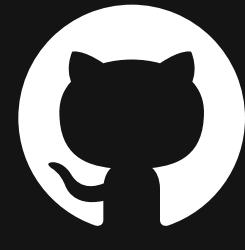
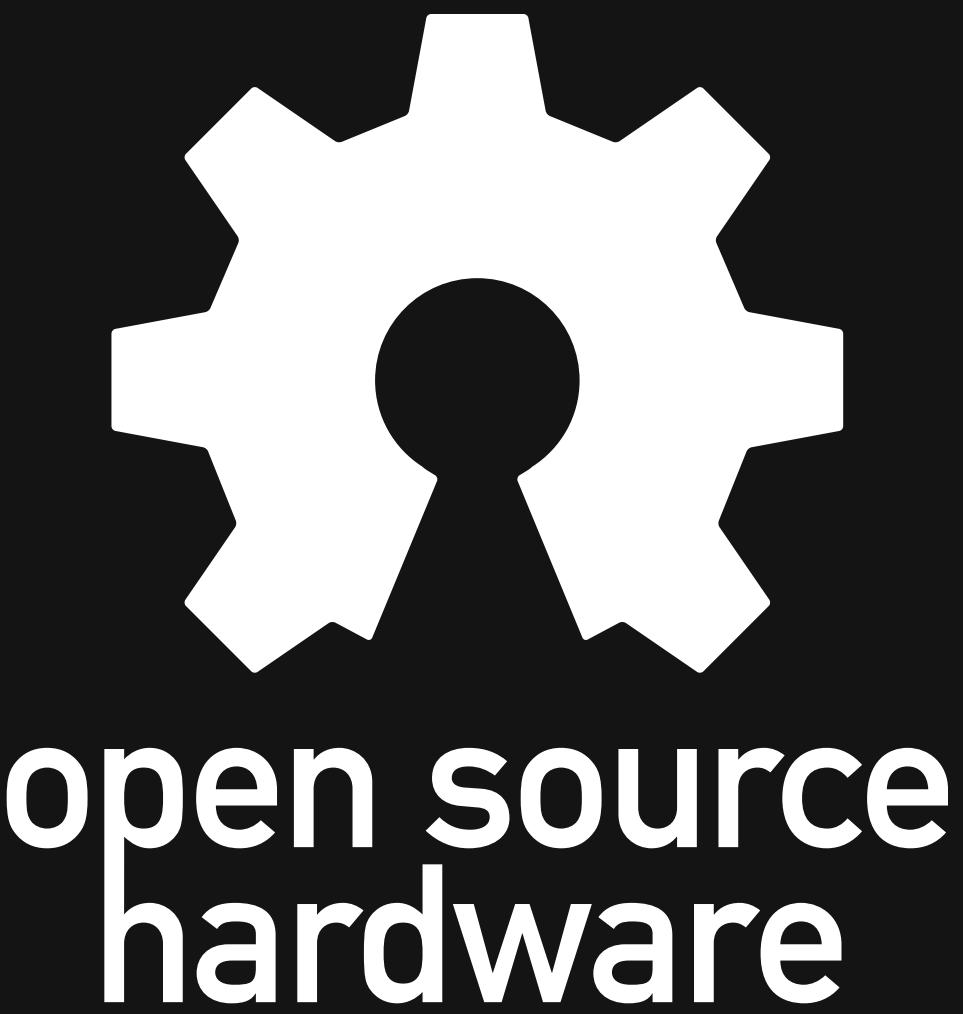
**Test first,
with a dev board +
breakout boards**

Can save a lot of time,
money & frustration.

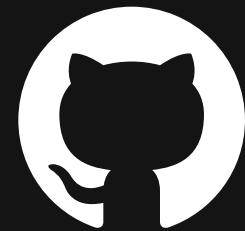
For example with **GlowCore**:



Select your electronic components



/LEDs-by-glowingkitty



/adafruit

To the rescue!

Select your electronic components

Need advice?

- ➡ ask around at hackspace
- ➡ Discord groups
(WLED, Unexpected Makers, glowingkitties)
- ➡ ChatGPT
(oh yes, it can help with electronics as well)

Select your electronic components

Where to search (& buy)?

- AliExpress... sometimes (China, Europe)
- DigiKey (USA), LCSC (China), Mouser (USA)
- or directly on JLCPCB (China)

Any good german stores?....

Select your electronic components

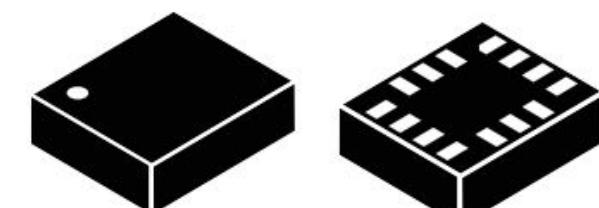
Datasheets are
a blessing!



LSM6DS3TR-C

iNEMO inertial module:
always-on 3D accelerometer and 3D gyroscope

[Datasheet - production data](#)



LGA-14L
(2.5 x 3 x 0.83 mm) typ.

Features

- “Always-on” experience with low power consumption for both accelerometer and gyroscope
- Power consumption: 0.90 mA in combo high-performance mode
- Smart FIFO up to 4 kbyte based on features set
- Android M compliant
- Hard, soft ironing for external magnetic sensor corrections
- $\pm 2/\pm 4/\pm 8/\pm 16\text{ g}$ full scale
- $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000\text{ dps}$ full scale
- Analog supply voltage: 1.71 V to 3.6 V
- Independent IO supply (1.62 V)
- Compact footprint, 2.5 mm x 3 mm x 0.83 mm
- SPI & I²C serial interface with main processor data synchronization feature
- Pedometer, step detector and step counter
- Significant motion and tilt function
- Standard interrupts: free-fall, wakeup, 6D/4D orientation, click and double-click
- Embedded temperature sensor
- ECOPACK®, RoHS and “Green” compliant

The LSM6DS3TR-C is a system-in-package featuring a 3D digital accelerometer and a 3D digital gyroscope performing at 0.90 mA in high-performance mode and enabling always-on low-power features for an optimal motion experience for the consumer.

The LSM6DS3TR-C supports main OS requirements, offering real, virtual and batch sensors with 4 kbyte for dynamic data batching.

ST's family of MEMS sensor modules leverages the robust and mature manufacturing processes already used for the production of micromachined accelerometers and gyroscopes.

The various sensing elements are manufactured using specialized micromachining processes, while the IC interfaces are developed using CMOS technology that allows the design of a dedicated circuit which is trimmed to better match the characteristics of the sensing element.

The LSM6DS3TR-C has a full-scale acceleration range of $\pm 2/\pm 4/\pm 8/\pm 16\text{ g}$ and an angular rate range of $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000\text{ dps}$.

High robustness to mechanical shock makes the LSM6DS3TR-C the preferred choice of system designers for the creation and manufacturing of reliable products.

The LSM6DS3TR-C is available in a plastic land grid array (LGA) package.

Select your electronic components

Confusing?

Ask your fellow
hackers or ChatGPT:

GR

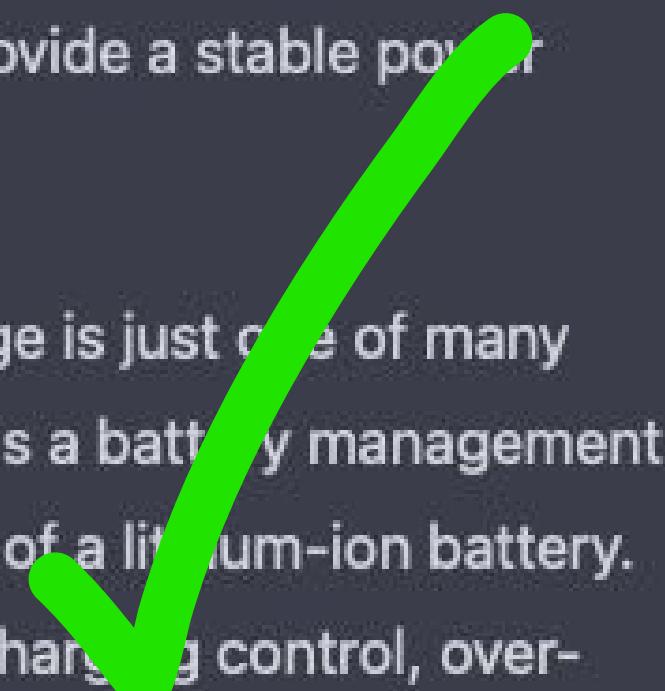
What does the term "OTG Voltage Limit Regulation Range" mean in the datasheet of the "RT9471D" battery management IC?



The "OTG Voltage Limit Regulation Range" in the RT9471D datasheet refers to the range of voltage levels that the device can maintain while in OTG (On-The-Go) mode. OTG mode is a mode in which the device can act as a USB host, allowing it to connect to and communicate with other USB devices.

In the context of the RT9471D, the OTG Voltage Limit Regulation Range is the range of voltage levels that the device can maintain while providing power to other devices through the USB port. This range is typically set to a value above the normal operating voltage range of the device, and is used to ensure that the device can provide a stable power supply to other devices while in OTG mode.

It is important to note that the OTG Voltage Limit Regulation Range is just one of many parameters that can be set or controlled by the RT9471D, which is a battery management IC designed to monitor and control the charging and discharging of a lithium-ion battery. Other features of the RT9471D include battery charging and discharging control, over-current protection, over-voltage protection, and short-circuit protection, among others.



Select your electronic components

Just remember...

AI will never be
100% right.

No!

GR

What does the term "OTG Over-Voltage Threshold" mean in the datasheet of the "RT9471D" battery management IC?



The "OTG Over-Voltage Threshold" in the RT9471D datasheet refers to the voltage level at which the device will enter "OTG" mode. OTG stands for "On-The-Go" and refers to a mode in which the device can act as a USB host, allowing it to connect to and communicate with other USB devices.

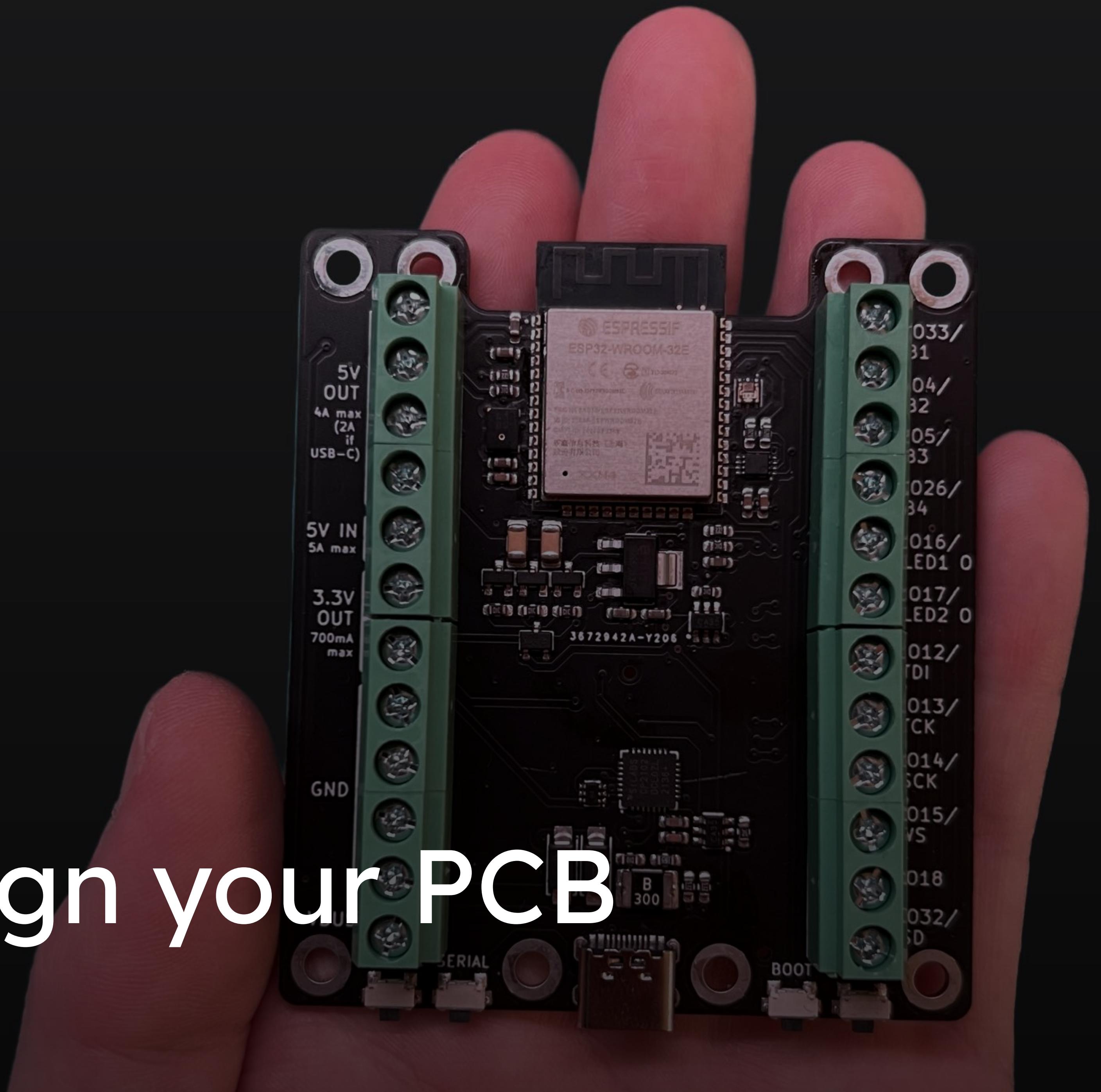
GR

what does over-voltage mean?

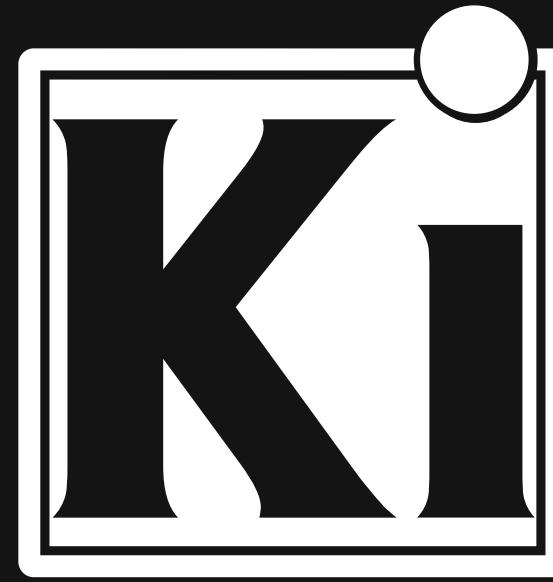


Over-voltage refers to a condition in which the voltage level of an electrical power supply exceeds the normal operating range for a device or system. In general, most electrical devices are designed to operate within a specific range of voltage levels, and can be damaged or malfunction if the voltage level exceeds this range.

Step 4: Design your PCB

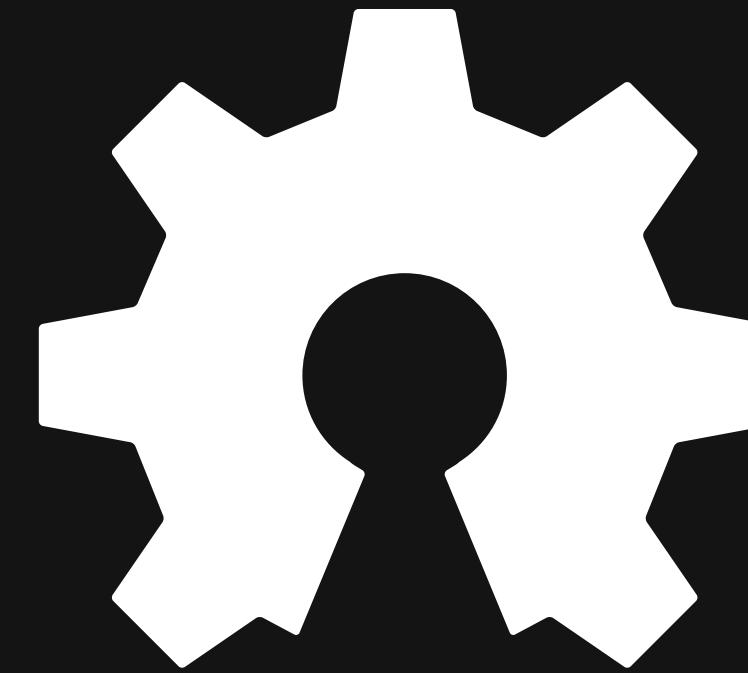


Design your PCB



Cad

+

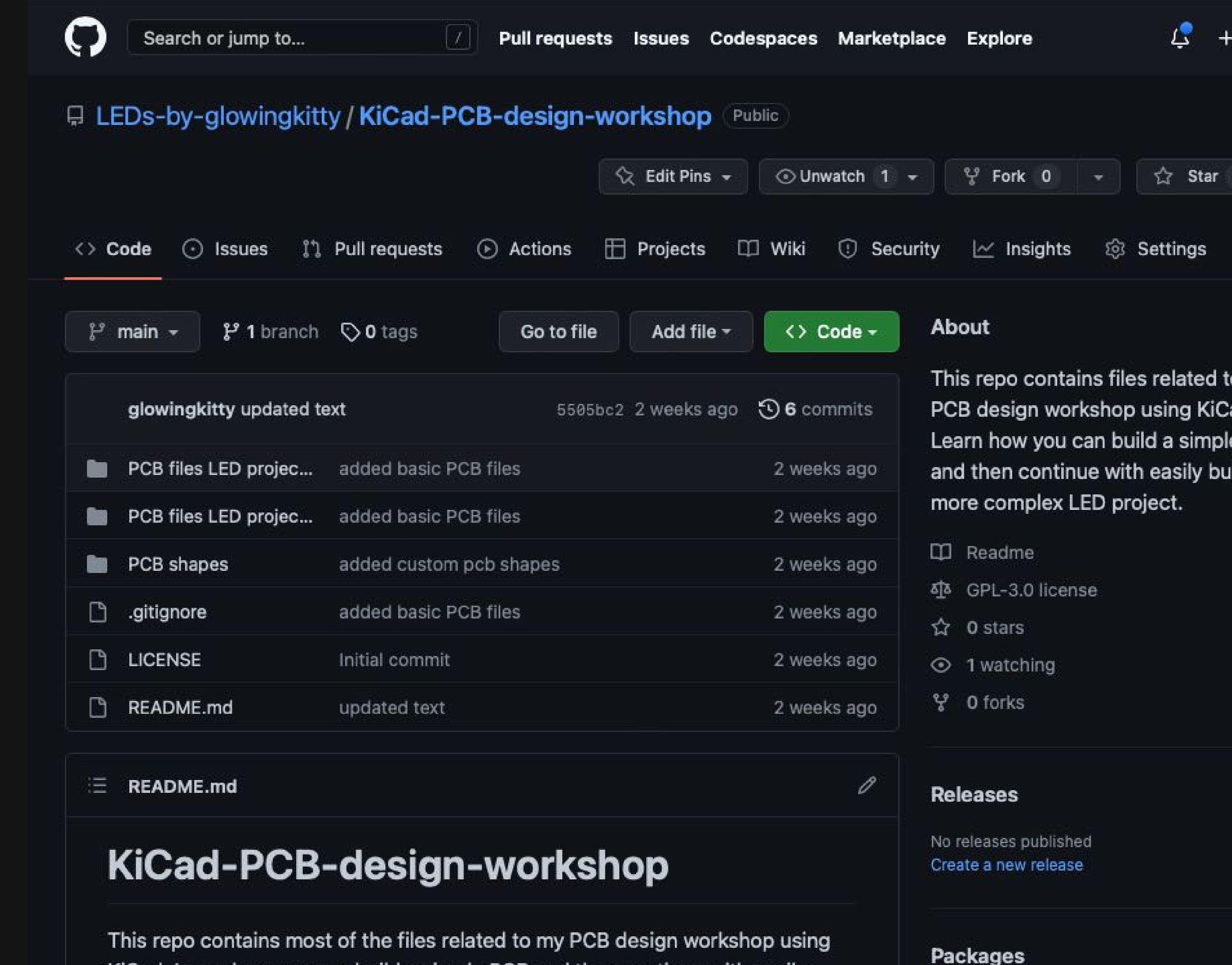


open source
hardware

Design your PCB

PCB files for USB-C
powered & battery
powered LED projects:

 **pcb-workshop.**
glowingkitty.com



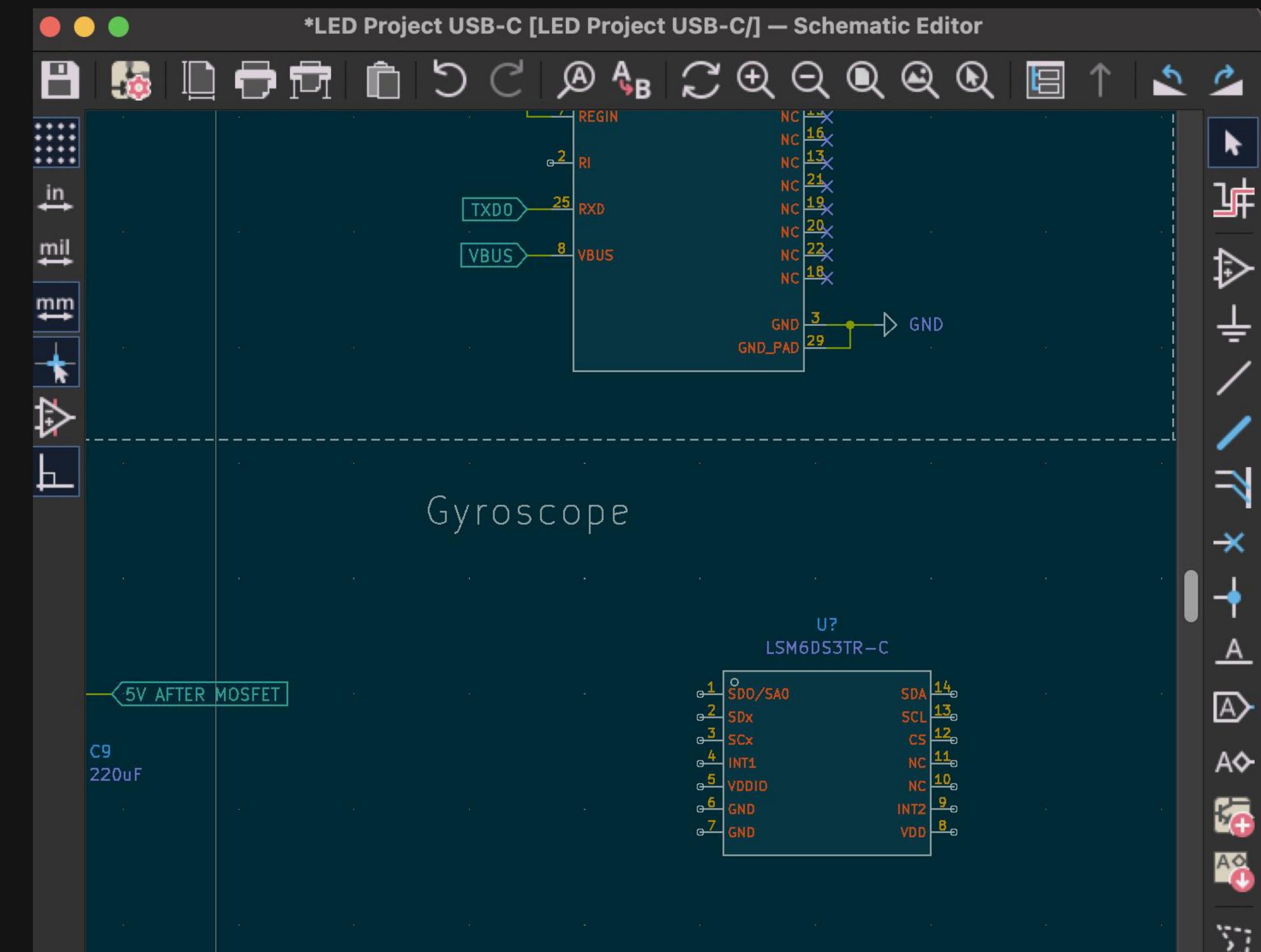
The screenshot shows a GitHub repository page for `KiCad-PCB-design-workshop`. The repository is public and contains 6 commits from user `glowingkitty`. The commits are:

- updated text (5505bc2, 2 weeks ago)
- added basic PCB files (PCB files LED projec..., 2 weeks ago)
- added basic PCB files (PCB files LED projec..., 2 weeks ago)
- added custom pcb shapes (PCB shapes, 2 weeks ago)
- added basic PCB files (.gitignore, 2 weeks ago)
- Initial commit (LICENSE, 2 weeks ago)
- updated text (README.md, 2 weeks ago)

The repository has 0 stars, 1 watching, and 0 forks. It includes links for Readme, GPL-3.0 license, and Settings. A note states: "This repo contains files related to my PCB design workshop using KiCad. It contains most of the files needed to build a simple LED project, and then continue with easily building more complex LED projects." There is also a section for Releases with a link to Create a new release.

Design your PCB

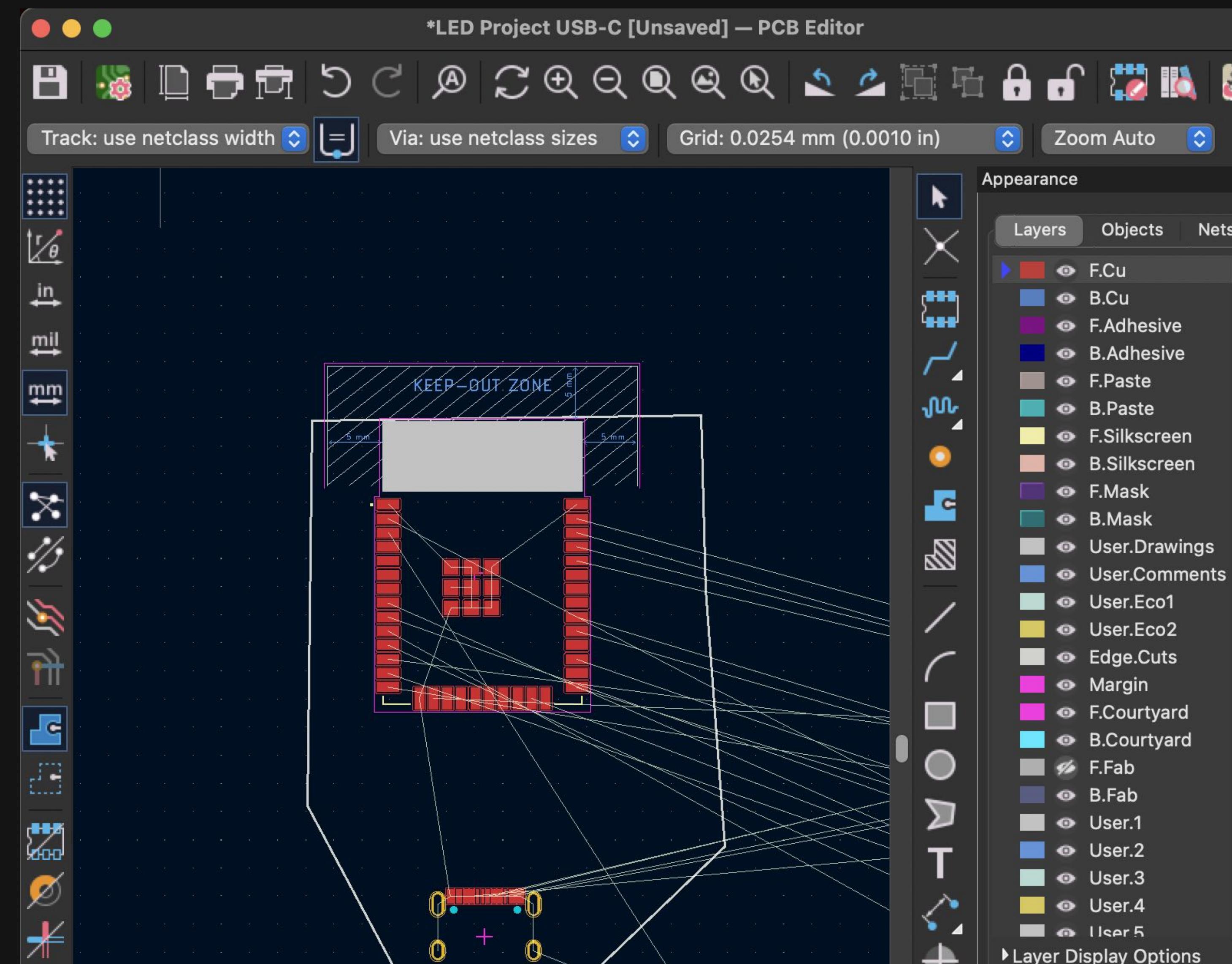
Add what you want,
remove what you
don't want.



Design your PCB

Sketch a PCB shape,
place components.

Just a draft,
to get an idea for
space needed.



Design your PCB

Want a more in depth
workshop about this?

Jan 19, 2023 6:30 PM

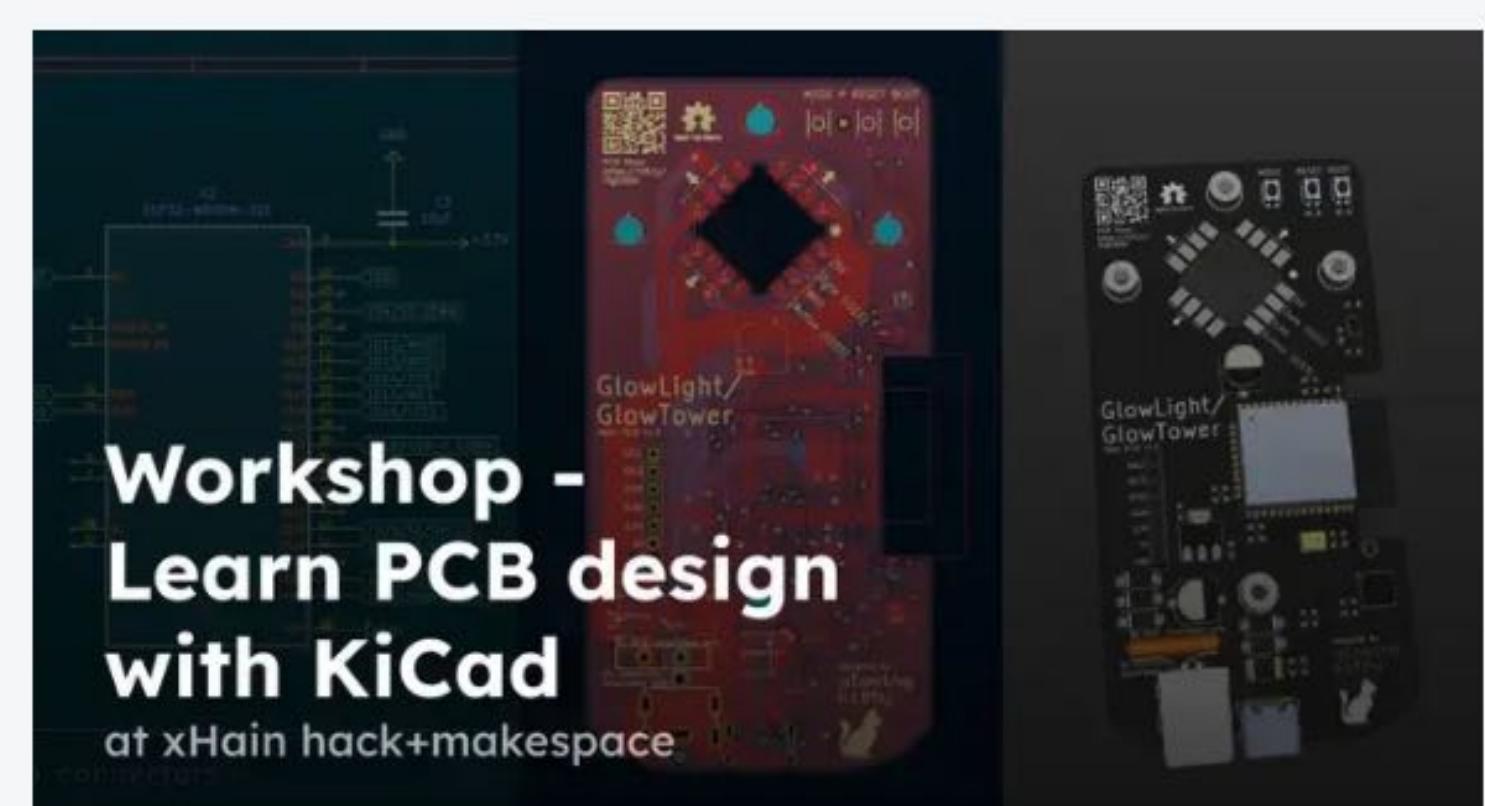
at xHain

 events.glowingkitty.com

Meetup Search for keyword: Flöha, DE Start a new group English Log in Sign up

Workshop - Learn PCB design with KiCad

Hosted By Glowingkitty



Details

Building LED projects with existing development boards and PCBs with sensors and other components are nice and fun. But at some point, you start to realize that all those wires connecting your components are getting really annoying, that most components are not available as breakout boards, and that you cannot build a project you have in mind, because it takes up too much space or because you cannot find the right components.

But there is a solution - and it's much easier than you might think: design your own PCB! We live in a time when makers have access to technology and the ability to make their ideas a reality like never before.

LED Makers Berlin Public group

Thursday, January 19, 2023 6:30 PM to 8:30 PM CET

xHain hack+makespace Grünberger Str. 16 · Berlin, BE

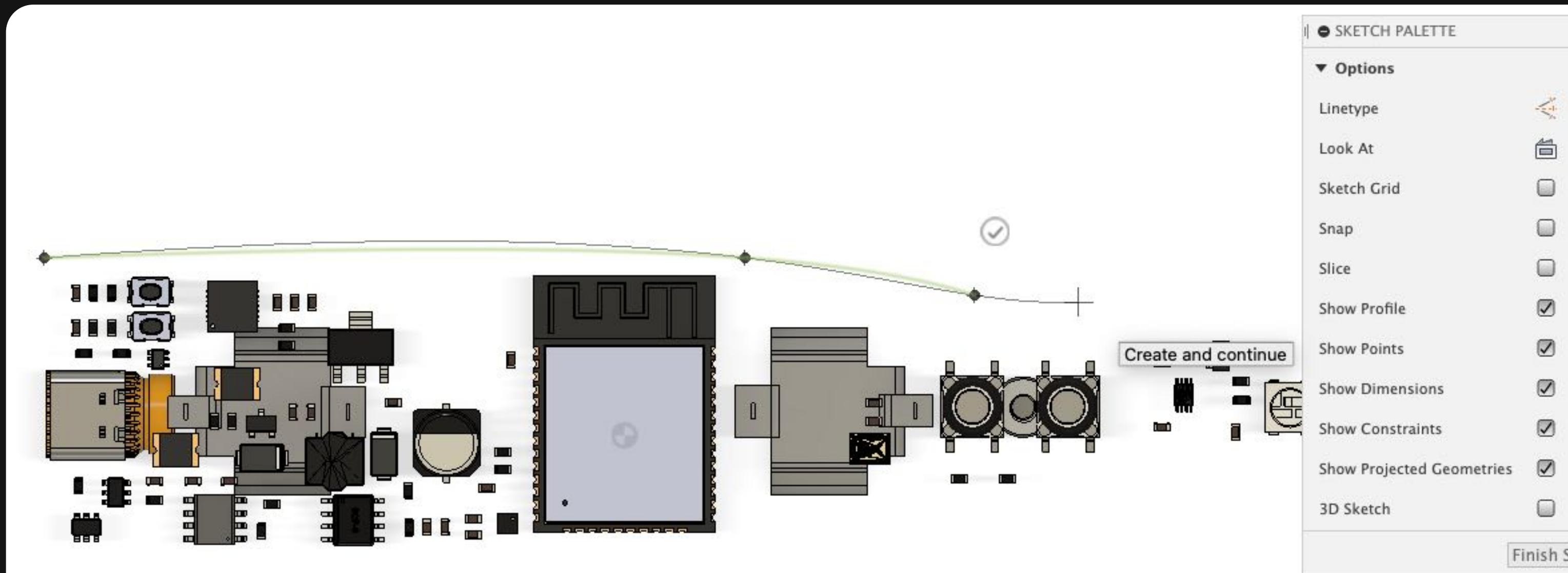


Design your PCB

Export 3D model,
import into CAD
software, 3D model
case around it.

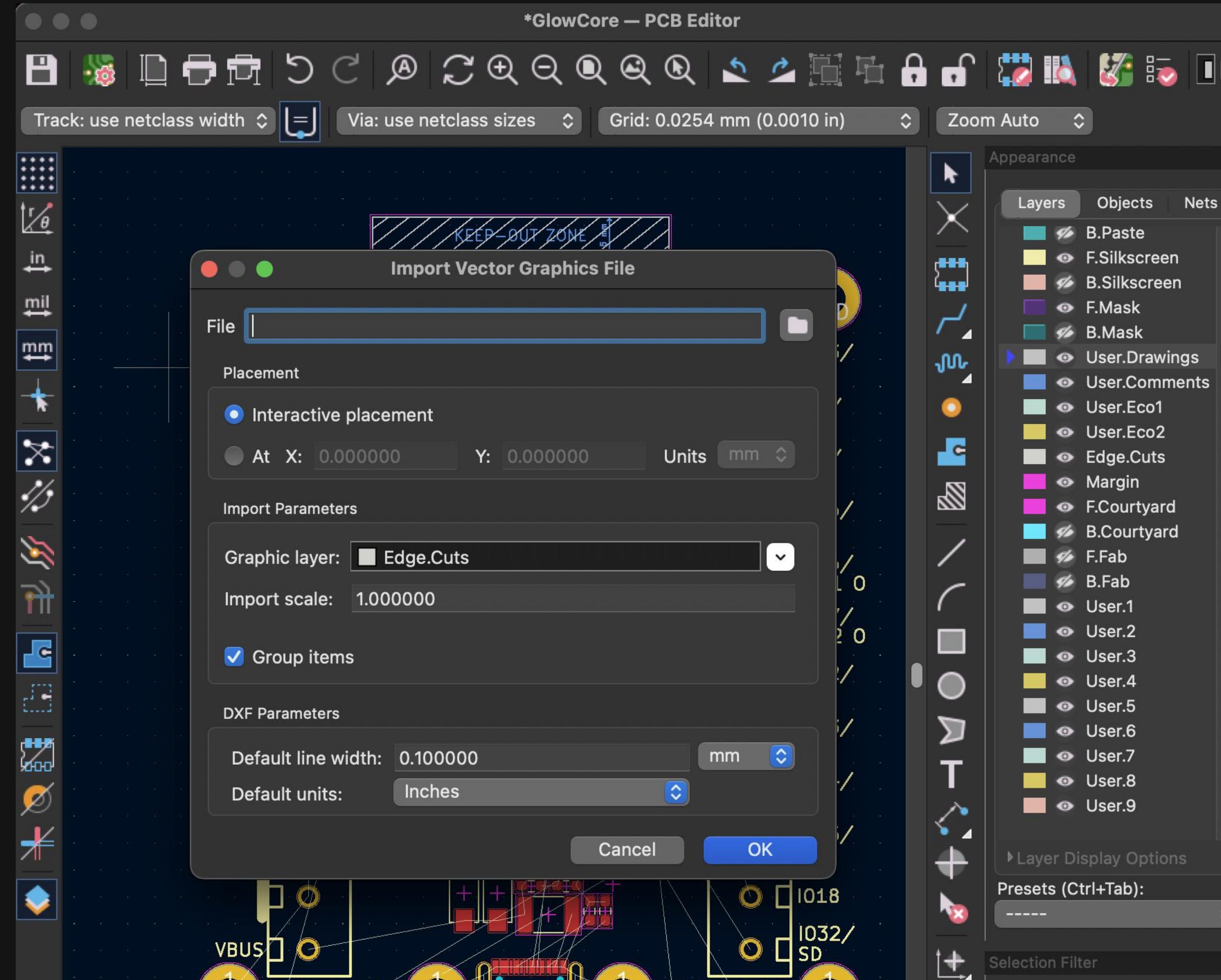
I wish I could
recommend FreeCAD
here... if only the usability
would be better...

My recommendation: **Fusion360**



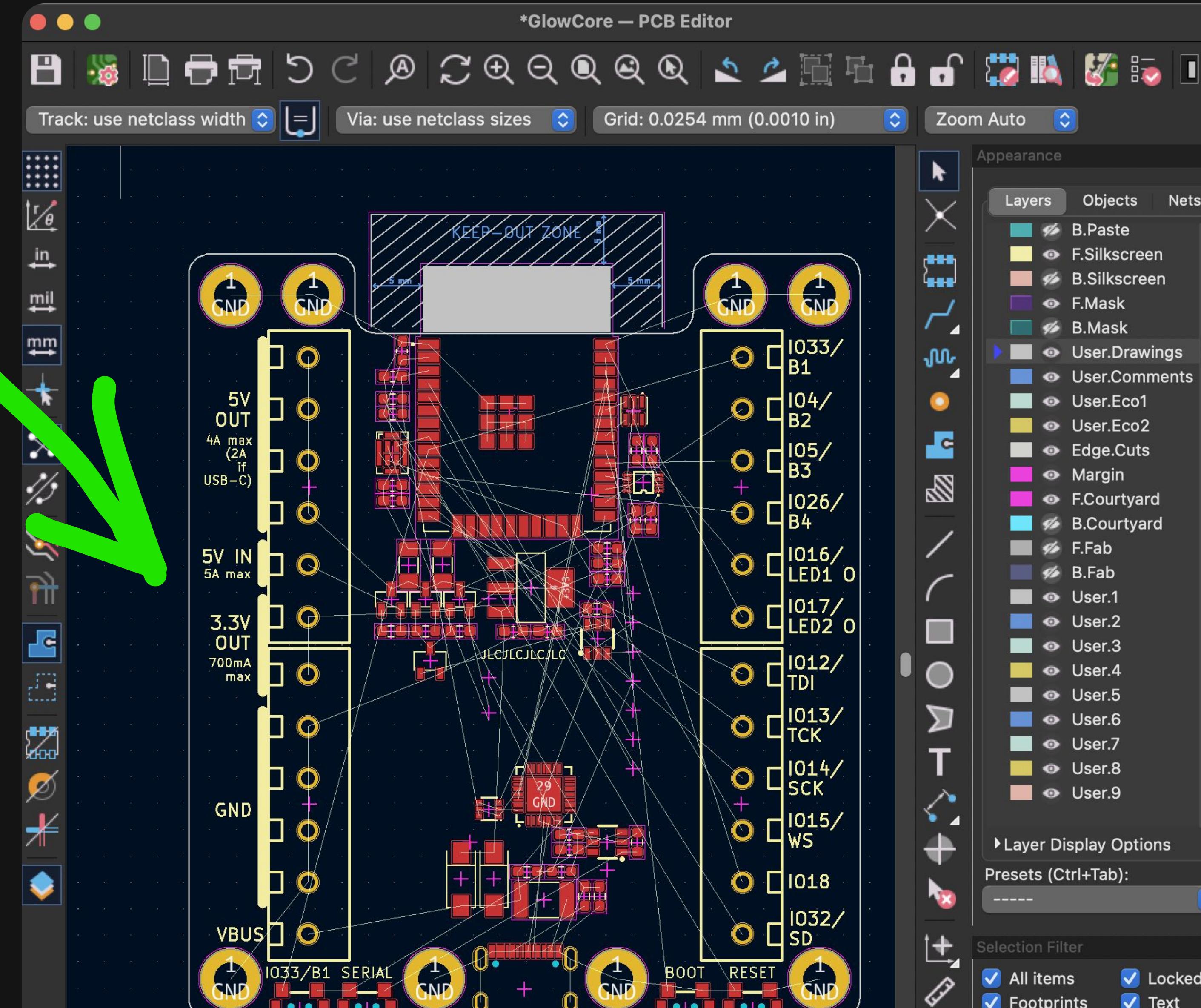
Design your PCB

Export real PCB
shape (a 2D sketch)
as DXF file &
import into KiCad
to Edge.Cuts



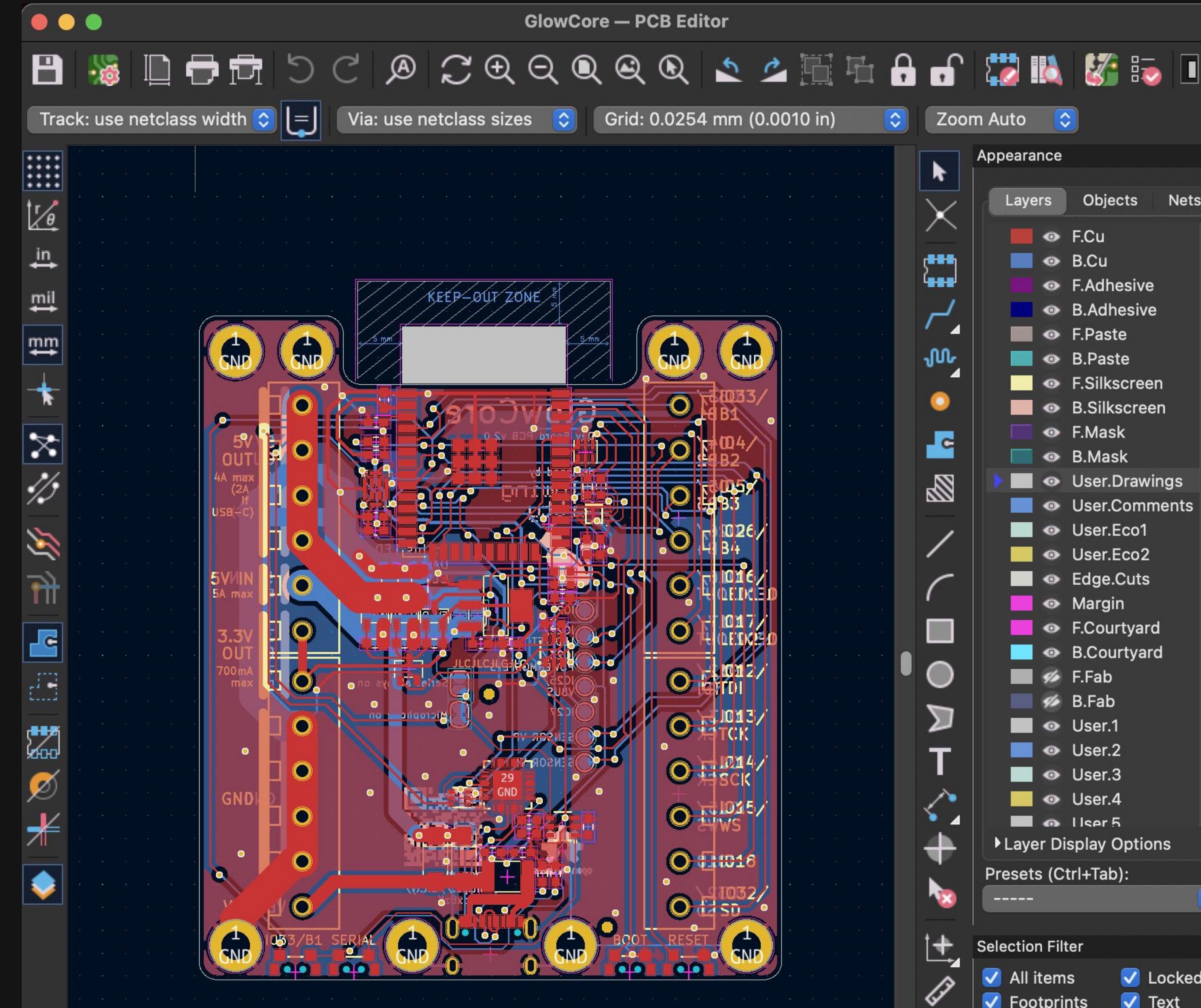
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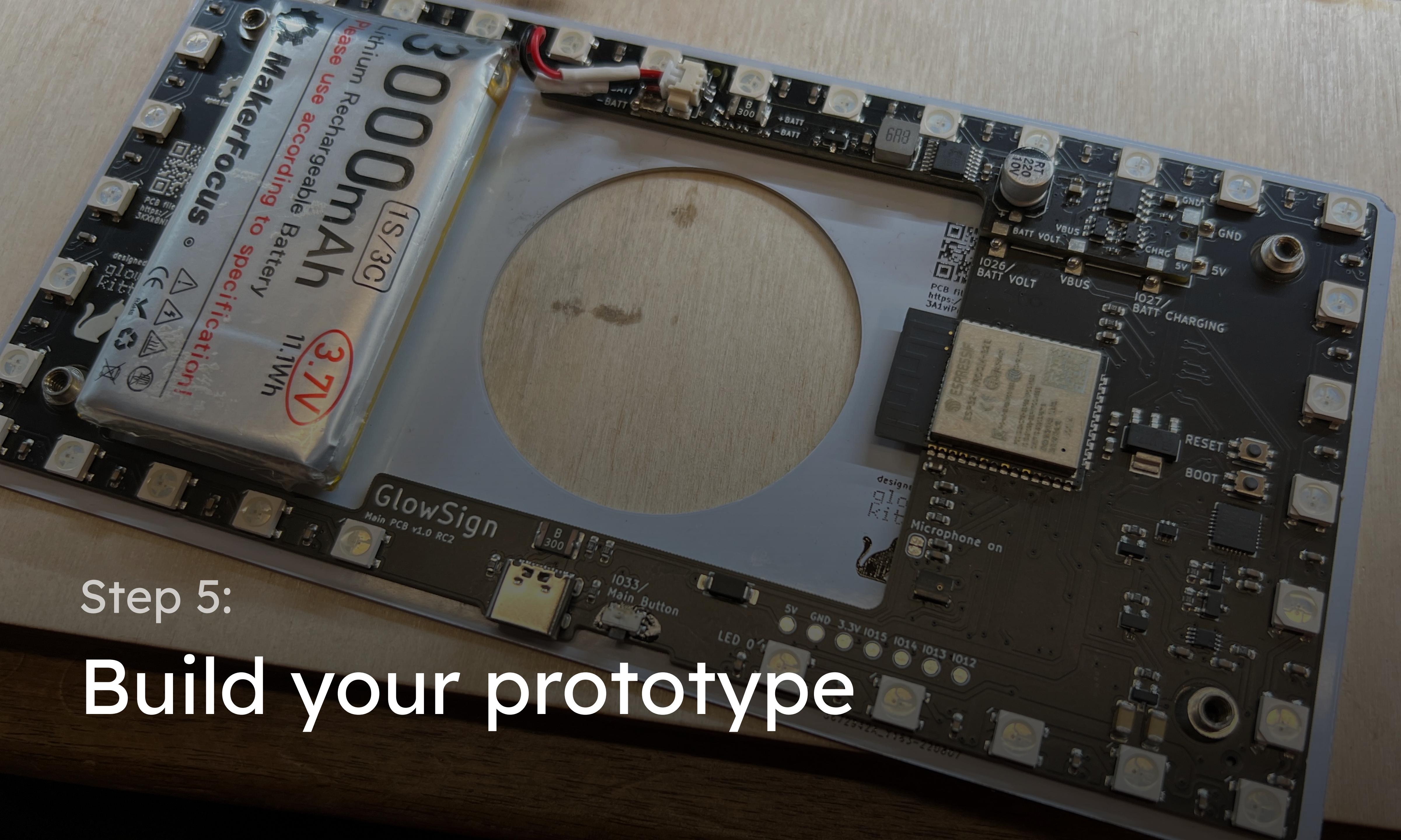
Design your PCB

Finish routing,
use the Design
Rules Checker,
export your PCB in
Gerbers format.



Step 5:

Build your prototype



Build your prototype



Make your PCB:

Option 1 (my advice):

Order assembled PCBs

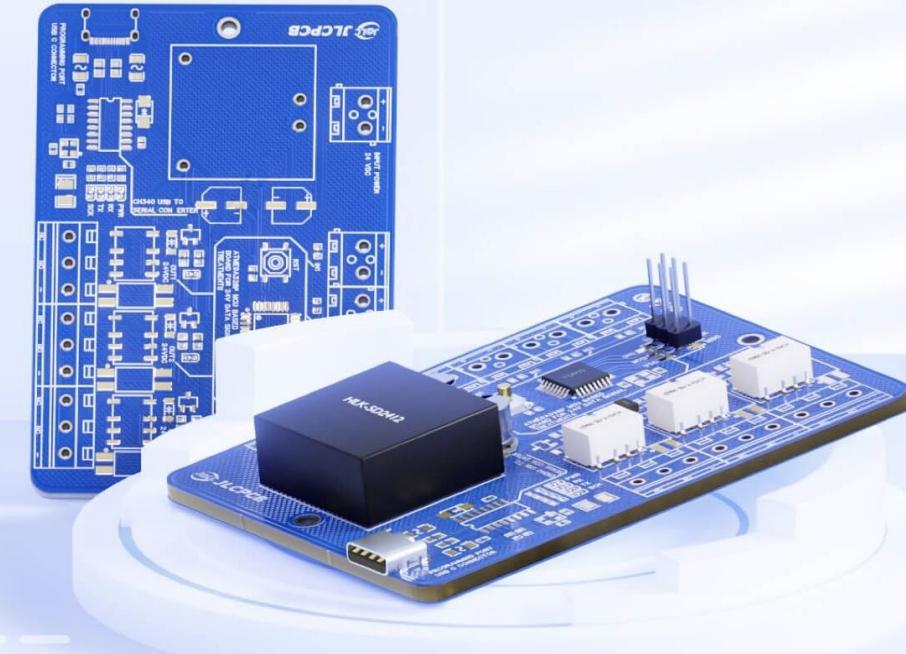


Special Offer

4-6-8 Layer PCBs for \$2

Free Assembly. Free ENIG & Via-in-pad with POFV for 6-8 Layers PCBs. 5pcs 50*50mm

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Full feature custom PCB prototype service.

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PCB Assembly

OEM | EMS

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Instant Quote

Full feature prototype PCB custom service at low cost.

Dimensions

Quantity

Length x Width mm

Choose Num (pcs)

Layers

Thickness

2 Layers

1.6mm

Quote Now

Get \$5.00 - Free Prototype Order

Order
custom parts
online

Online CNC
machining services
3D printing service
Sheet Metal Fabrication Service

\$ 5.00

10 pcs 1-2 layer
Build Time:24 hours

\$ 30

free shipping
for 1-20pcs assembly

Best Value
Manufacturer Direct Pricing

Fast Turnaround
As fast as 24 hours

One-on-one assistance
Smooth shopping experience

News: 09-09 Soldermask | Multi-layer PCB Manufacturing Process - 11

PCBWay, PCB Prototype the Easy Way

With more than a decade in the field of PCB prototype and ...

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Community

Company



AISLER

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Get started



Your design as a Powerful Prototype

Does your project need PCBs, parts, or stencils? AISLER has you covered. Everything you need to get your electronics project built. Manufactured within two business days and shipped to you for free world-wide. Boost your productivity without blowing your budget.

[Get Started](#)

Technical Capabilities

Merry Christmas

Click here for all deadlines of 2022

Build your prototype



Make your PCB:

Option 2 (cheaper):

Order PCBs + parts +

order/make stencil +

assemble yourself

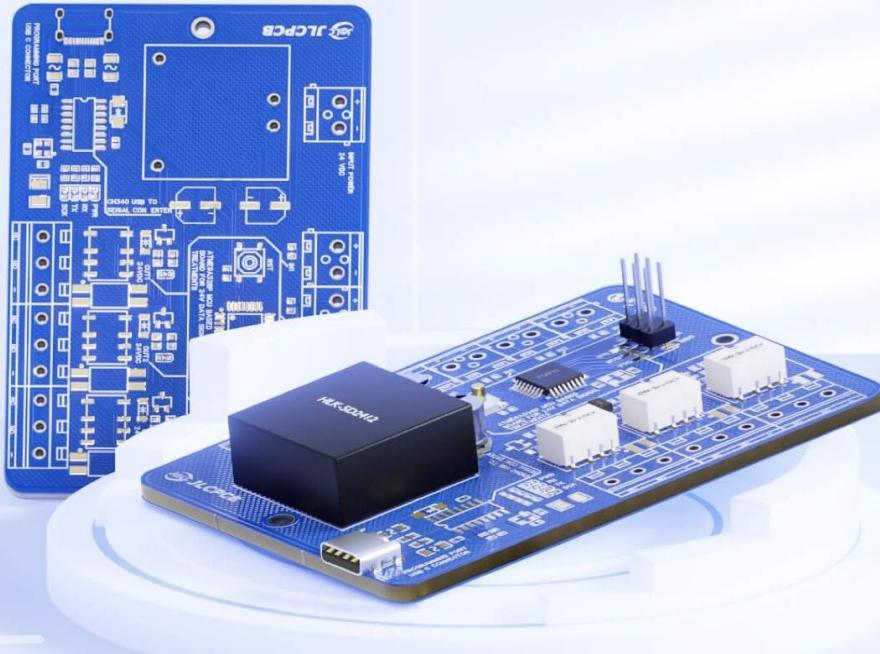


Special Offer

4-6-8 Layer PCBs for \$2

Free Assembly. Free ENIG & Via-in-pad with POFV for 6-8 Layers PCBs. 5pcs 50*50mm

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PCB Prototype

Instant Quote

Full feature prototype PCB custom service at low cost.

Dimensions

Quantity

Length x Width mm

Choose Num (pcs)

Layers

Thickness

2 Layers

1.6mm

SMD Stencil

Quote Now

Get \$5.00 - Free Prototype Order

**Order
custom parts
online**

Online CNC
machining services
3D printing service
Sheet Metal Fabrication Service

\$ 5.00
10 pcs 1-2 layer
Build Time:24 hours

\$ 30
free shipping
for 1-20pcs assembly

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Your design as a Powerful Prototype

Does your project need PCBs, parts, or stencils? AISLER has you covered. Everything you need to get your electronics project built. Manufactured within two business days and shipped to you for free world-wide. Boost your productivity without blowing your budget.

[Get Started](#)

Technical Capabilities

Merry Christmas

Click here for all deadlines of 2022

Build your prototype

Make your case:

Option 1:

Build it yourself

FDM 3D print

SLA 3D print

Laserutter

Resin casting

CNC machine

Build your prototype

Make your case:

Option 2:

Order the cases

JLCPCB

PCBway

Build your prototype

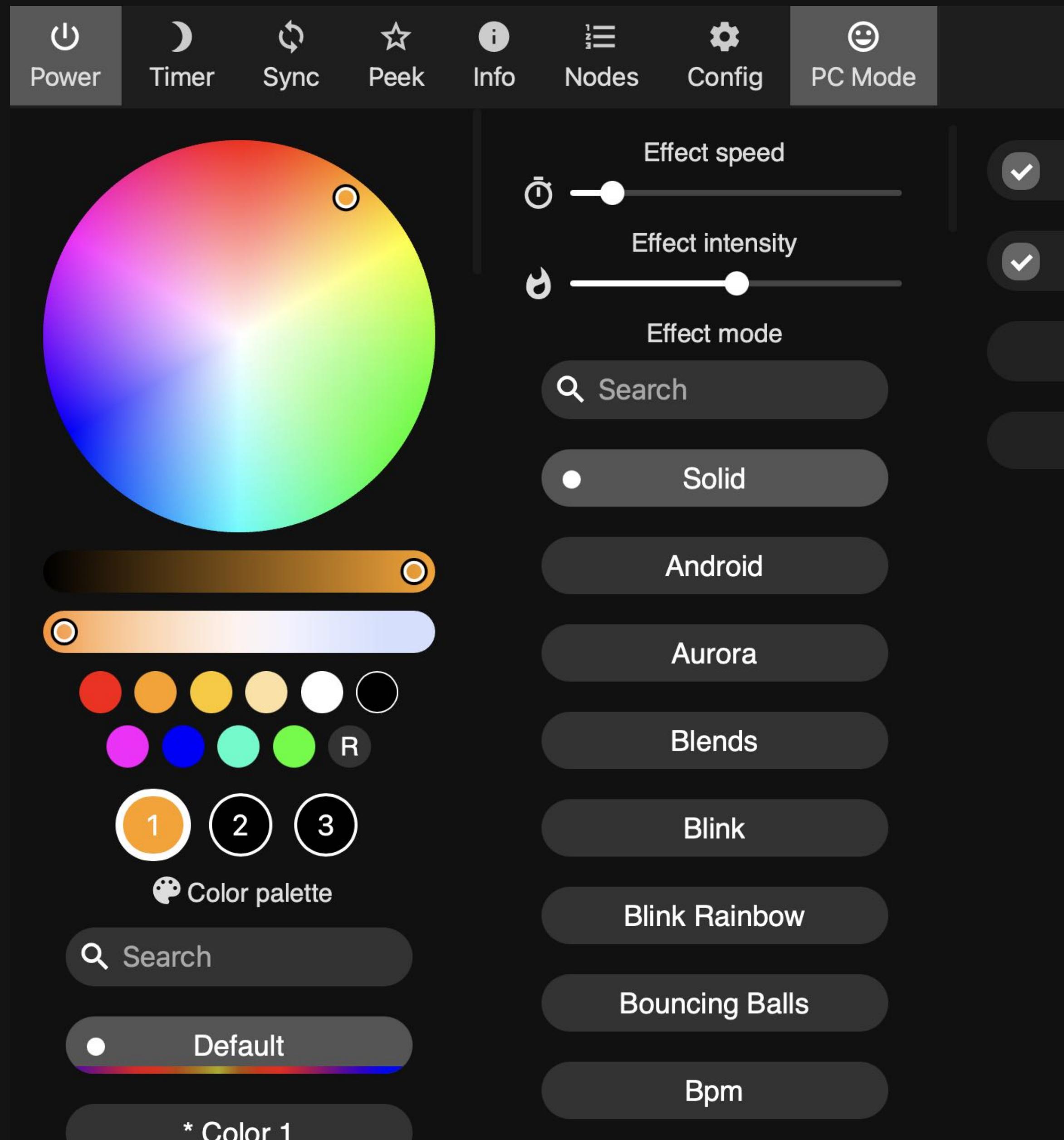
Software:

My advice (for LED projects):

WLED

or VScode + Platform.io +

Cpp for coding





Search or jump to...

Pull requests Issues Codespaces Marketplace Explore



LEDs by glowingkitty

We create open source LED lamps and educate people on how to build electronics!

3 followers Germany <https://glowingkitty-led.com>

Follow

Overview

Repositories 17

Projects

Packages

Teams

People 1

Settings

Pinned

Customize pins

GlowLight Public

A compact desk lamp that glows smoothly from all sides. Perfect for setting a relaxed mood at home, or to use it as a party light indoor or even outdoor.

1

GlowTower Public

A beautiful looking LED lamp for lighting up your home or setting the right mood at house parties - with animations that can react to music.

1 G-code

GlowTube Public

An LED strip system on the wall, that can be used to light up your home or set the right mood at a house party.

HTML

RELEASE YOUR PROJECT!!!

GlowSign Public

A battery powered LED sign for your laptop, or where ever else

View as: **Public** ▾

You are viewing the README and repositories as a public user.

You can create a README file visible to anyone.

Get started with tasks that most successful organizations complete.

People



Invite someone

Top languages

RELEASE YOUR PROJECT!!!

There is always something to improve.

Be careful, it's a trap!

Common mistakes

- endless development
- wrong tolerances between PCB & case -> consider tolerances are different for FDM, SLA, lasercutter
- “I am sure the PCB works, so I better order 10 of them assembled now, since it’s cheaper per unit”
- getting demotivated by failures/slow progress

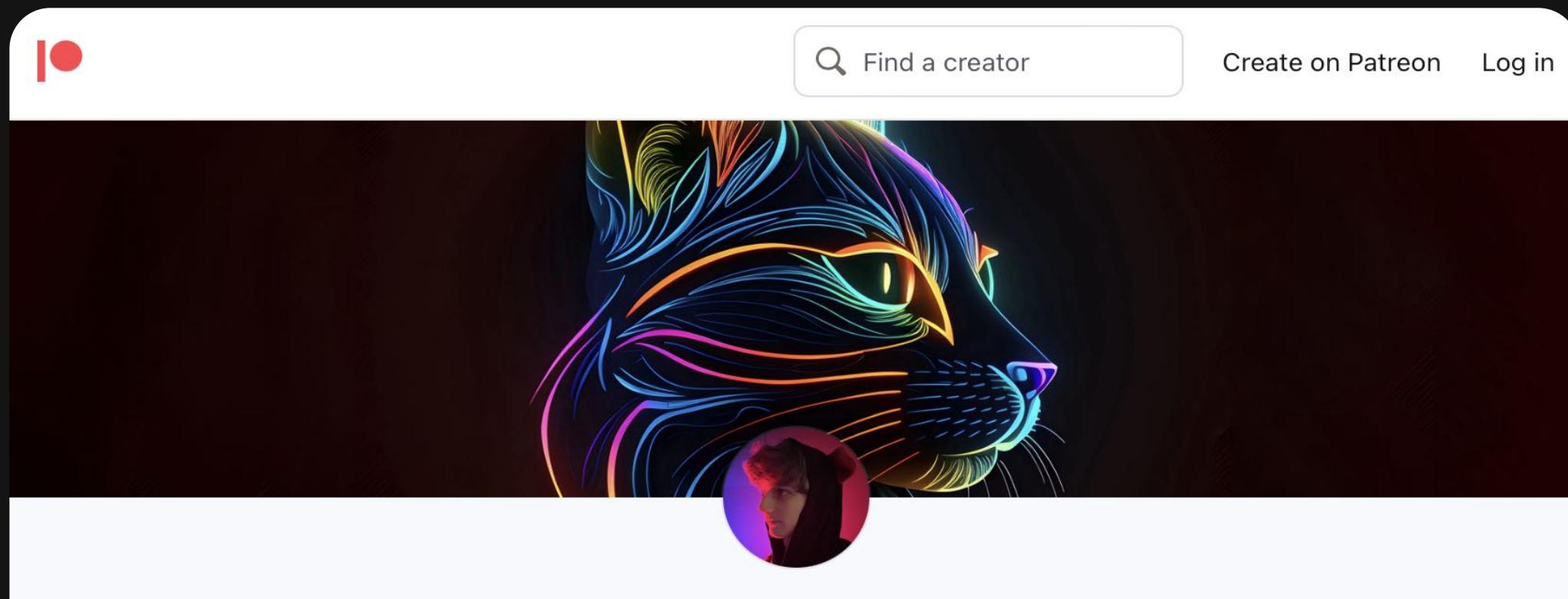
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