WAi

Your Manufacturer Is Stupid

Help Them

Chris Denney

CTO - Worthington Assembly

CircuitHub

Chris Denney

CircuitHub

Chris Denney

Jerk Who Tells You There's A Problem

Your Manufacturer Is Stupid

Have to act stupid

WAi

Your Manufacturer Is Stupid

Play dumb on new products

The Problem

Information about your design is unclear

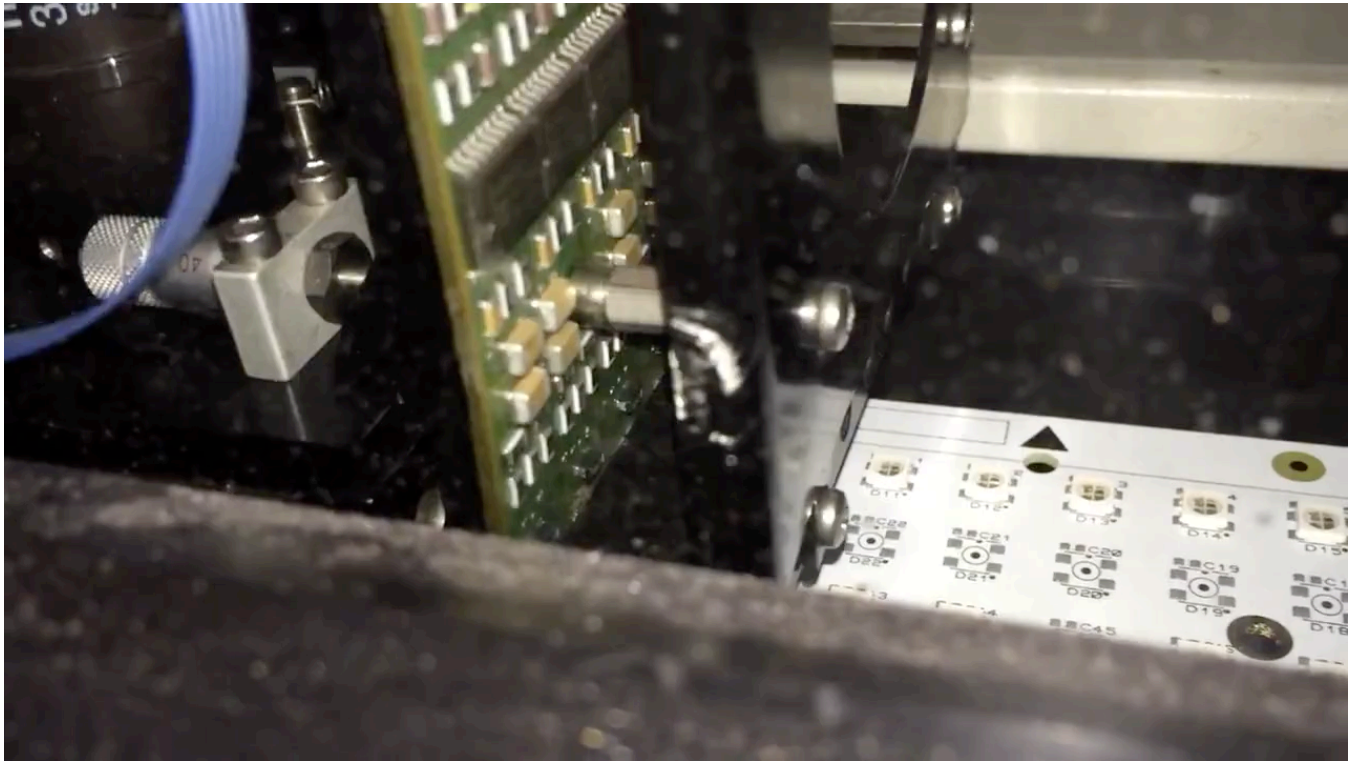
Phone calls needs to be made

The Problem

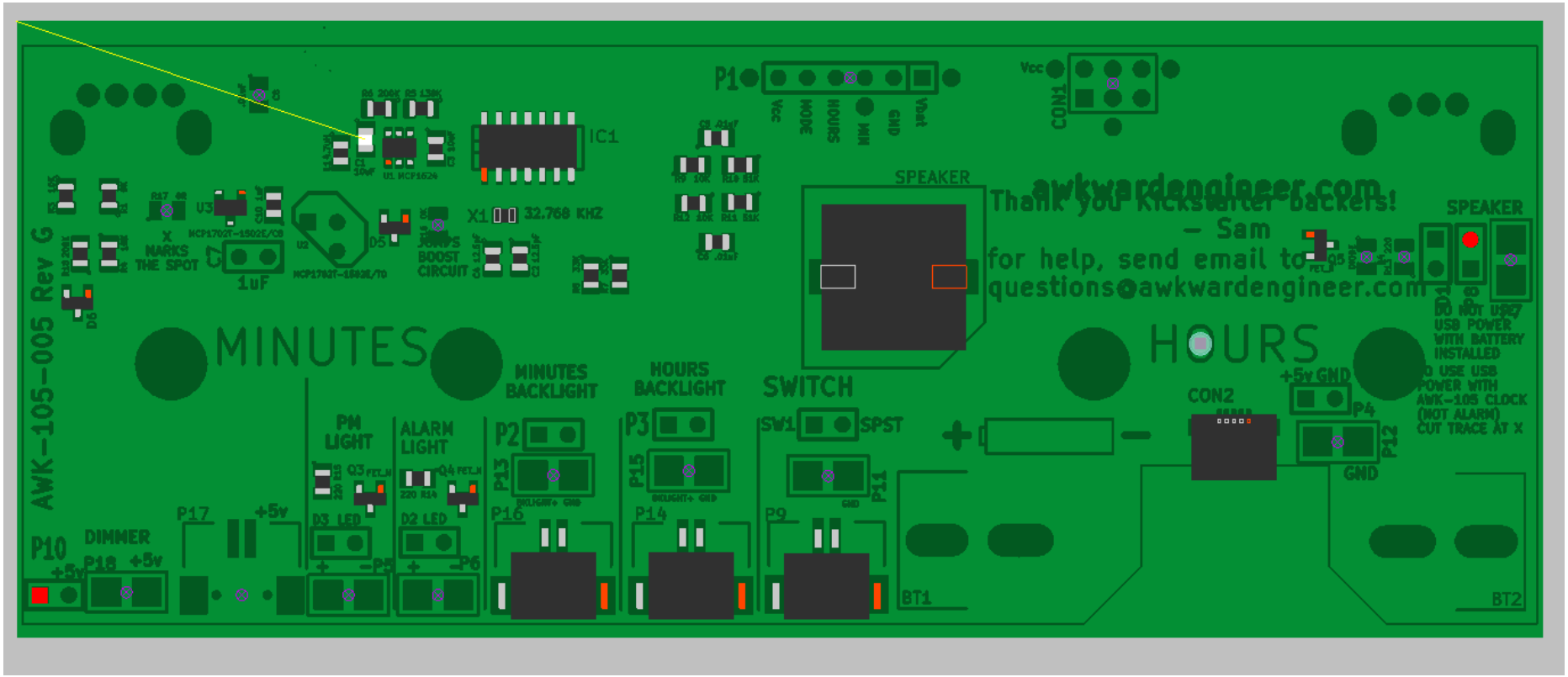
I hate people calling me.
I hate calling people.

The Problem

But machines build things!



Actually, humans build things



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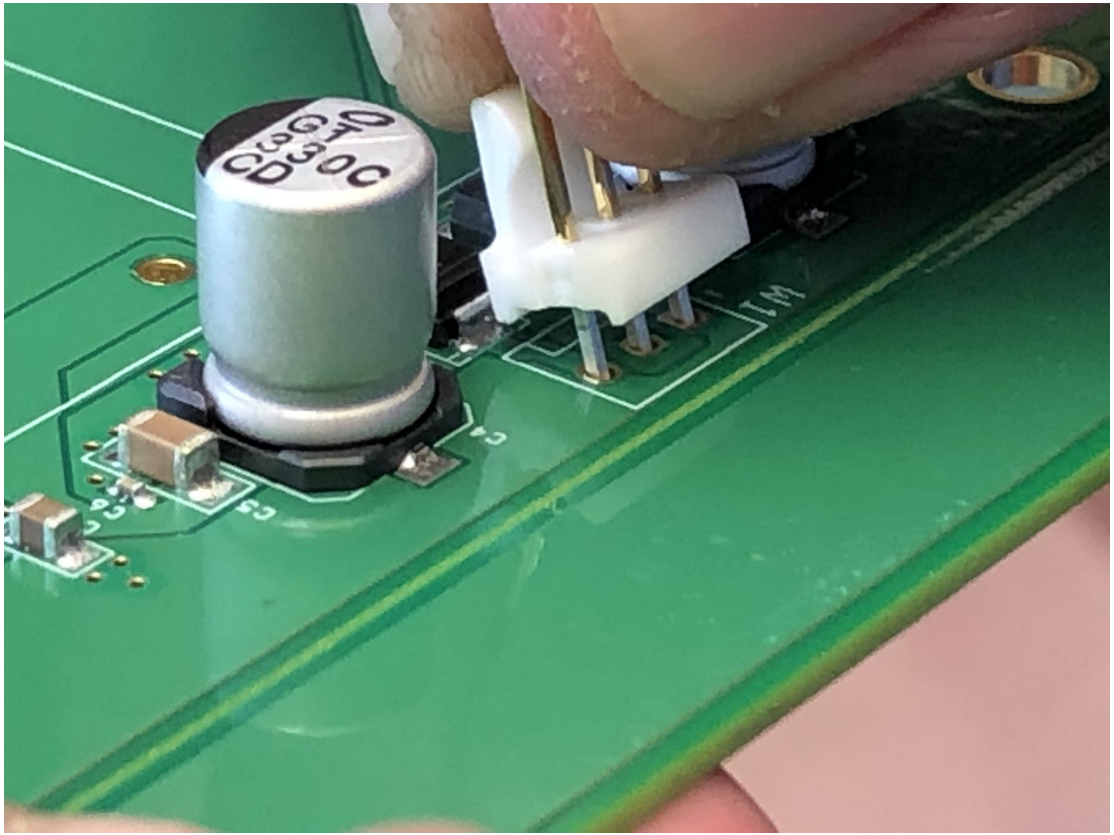

WAi

Actually, humans build things

Tentpole Problems

1. Identifying polarity of components
2. Silkscreen legibility
3. Panelization
4. PCB properties
5. Specific manufacturer’s part numbers

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1. Identifying polarity of components
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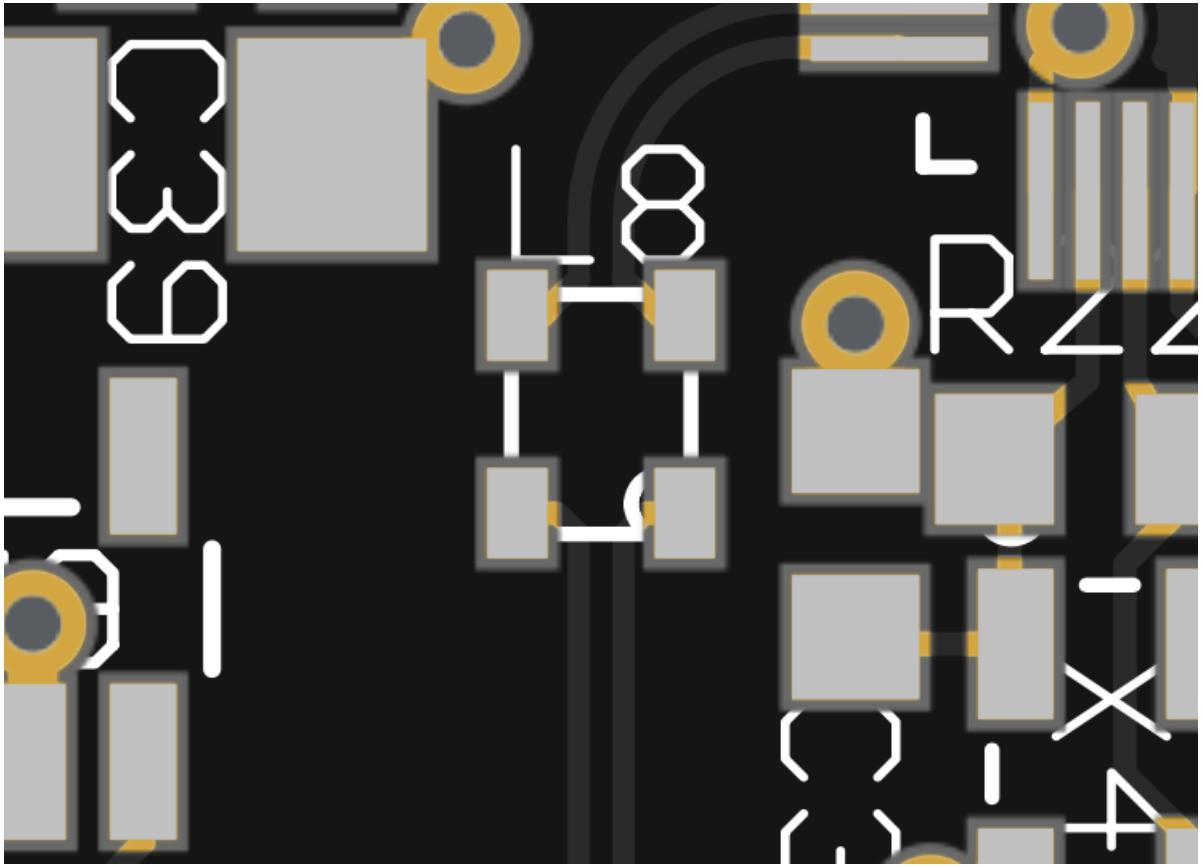
The number 1 problem

The Assembly Made for the First Time

- Polarity of all IC’s
  - What is this IC’s reference designator?
  - Which pad is Pin 1
- Polarity of all diodes
- Polarity of all LED’s
  - This LED here, what reference designator is it?
  - Which pad is the cathode?

Identifying Polarity



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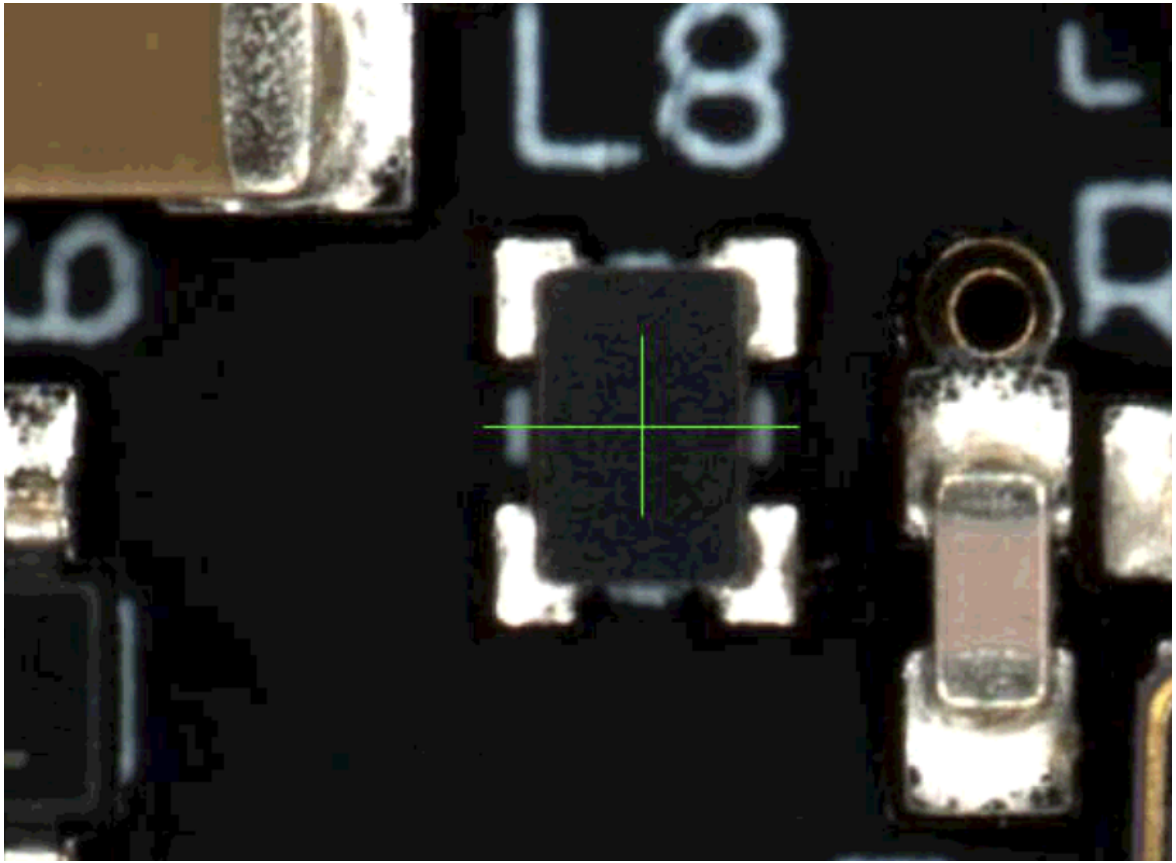

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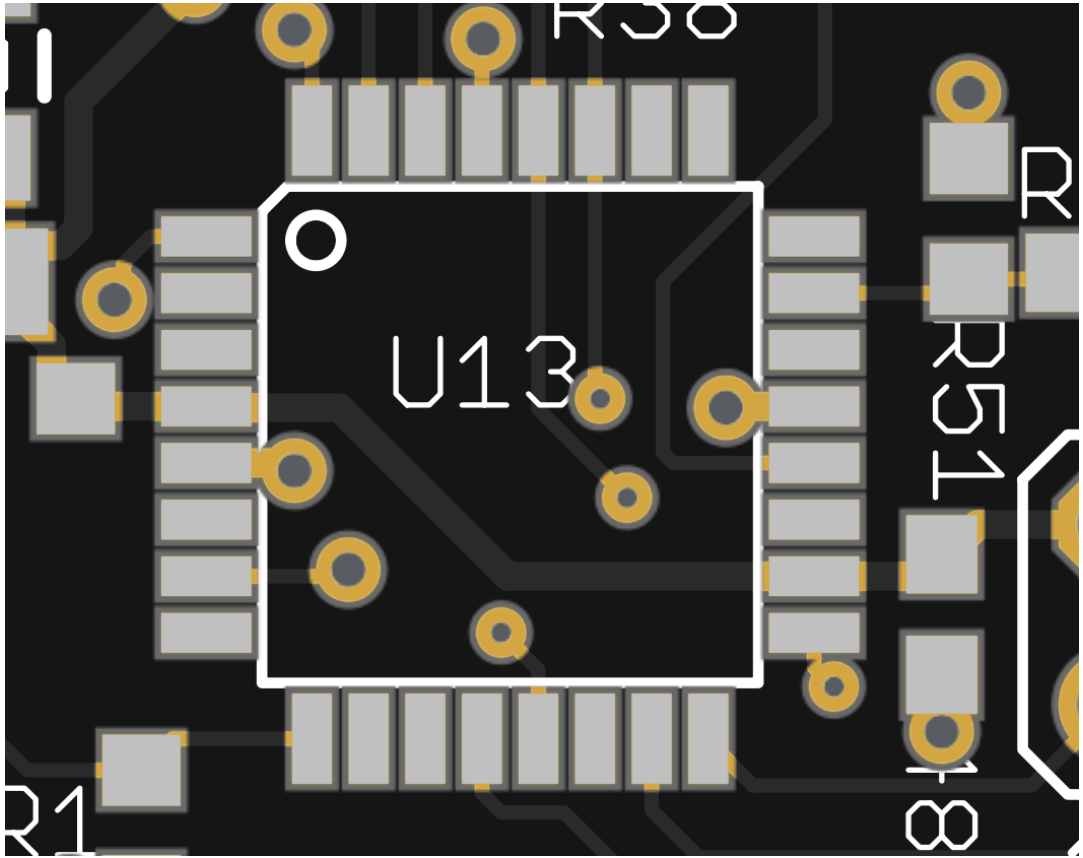

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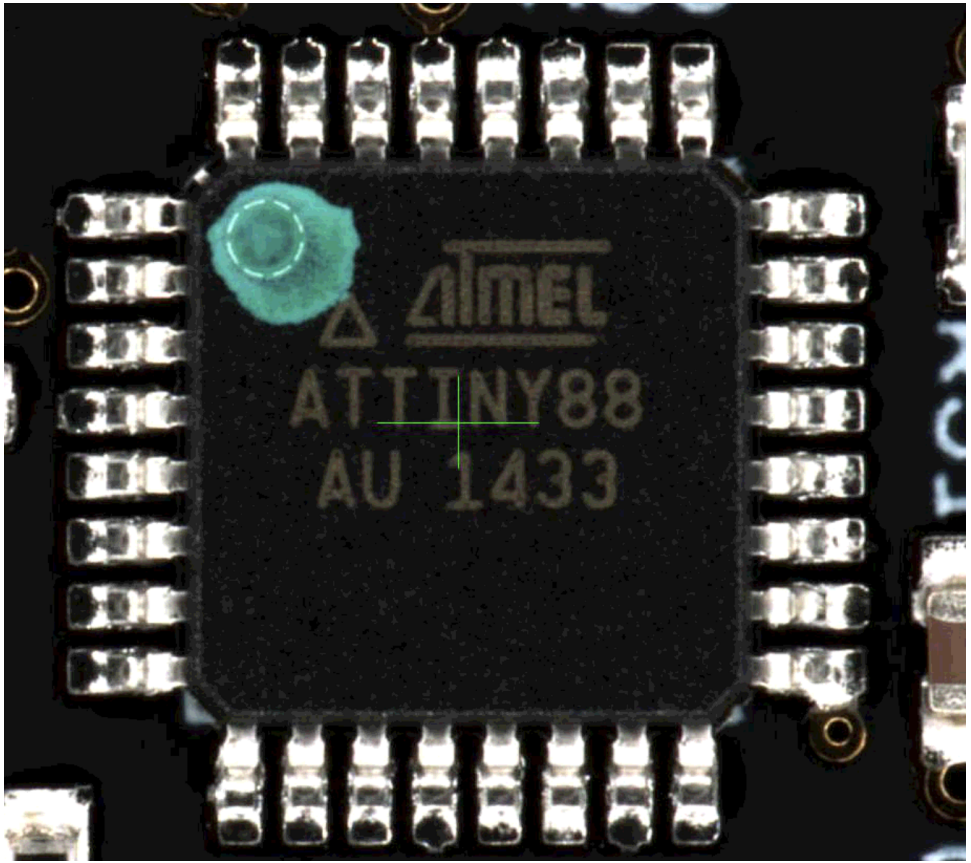

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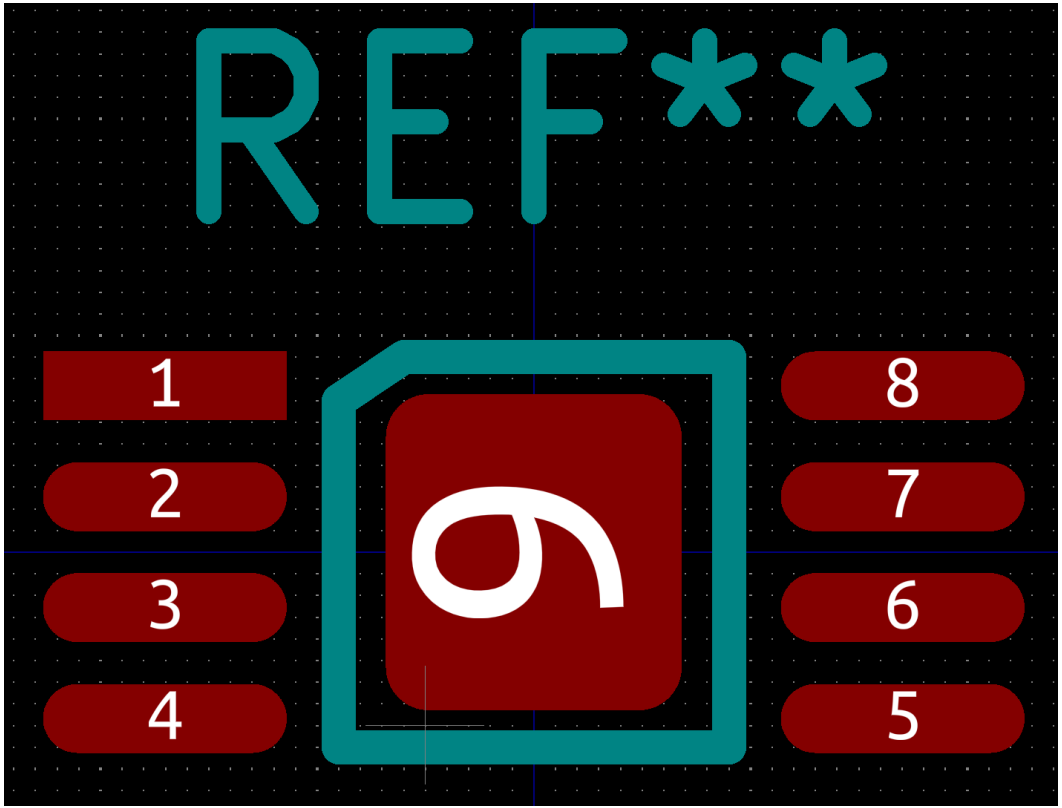

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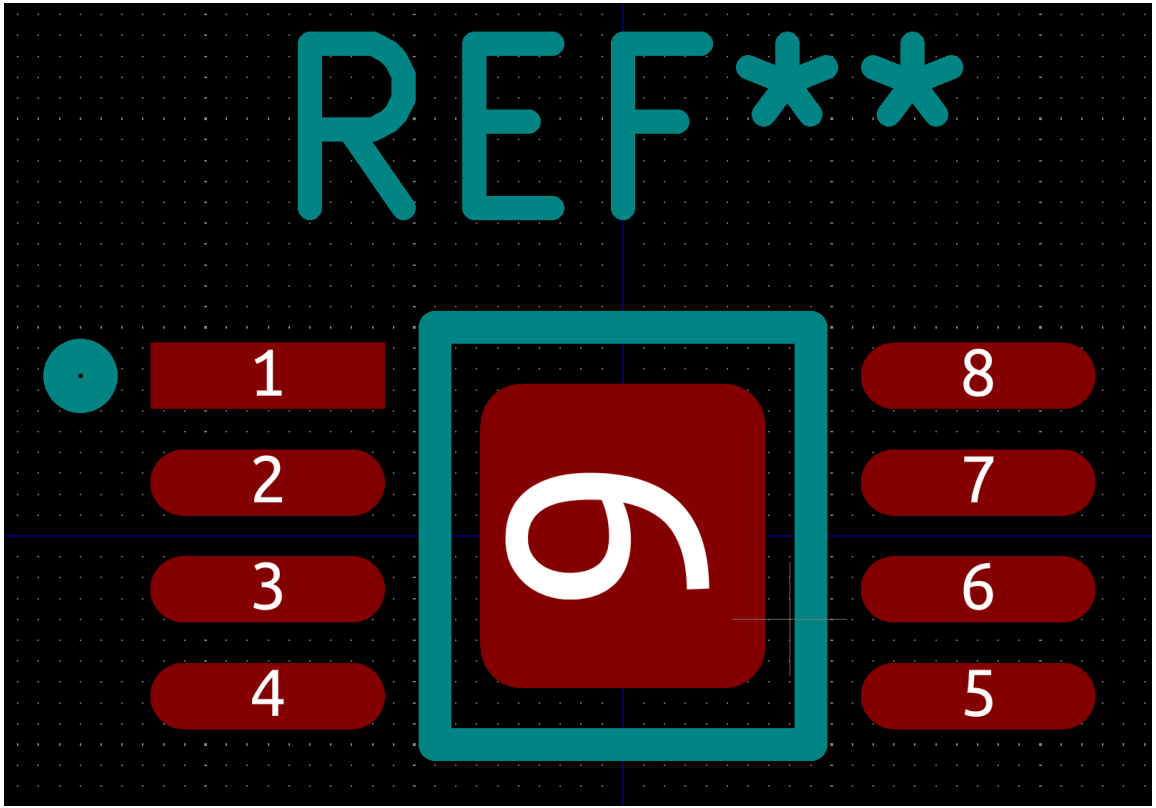

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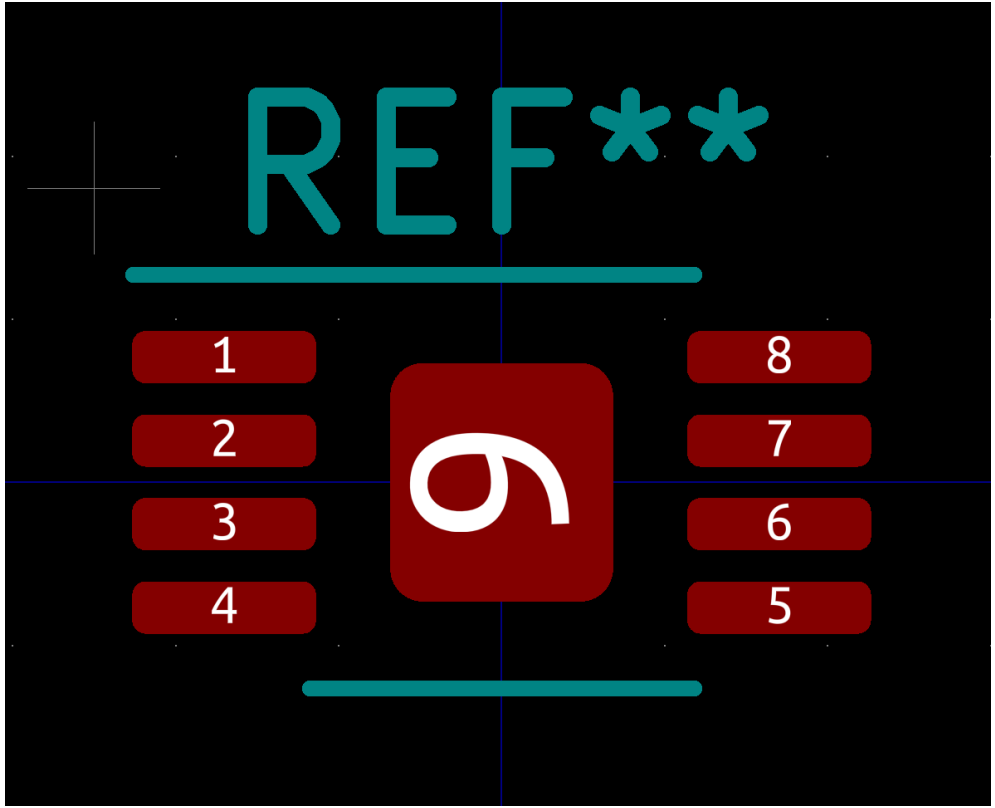
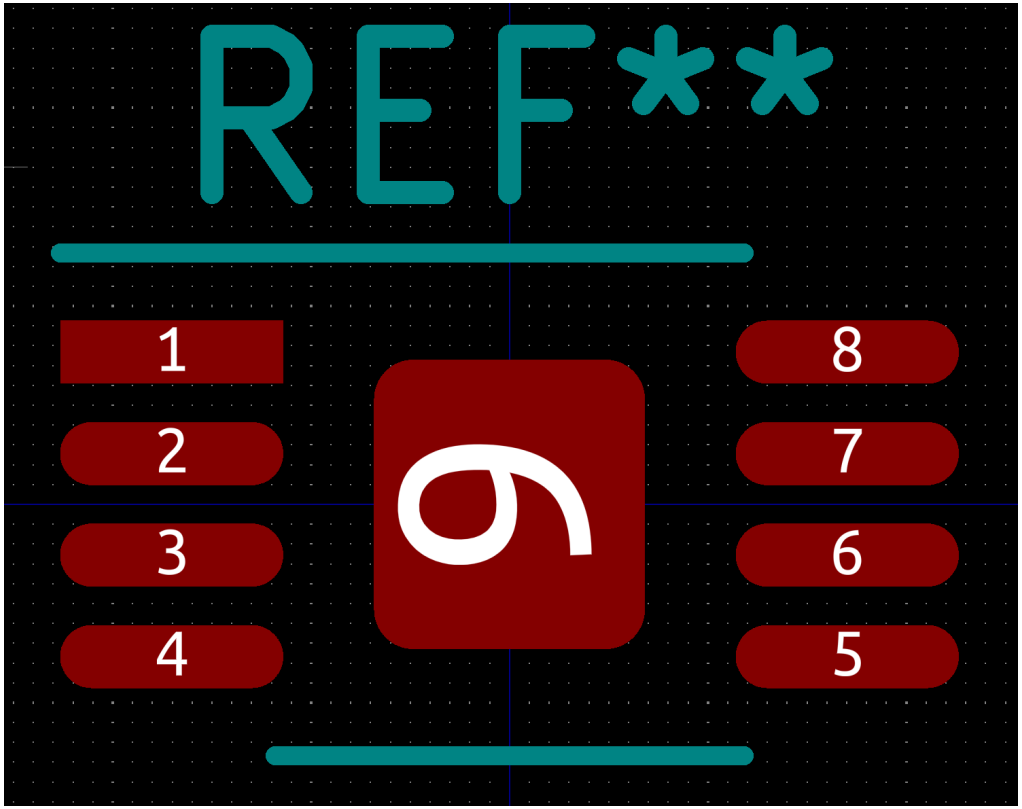


The Case for Rectangular Pin 1



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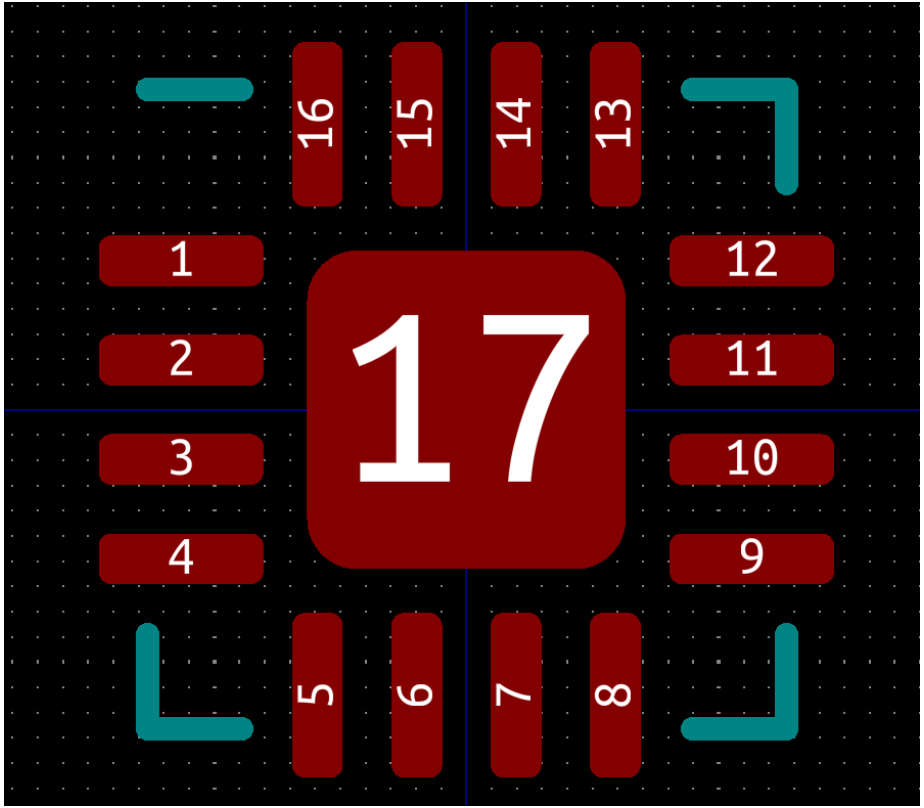

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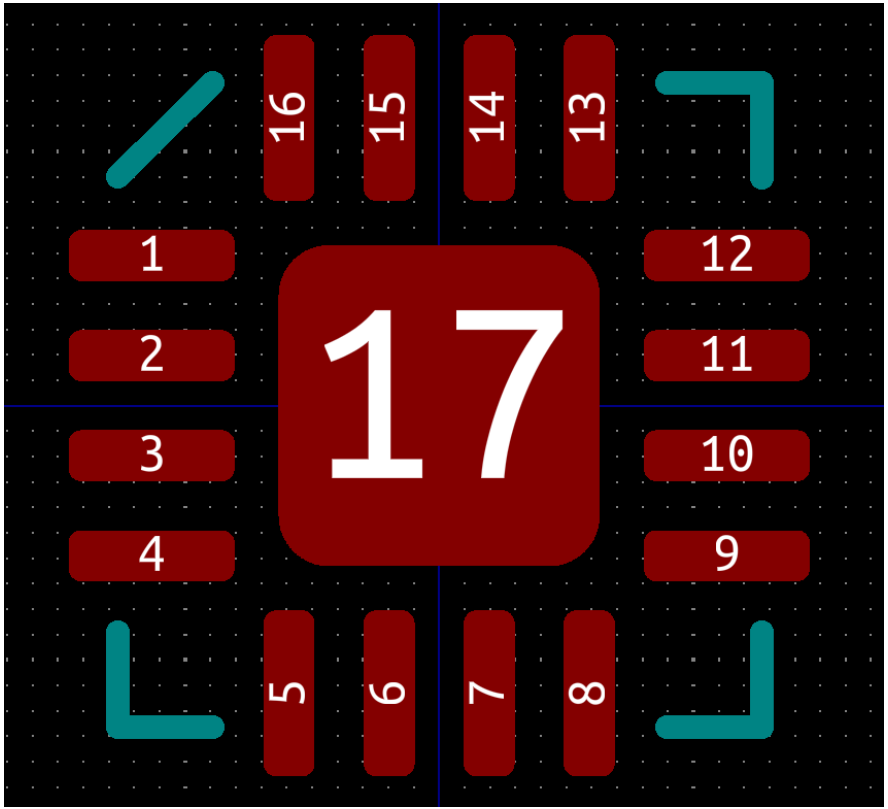

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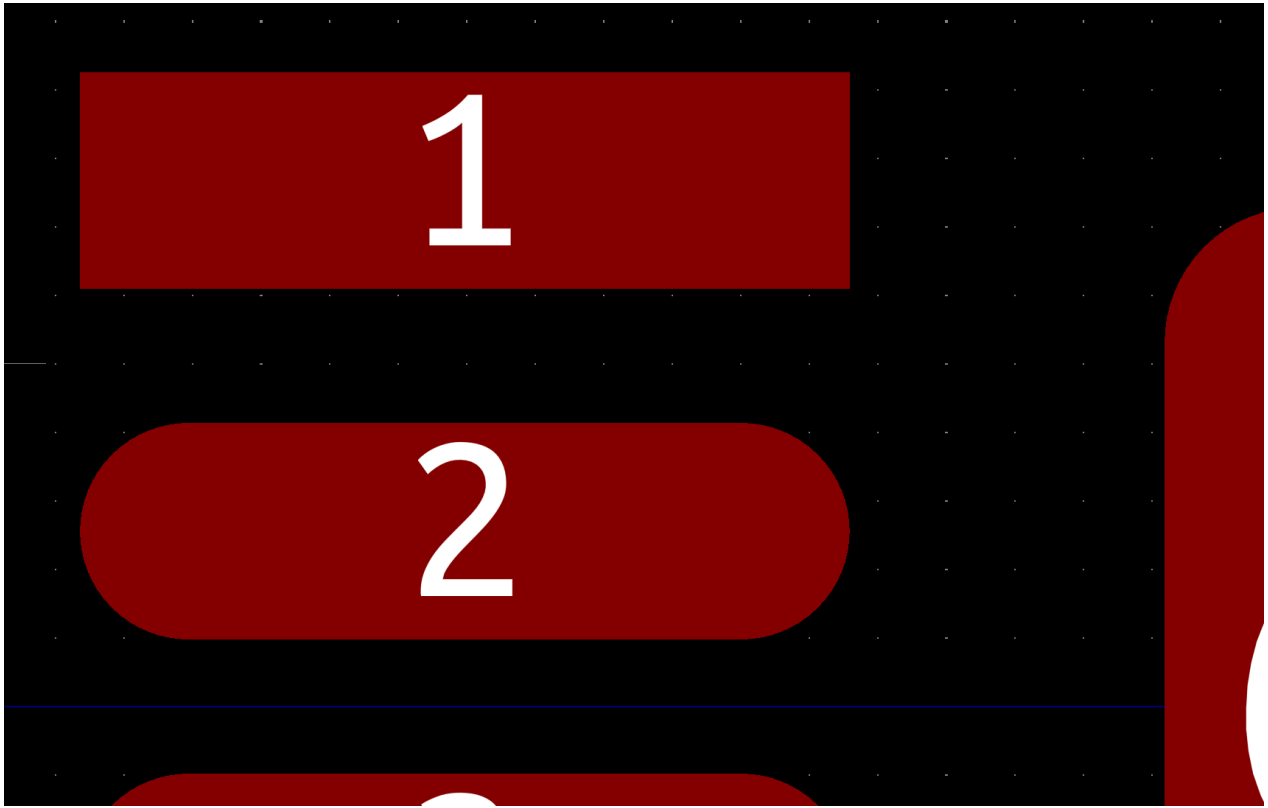

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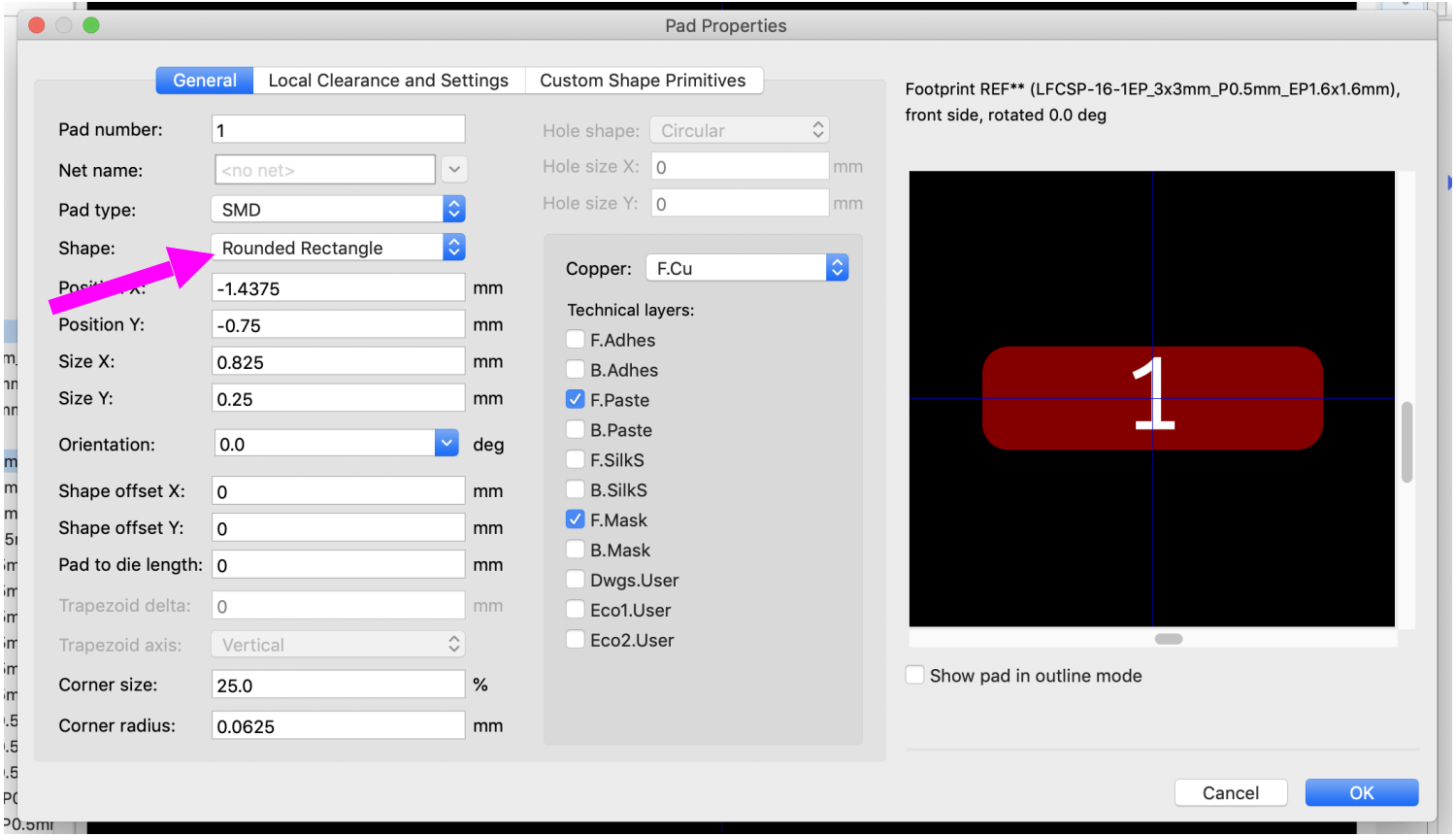

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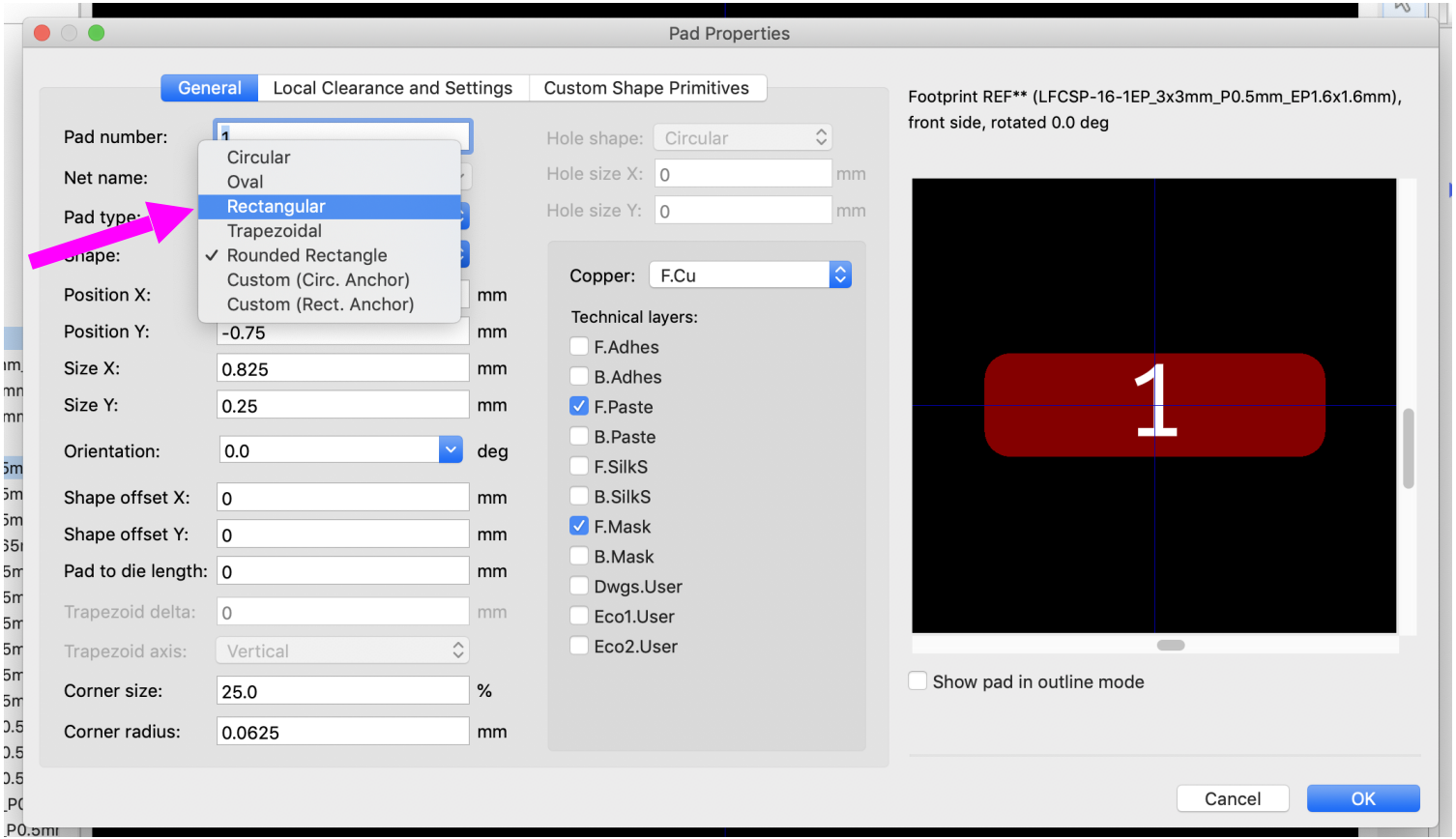

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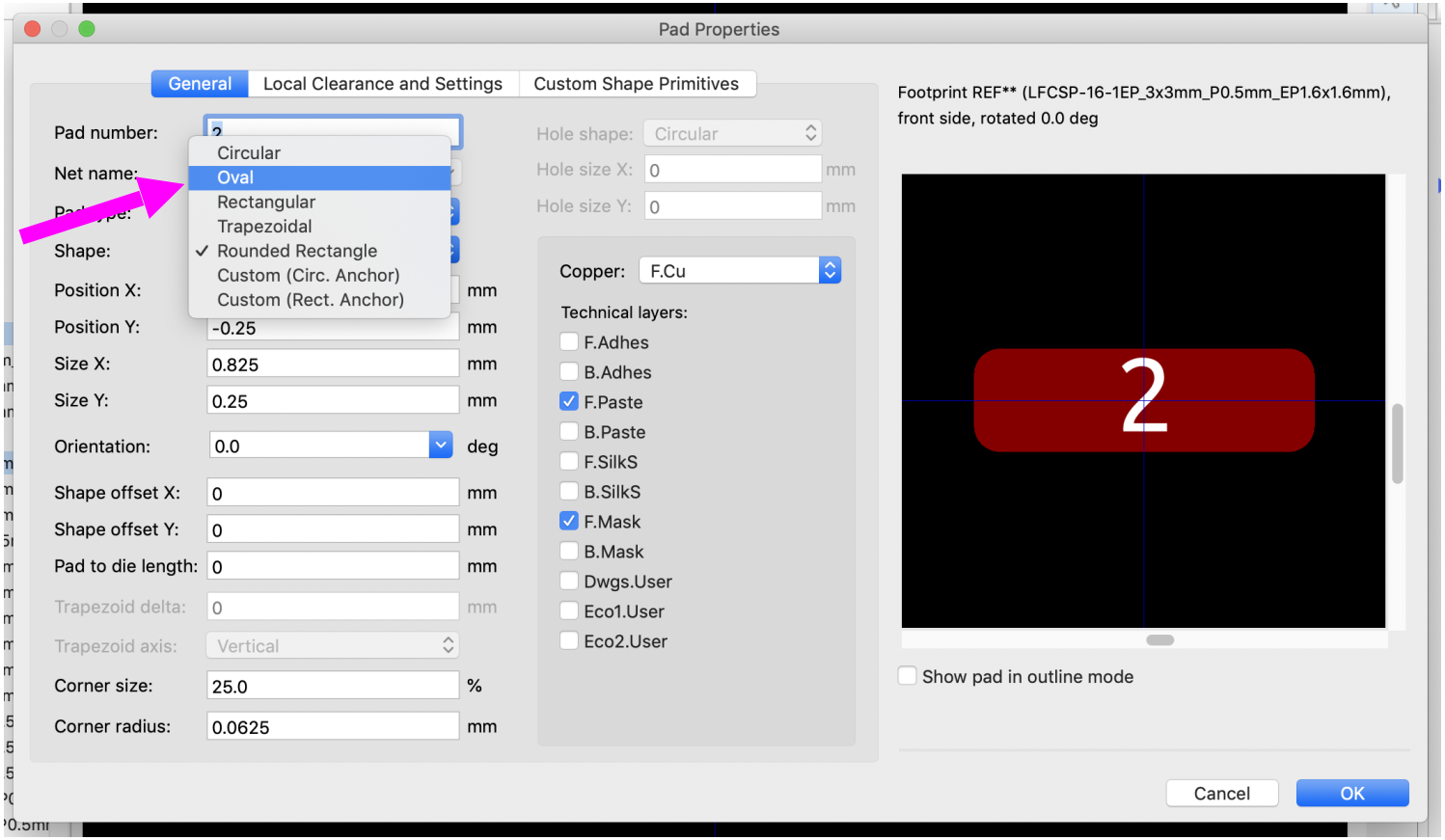

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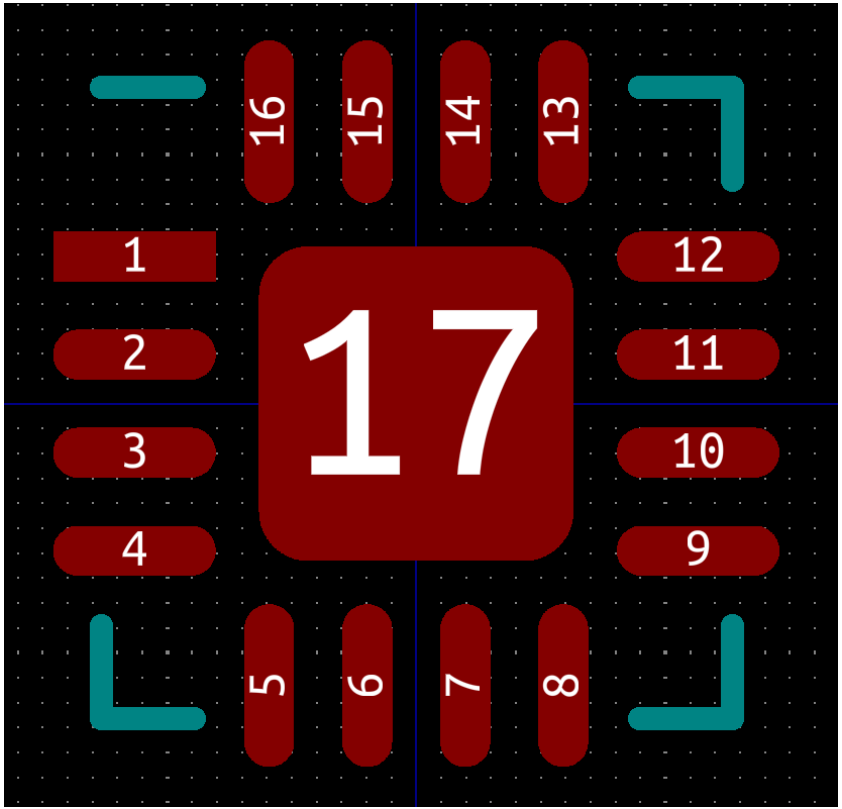
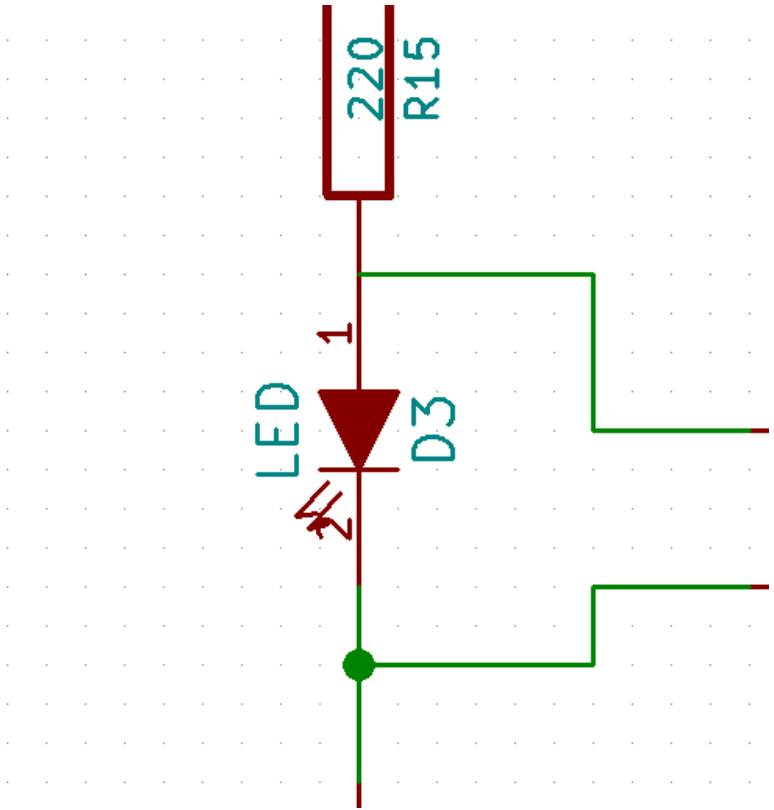


LED Orientation



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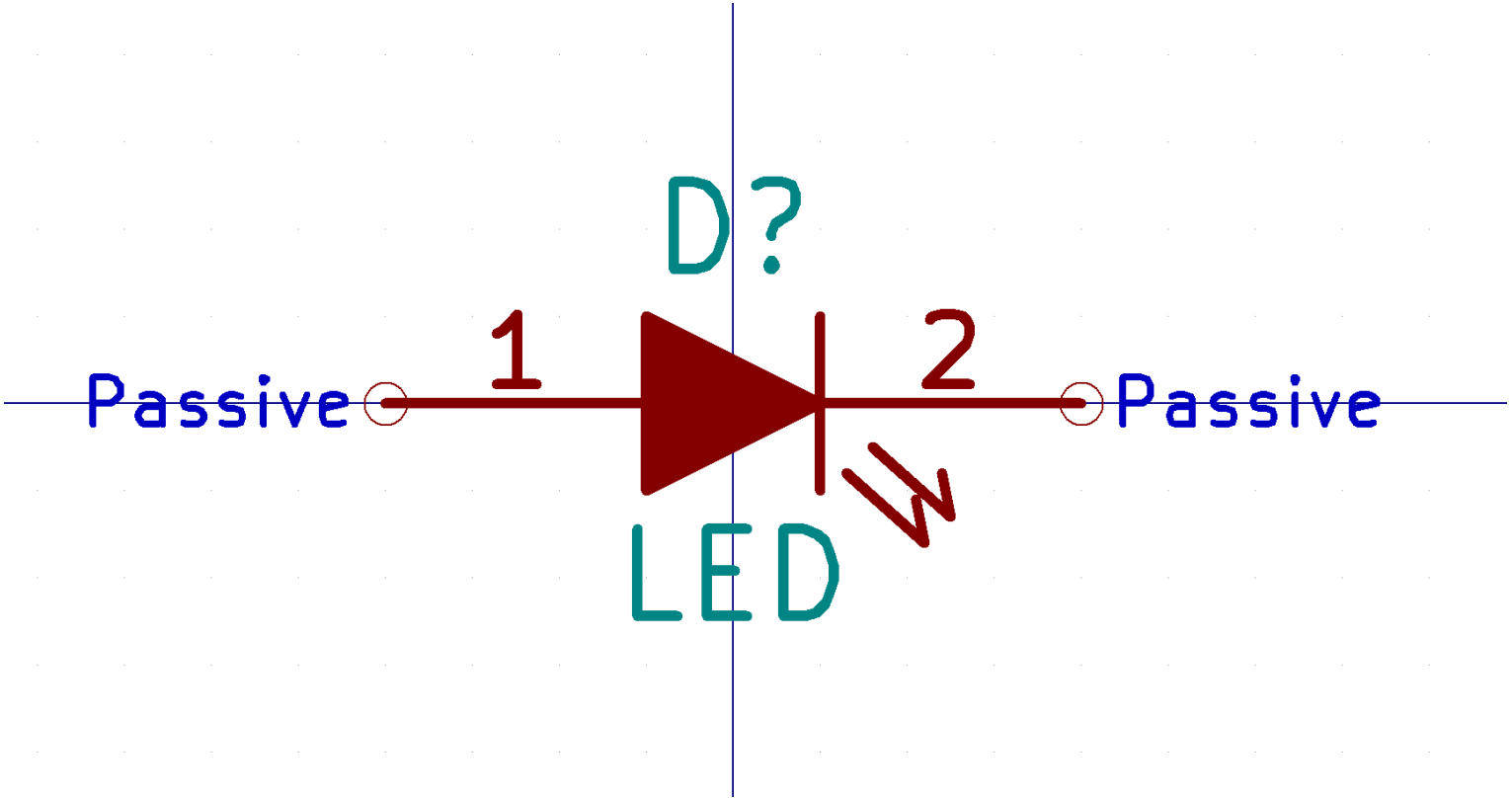

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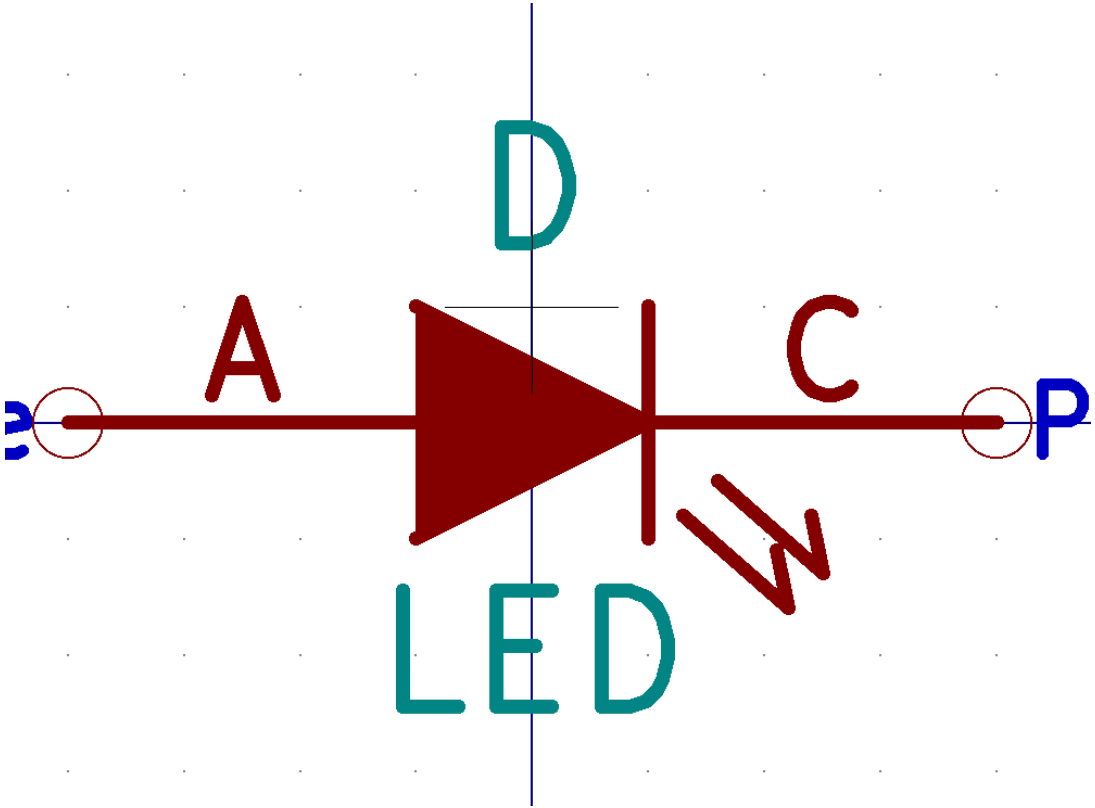

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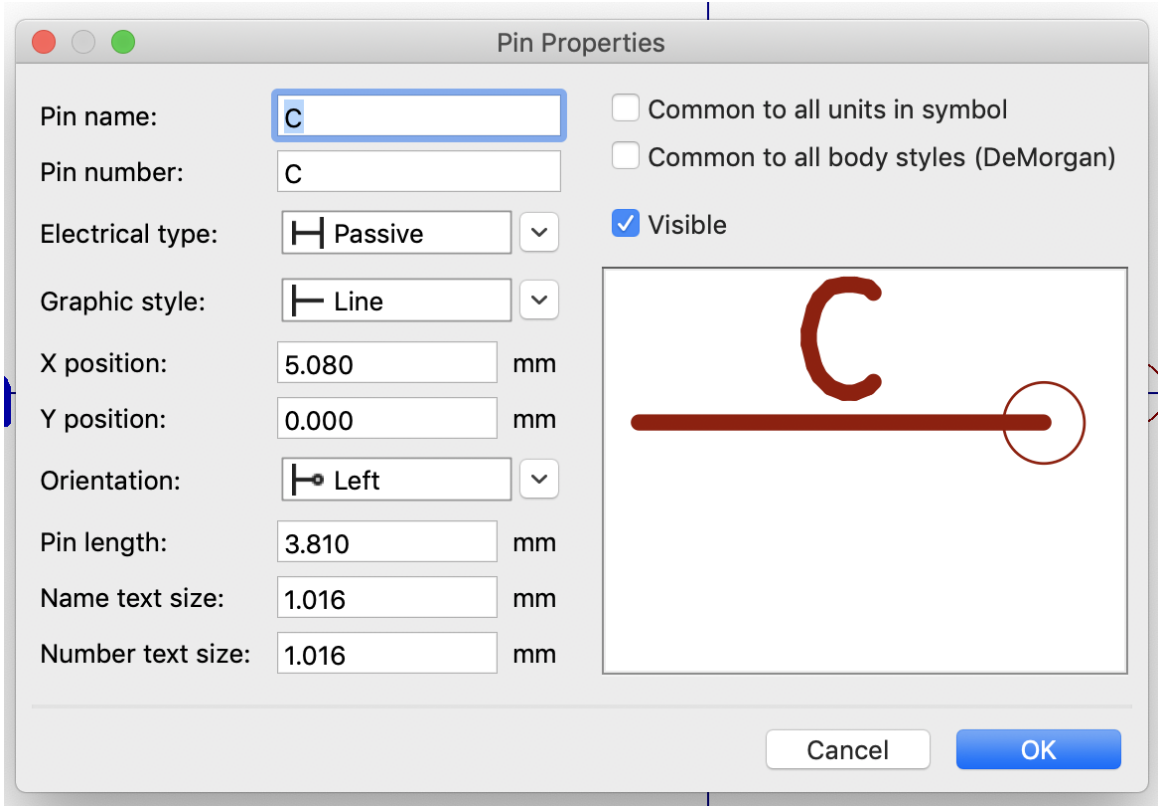

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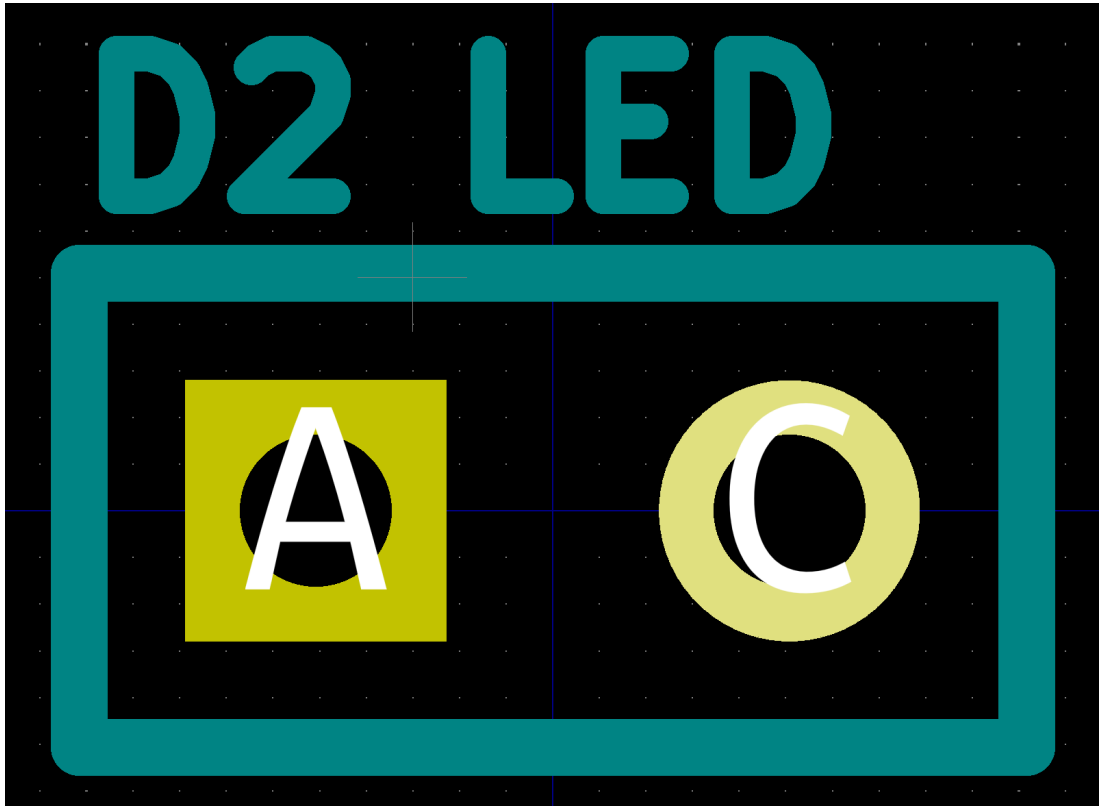

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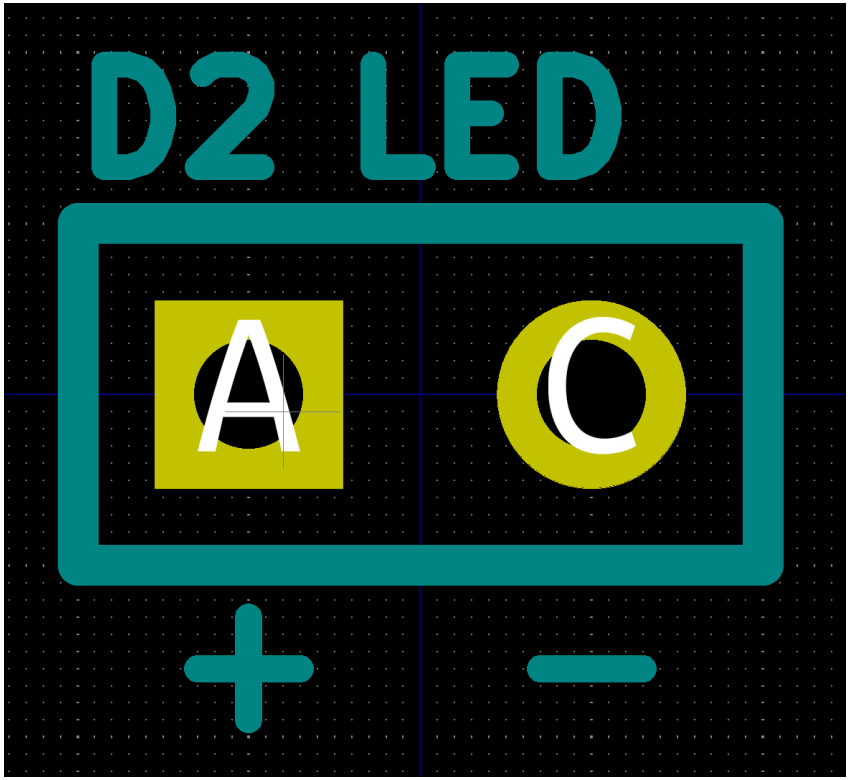

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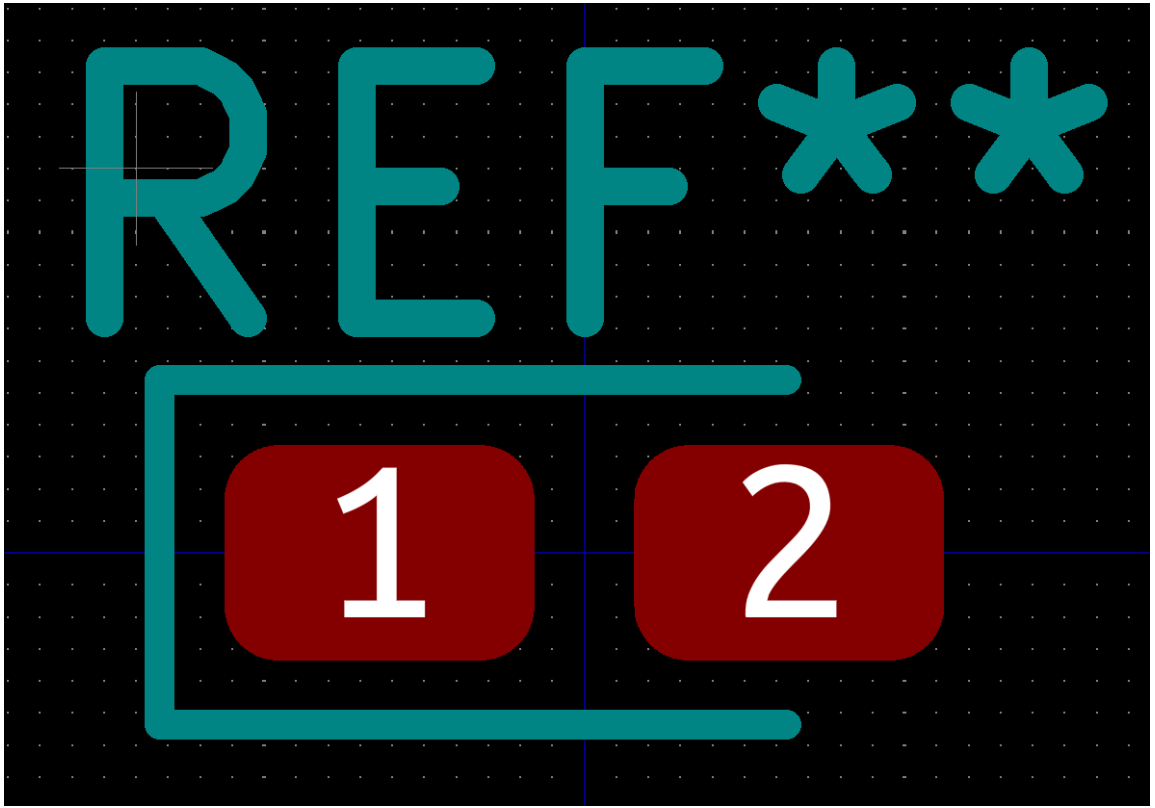

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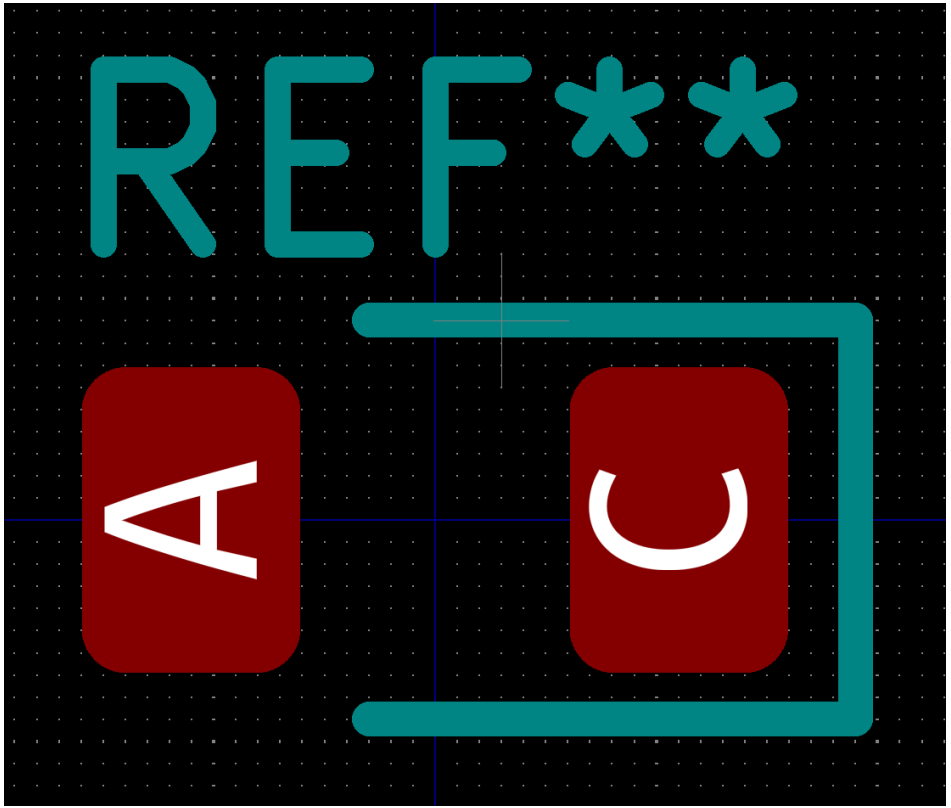

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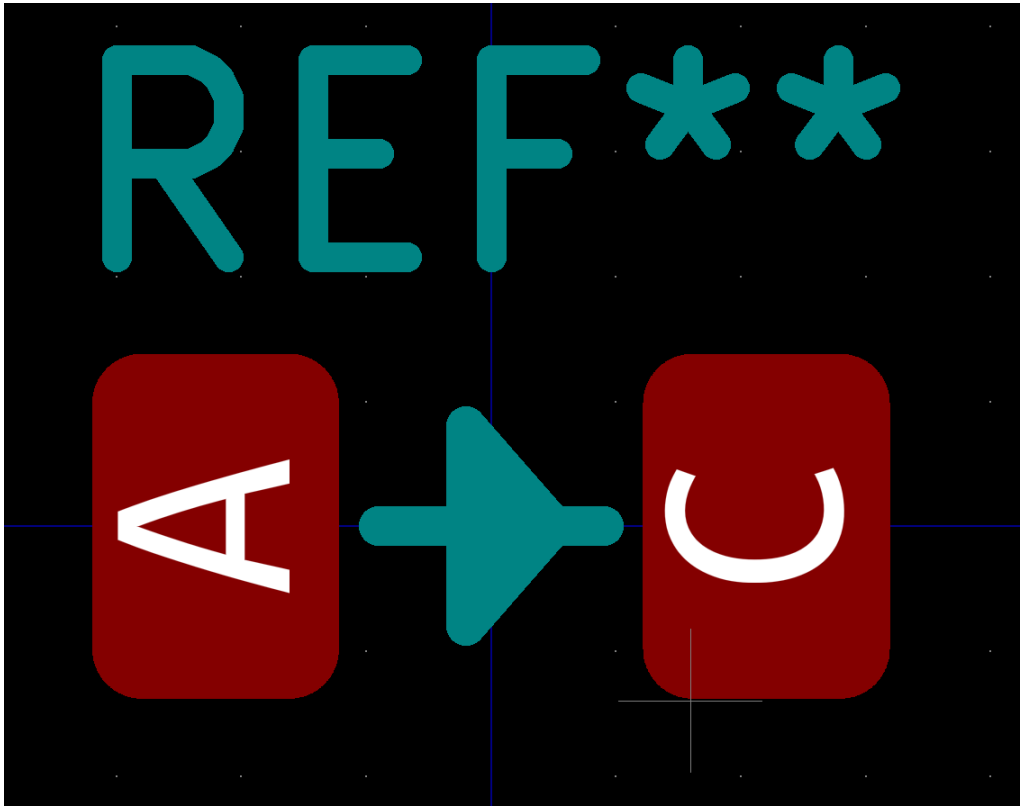

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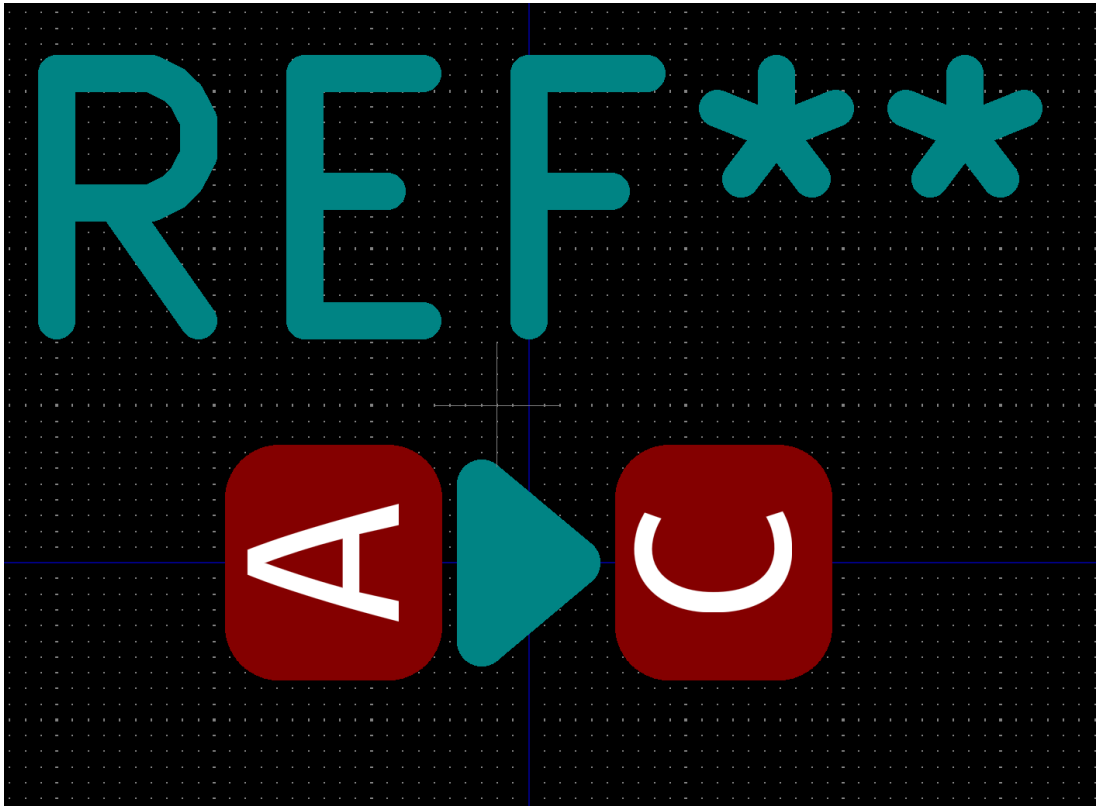

Identifying Polarity - Summary

1. Silkscreen pin 1 indicators
    a. Move them out from underneath the placed part
    b. Square pad for Pin 1 on IC's
2. LED cathode indicators
    a. Use a C in pin naming scheme
    b. Use symbol in silkscreen
    c. Use + and - symbols in silkscreen
    d. Thru-hole: Square pad for Anode. Circle for Cathode

Tentpole Problems

1. ~~Identifying polarity of components~~
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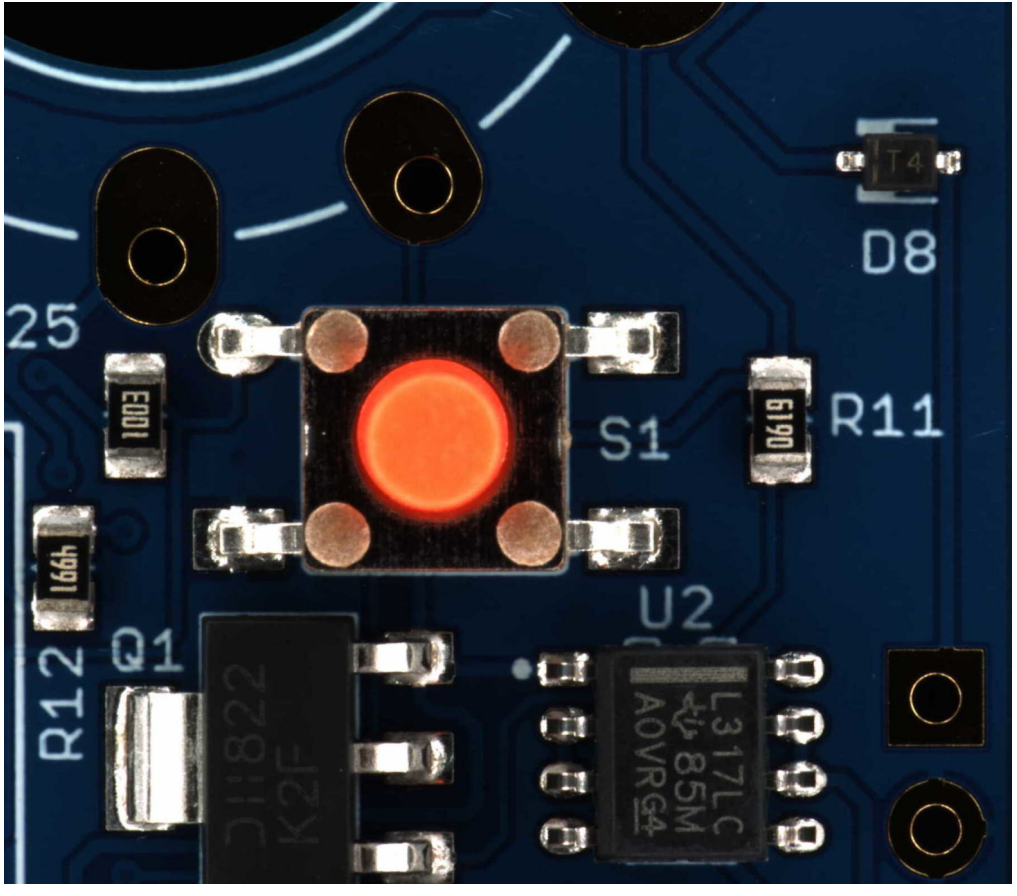
Silkscreen Legibility



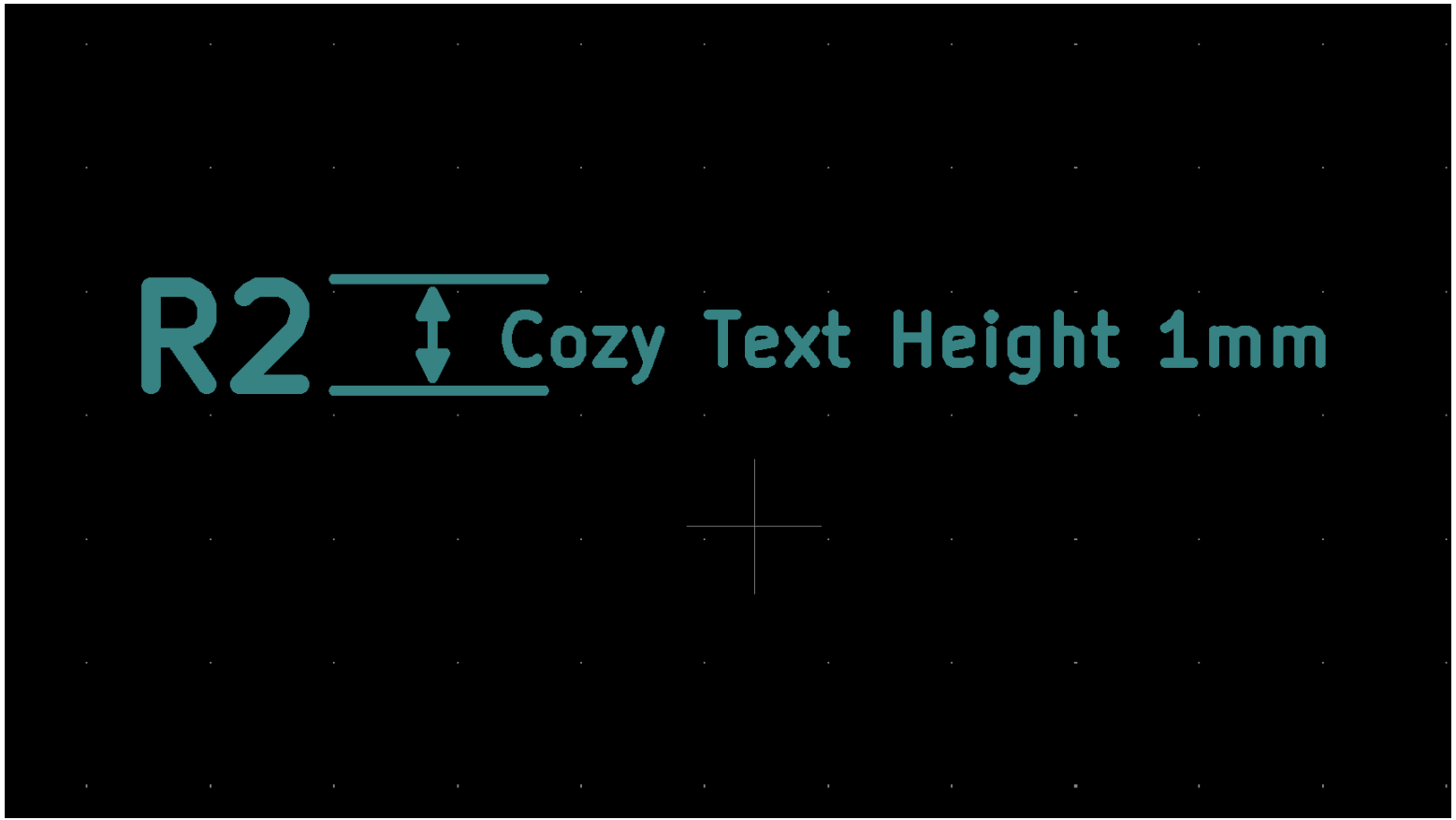
Silkscreen Legibility

Not minimums

Not maximum

Cozy

Silkscreen Legibility



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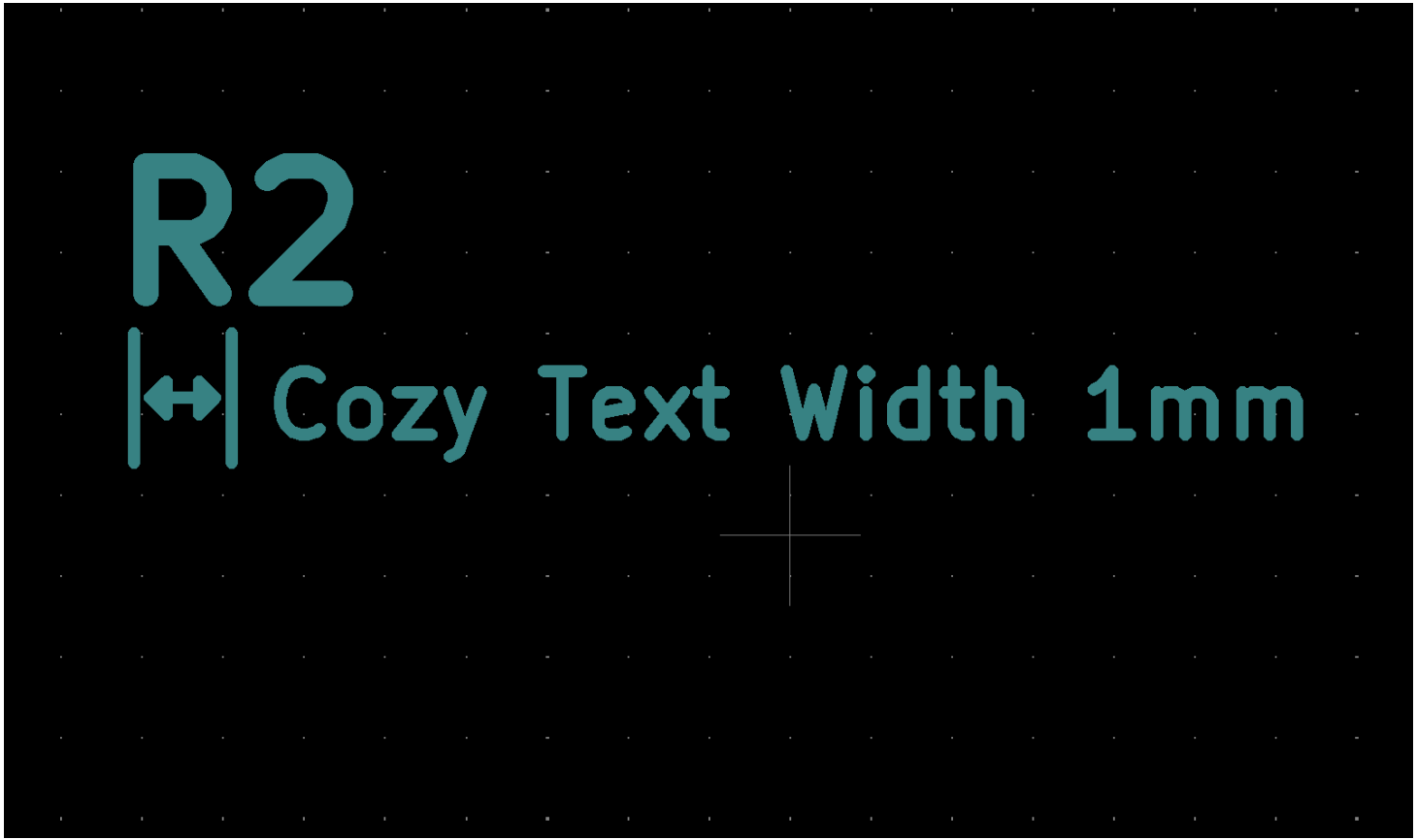

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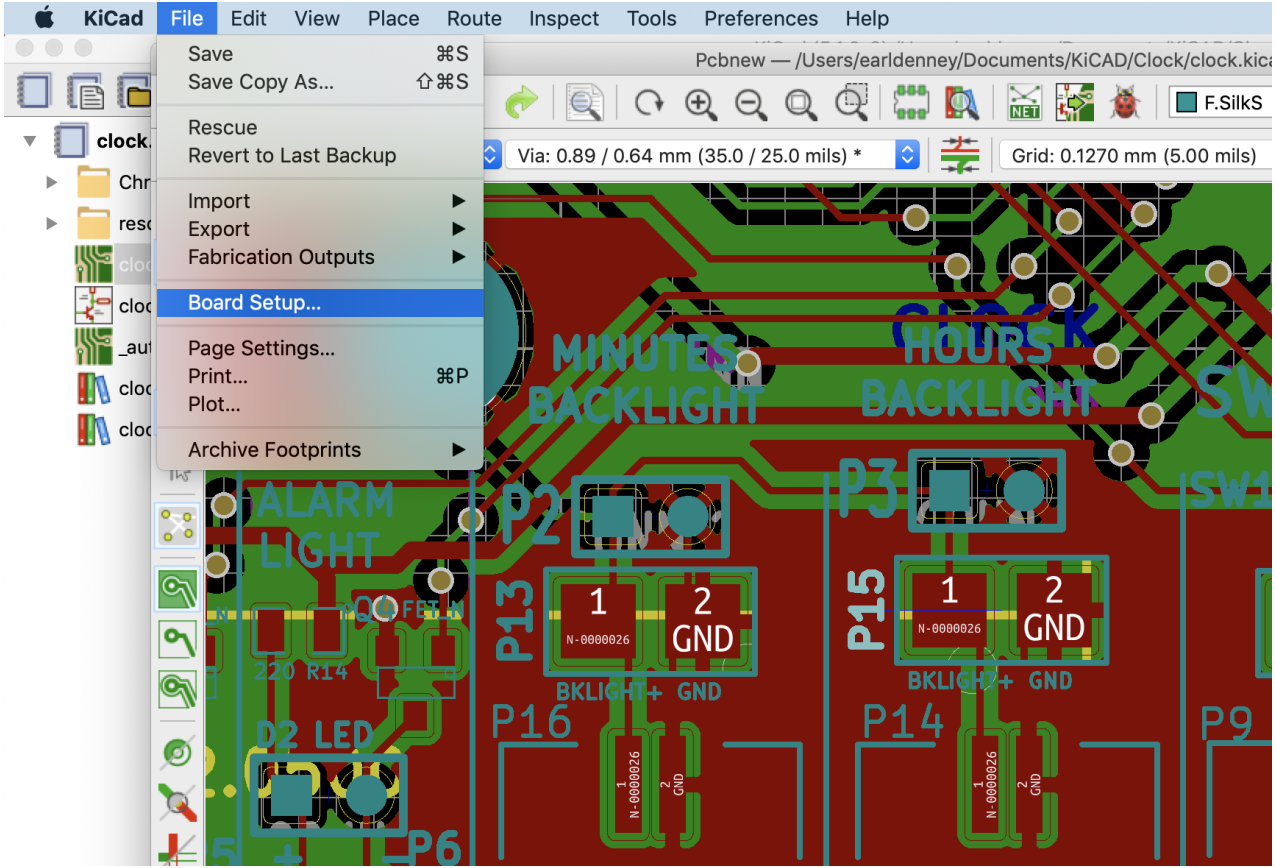

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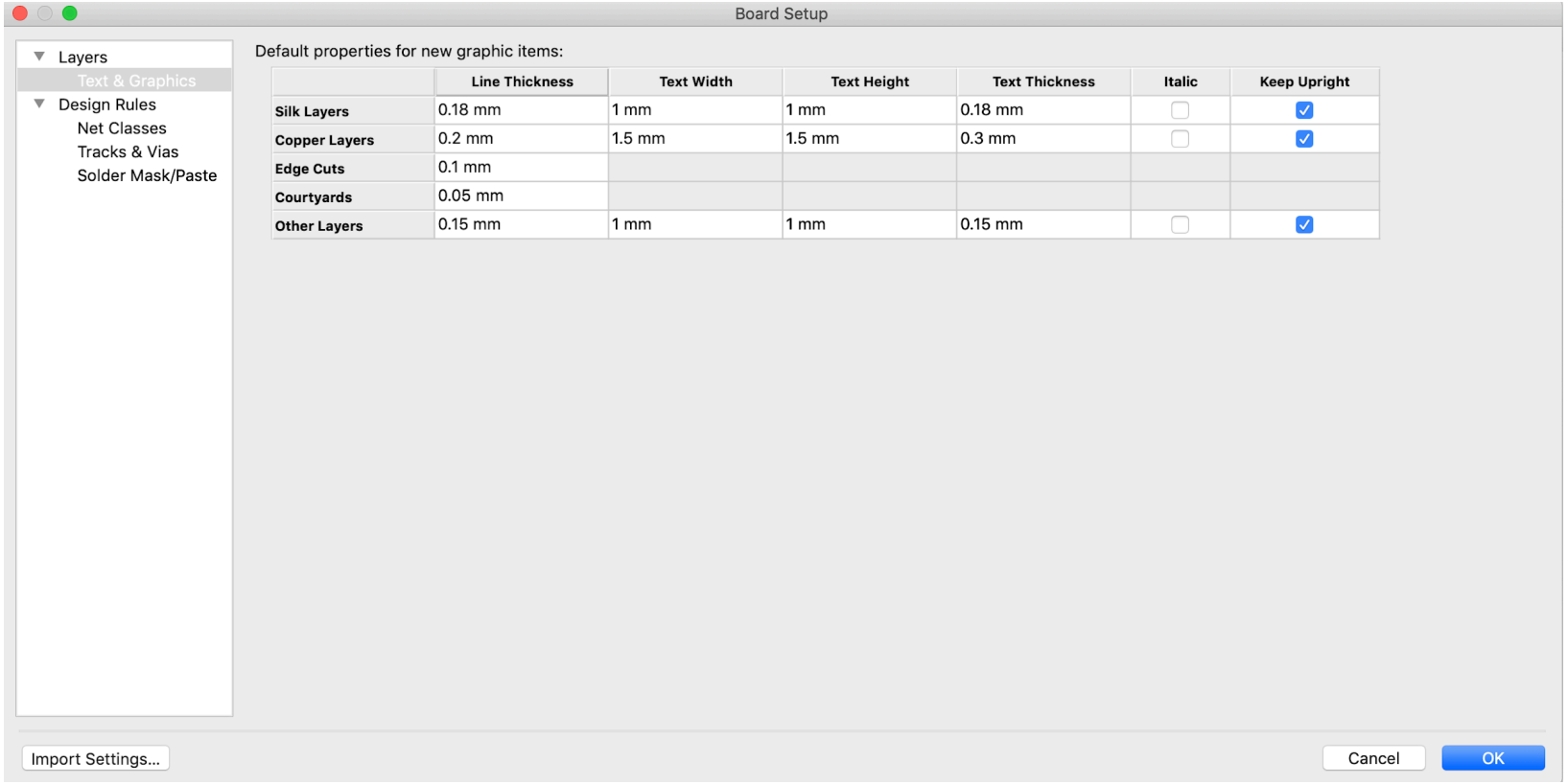
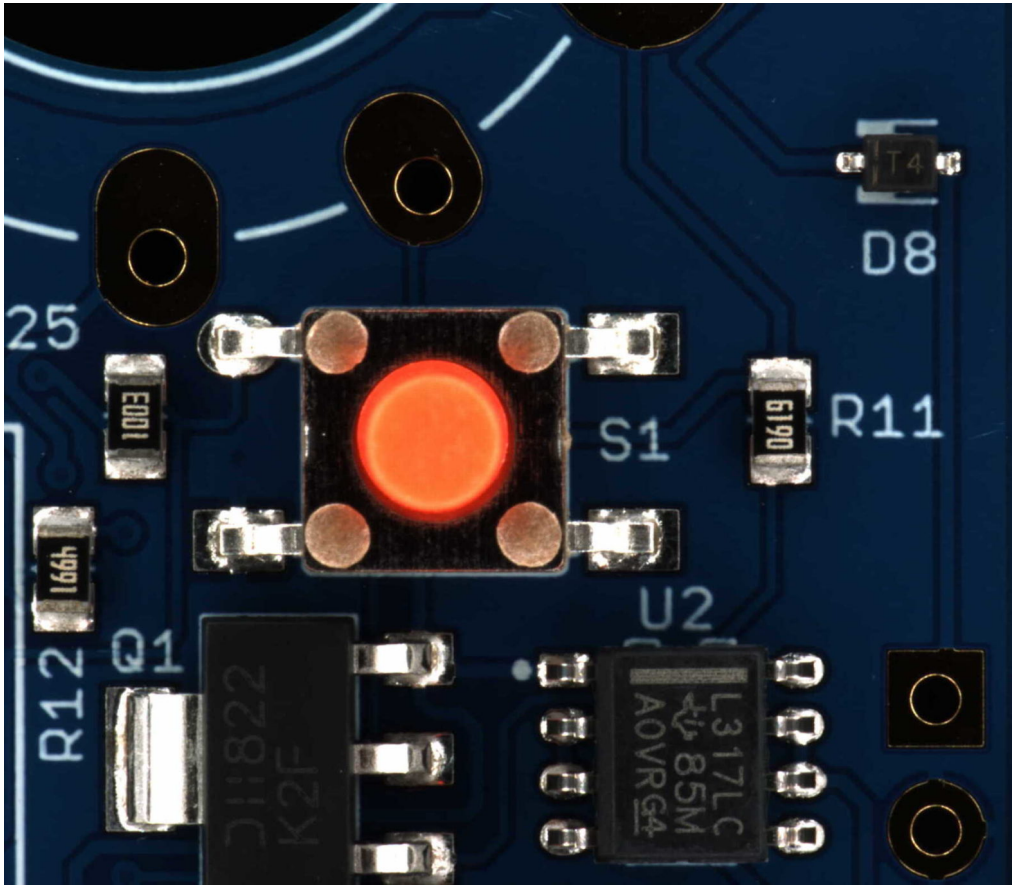


Silkscreen Legibility

Default properties for new graphic items:

	Line Thickness	Text Width	Text Height	Text Thickness	Italic	Keep Upright
Silk Layers	0.18 mm	1 mm	1 mm	0.18 mm	☐	☑
Copper Layers	0.2 mm	1.5 mm	1.5 mm	0.3 mm	☐	☑

Silkscreen Legibility



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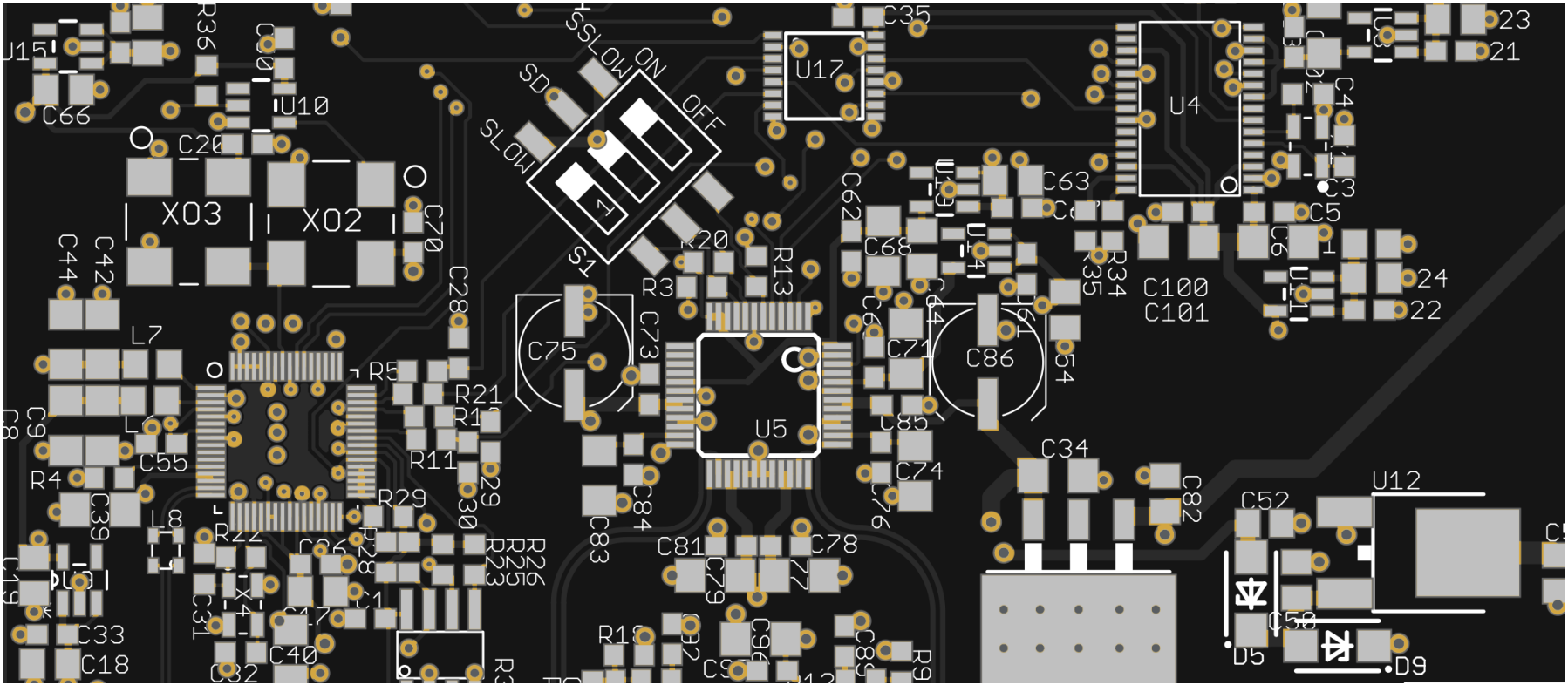

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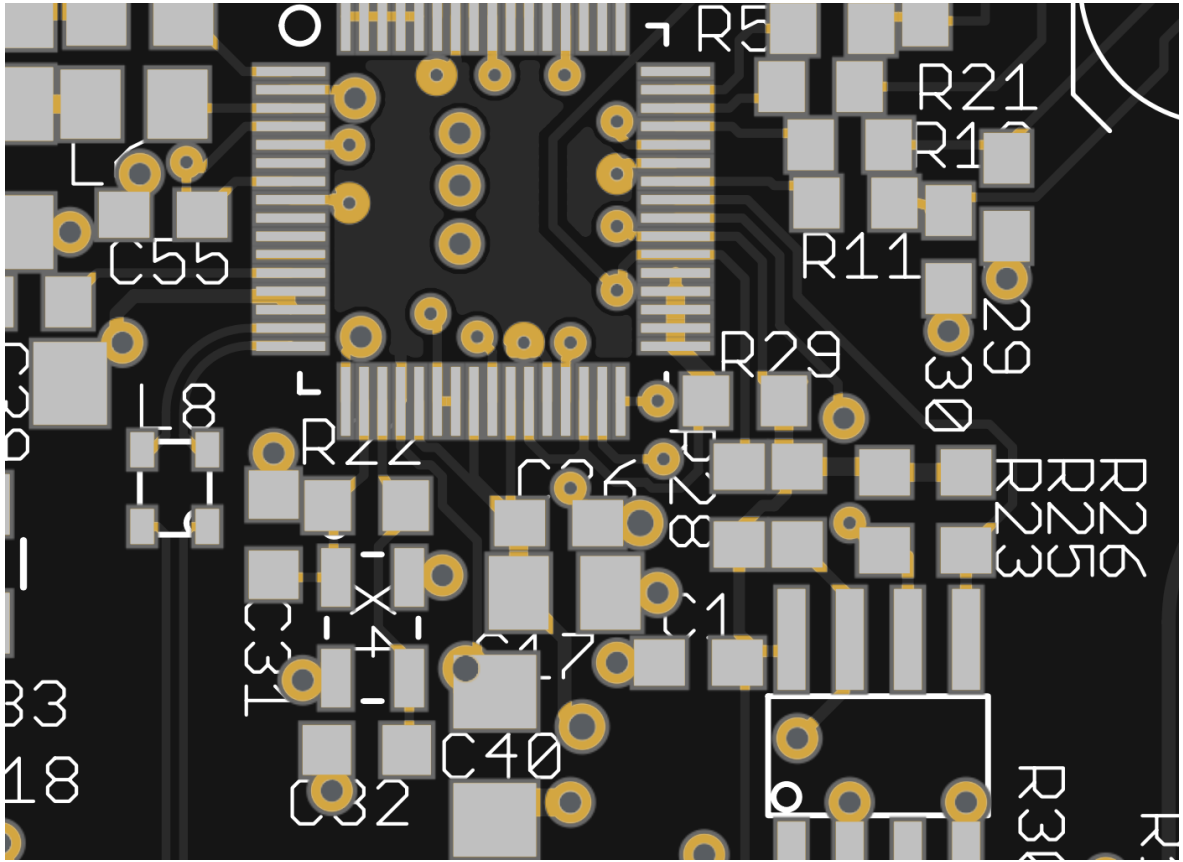

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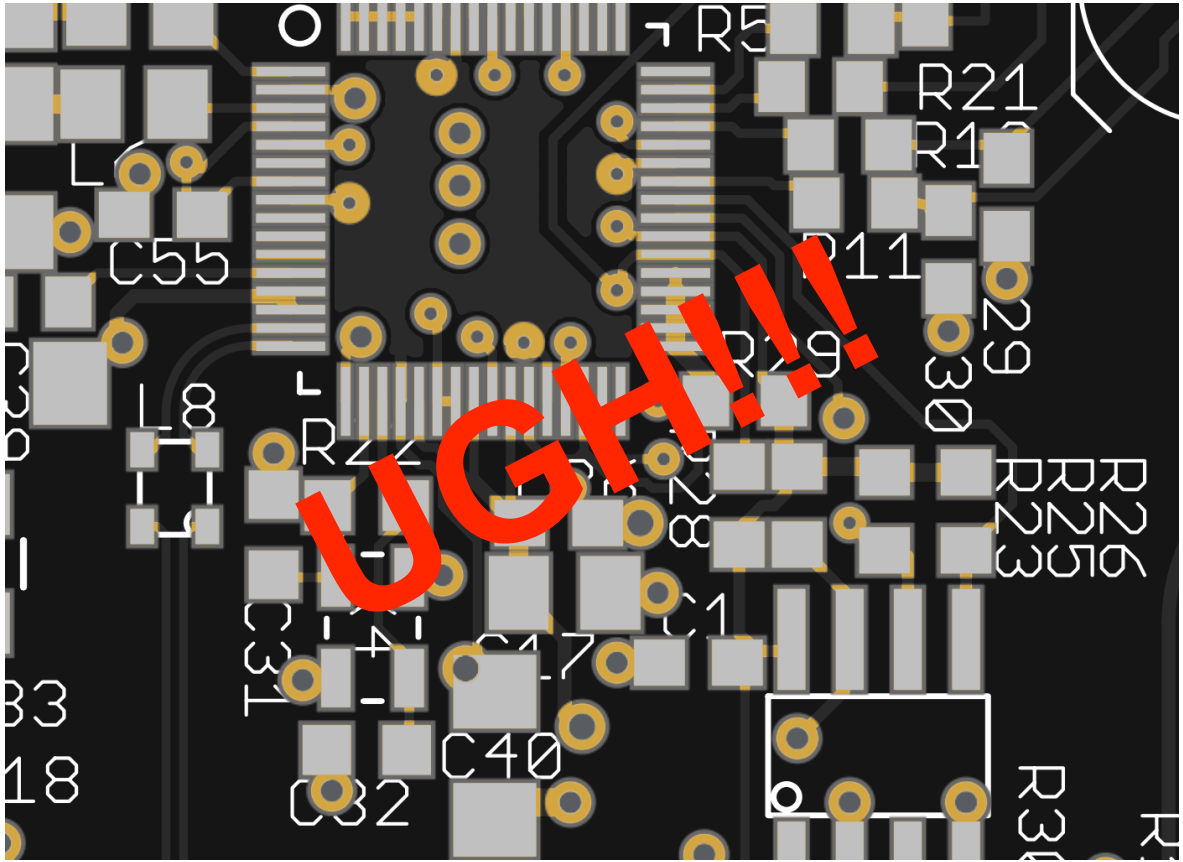

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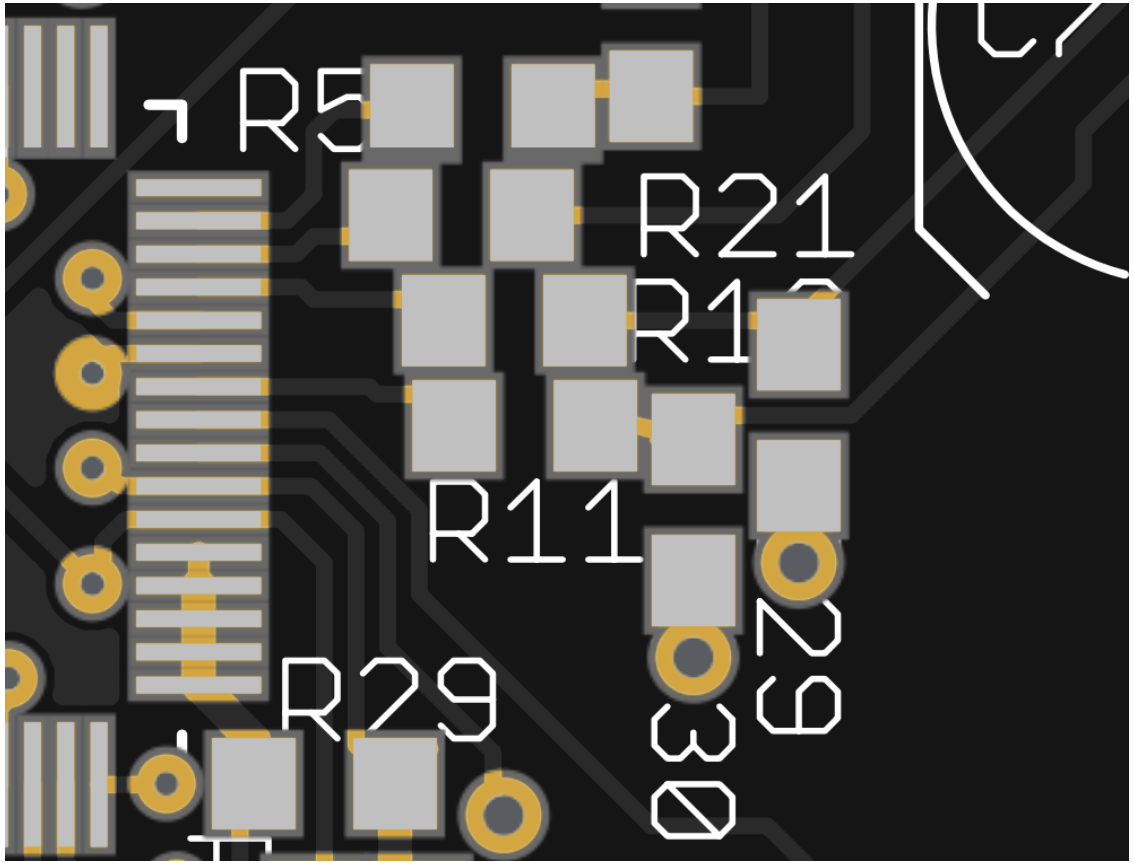

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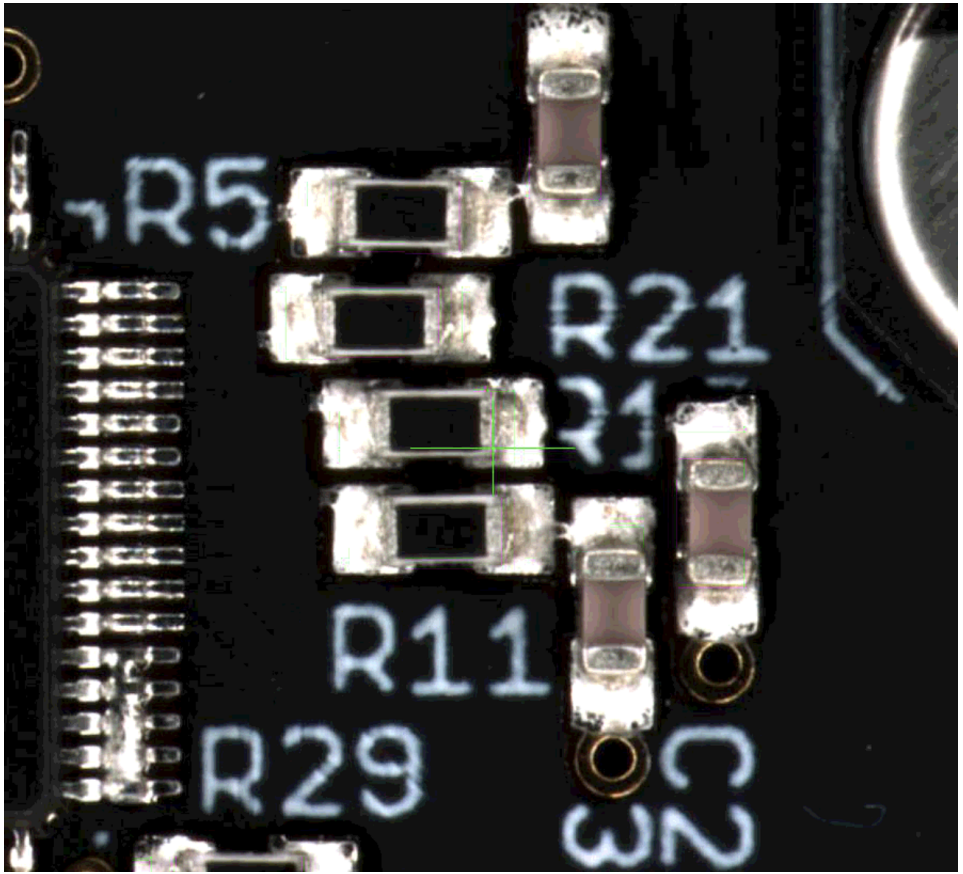

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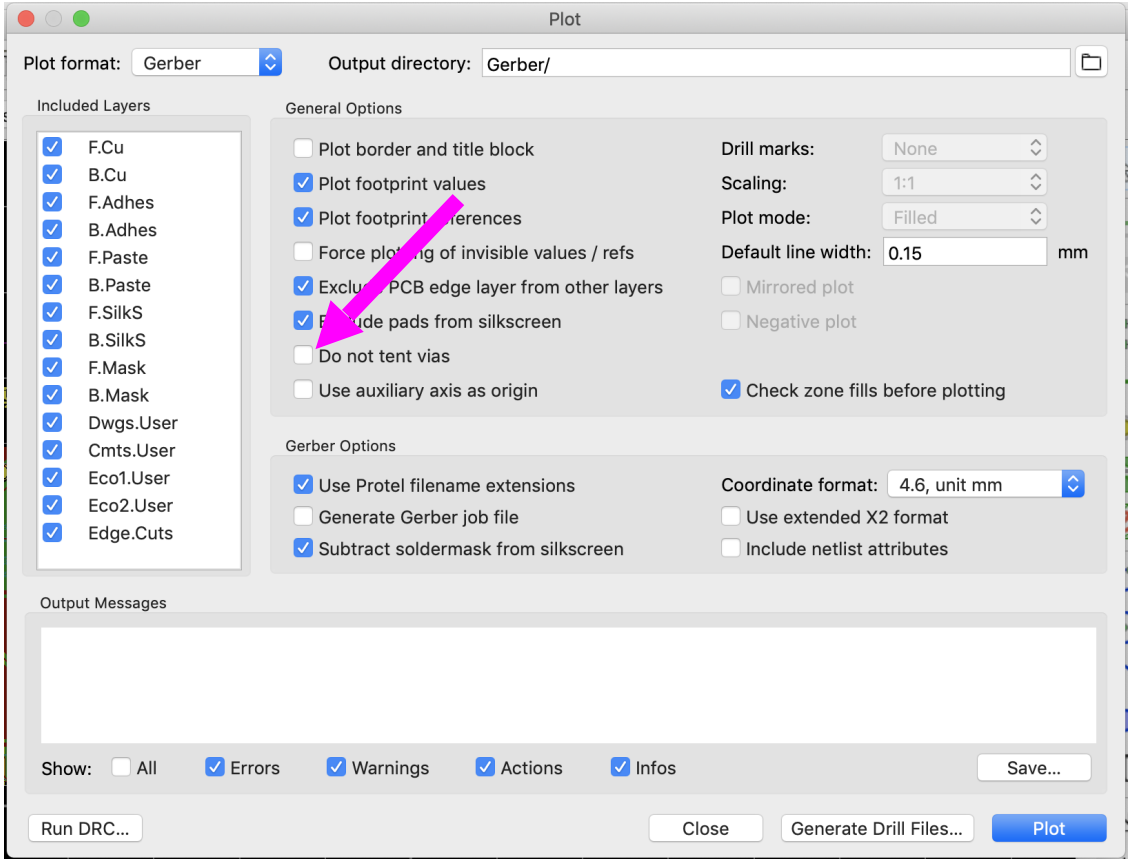

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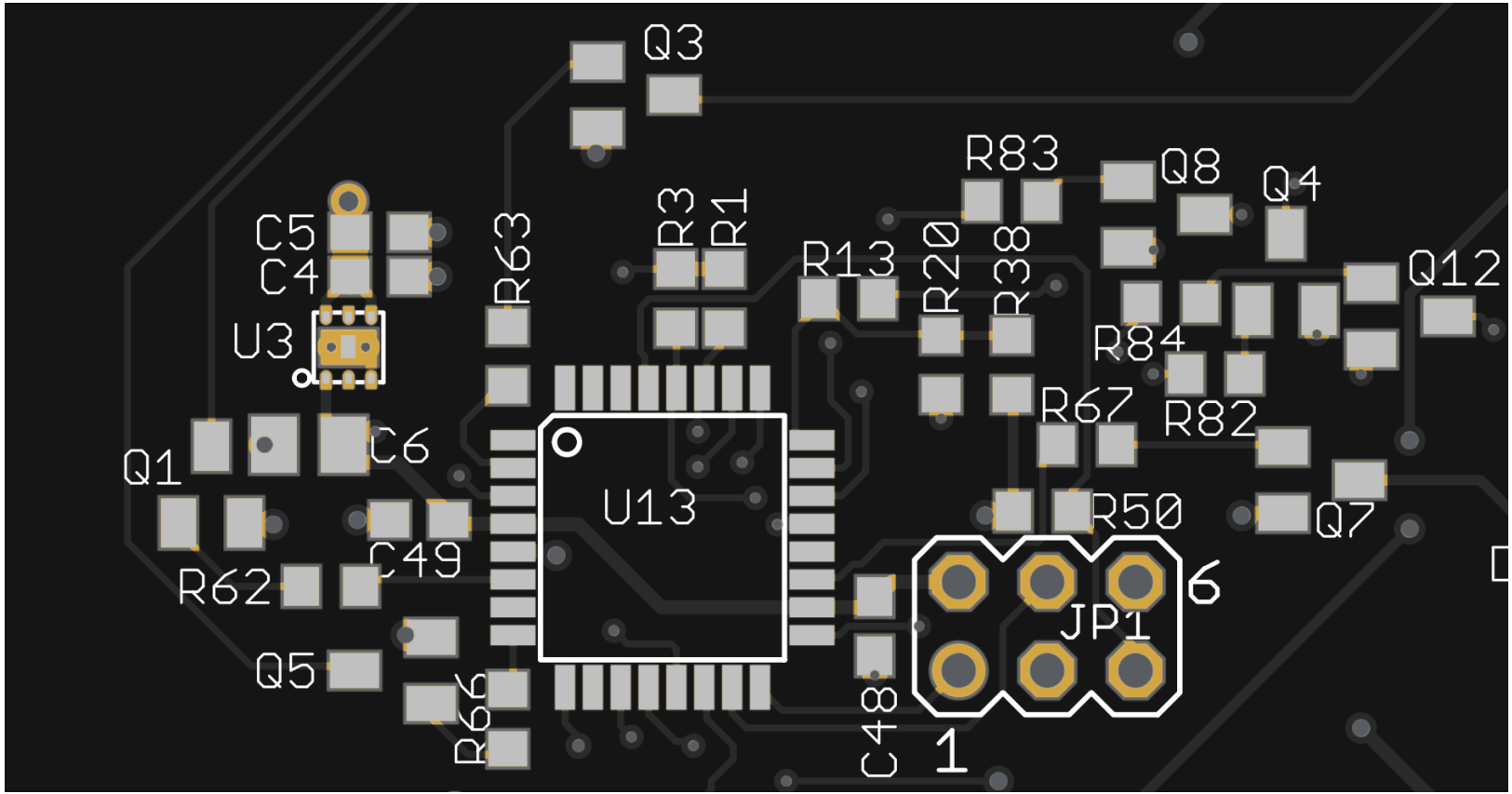

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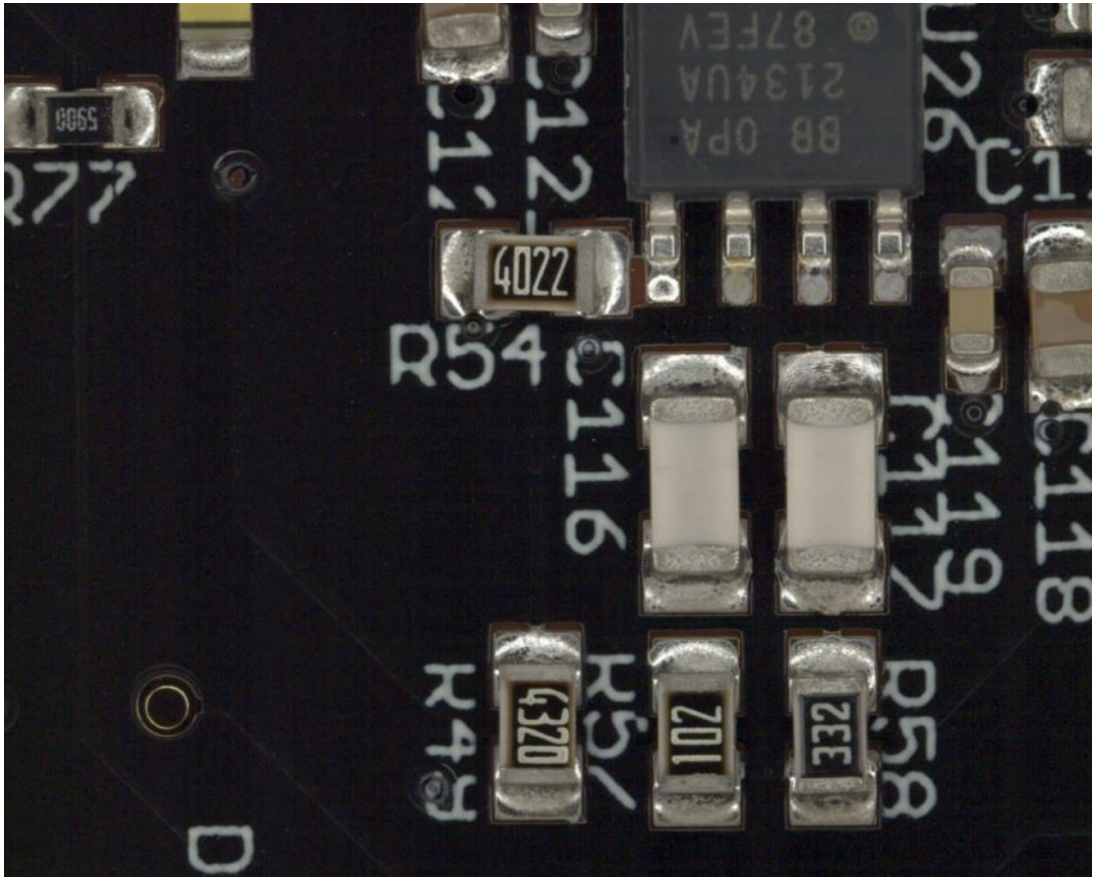

Silkscreen Legibility

Silkscreen Legibility - Summary

1. Cozy Text: 1x1mm with 0.18mm line width
2. Move away from pads, holes, and vias
3. Tent vias to print on top of vias - but only if you must

Tentpole Problems

1. ~~Identifying polarity of components~~
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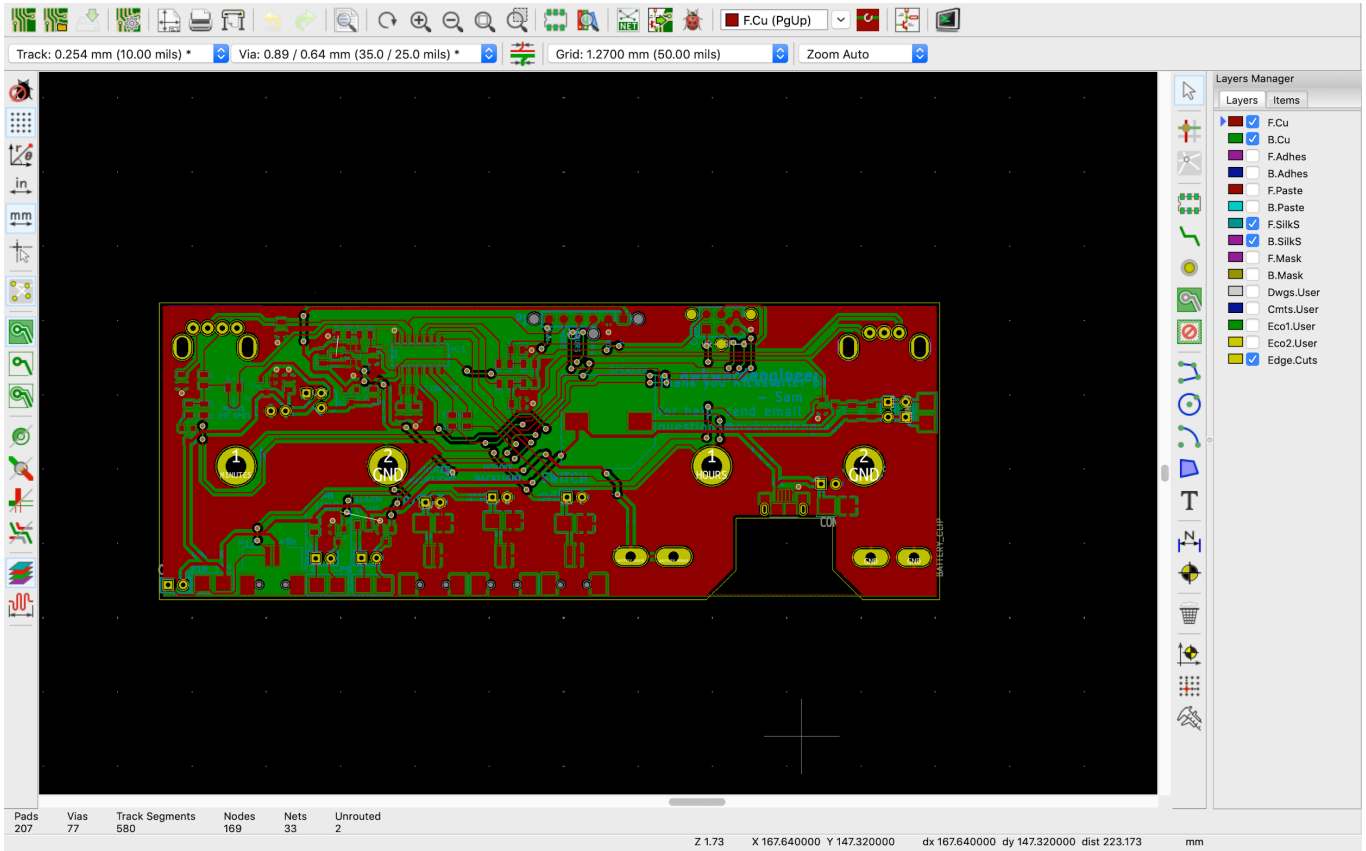
Panelization



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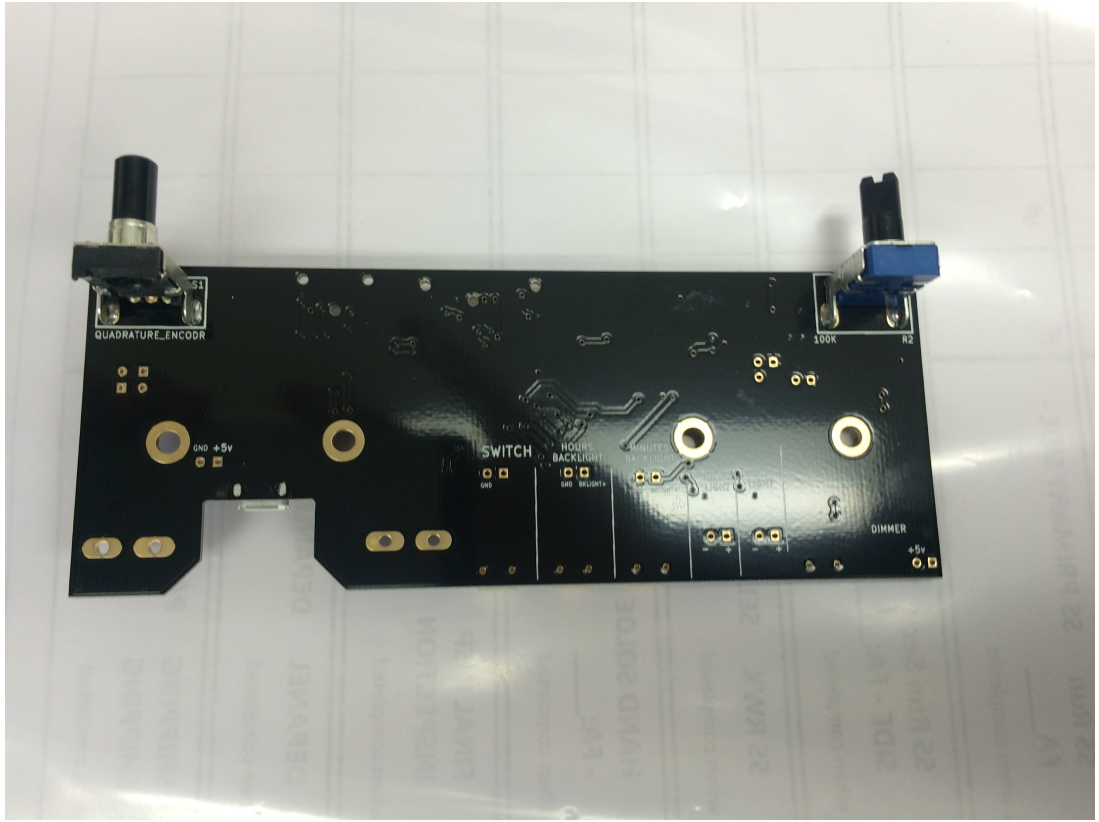

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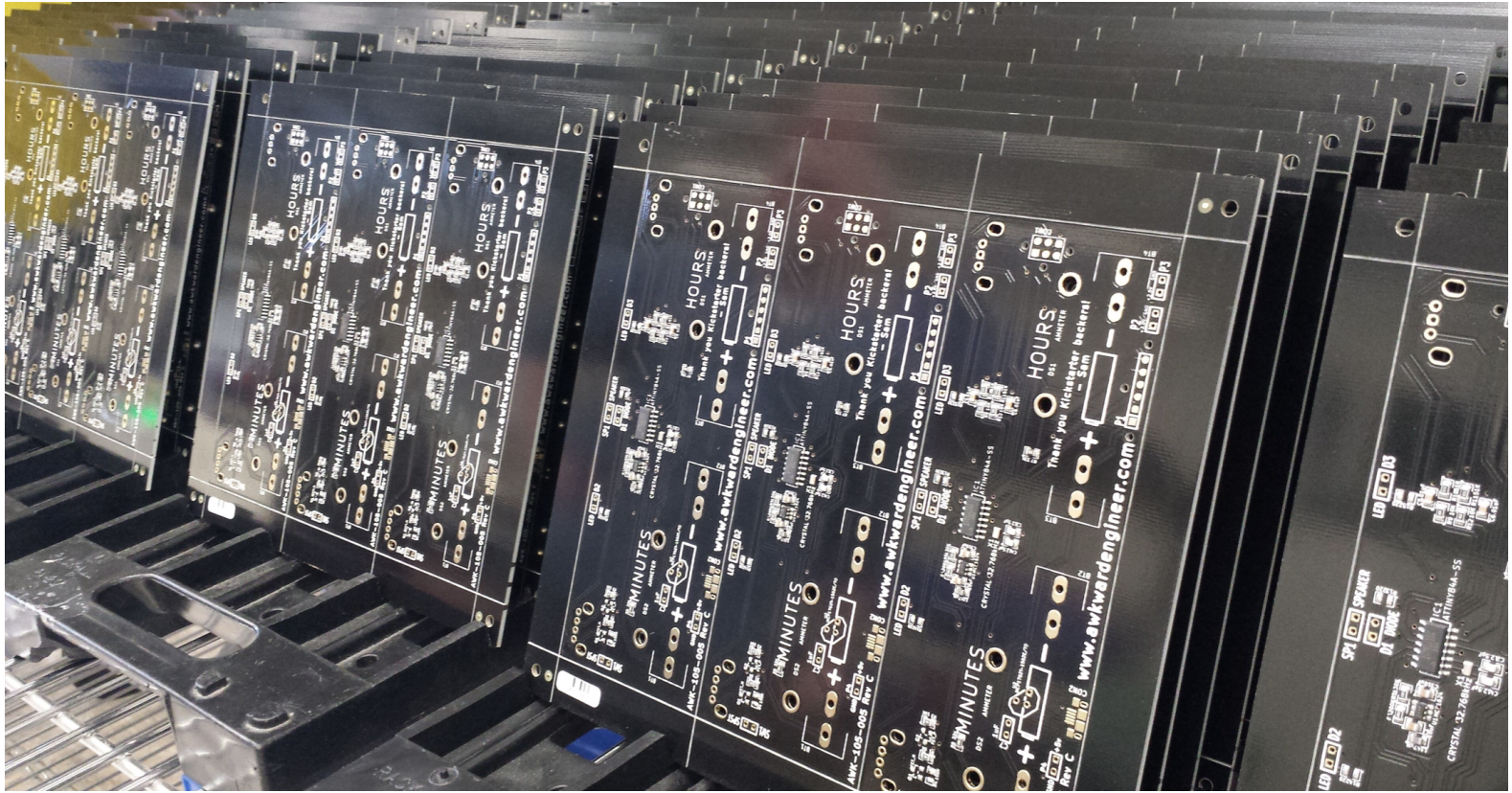

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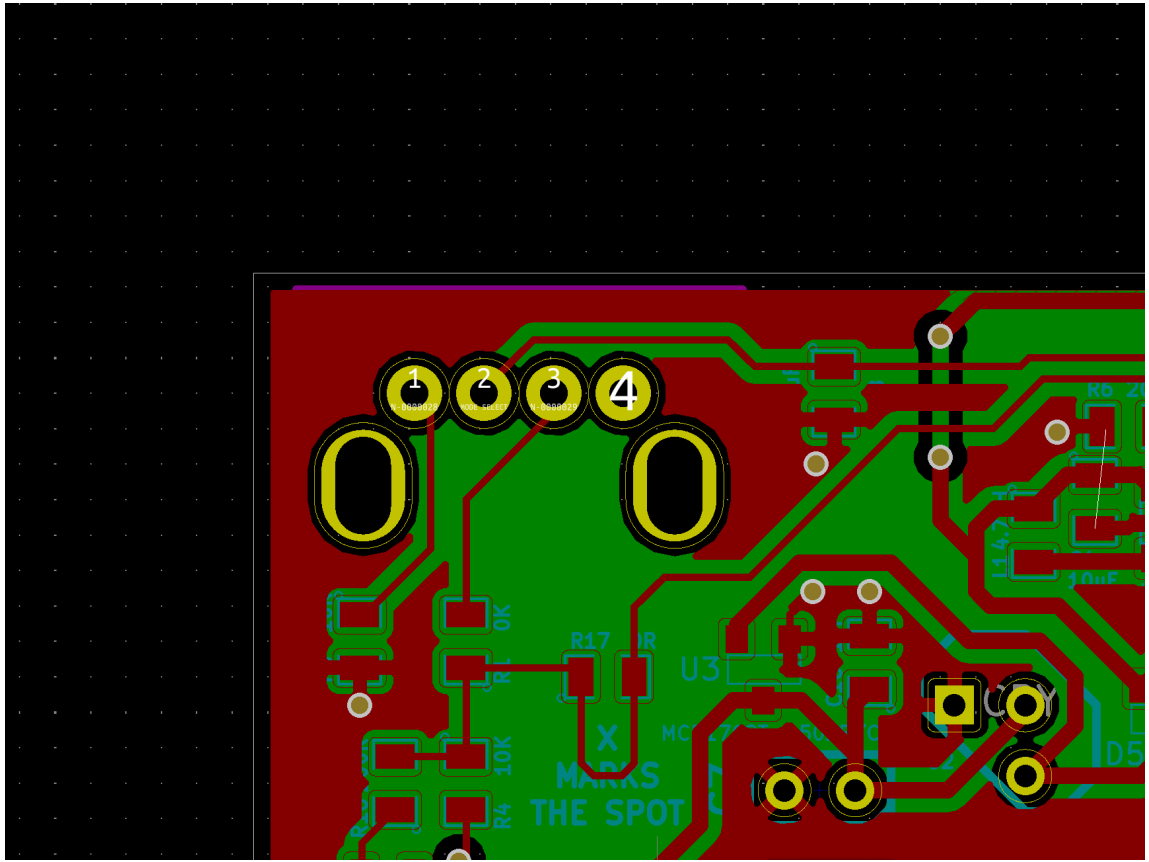

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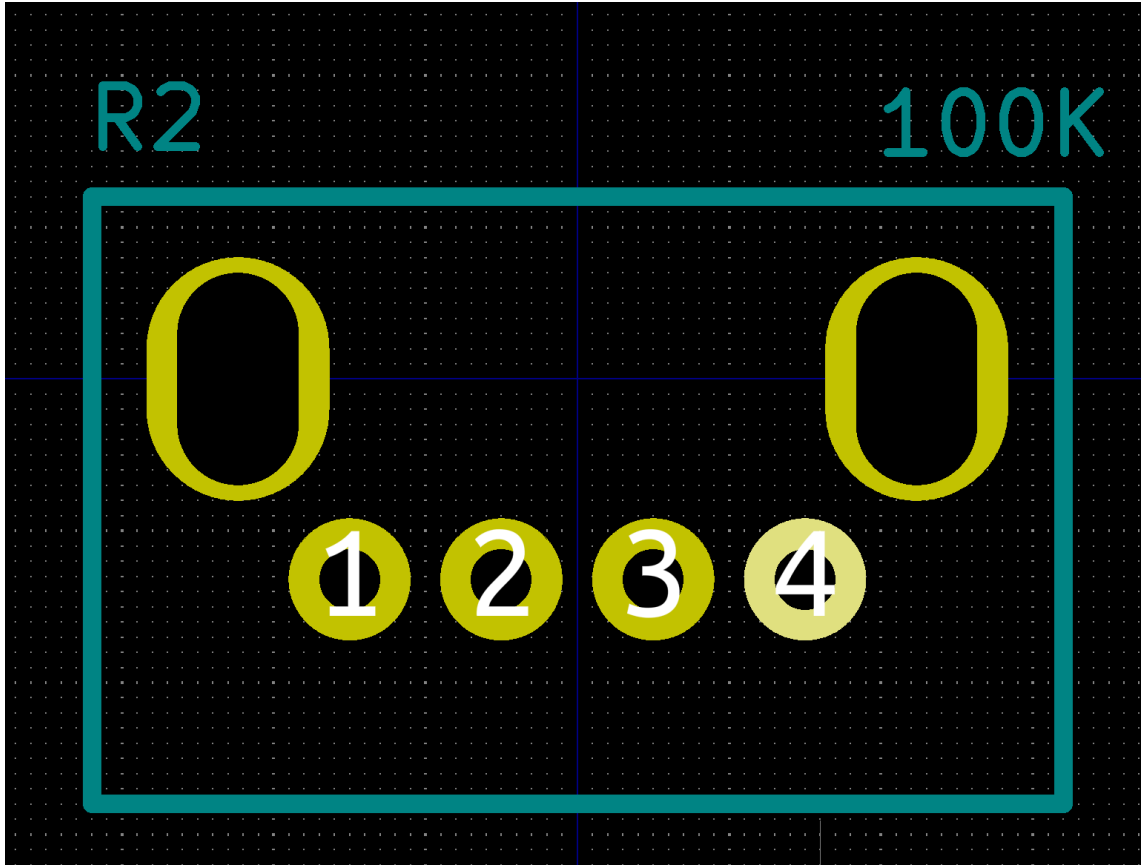

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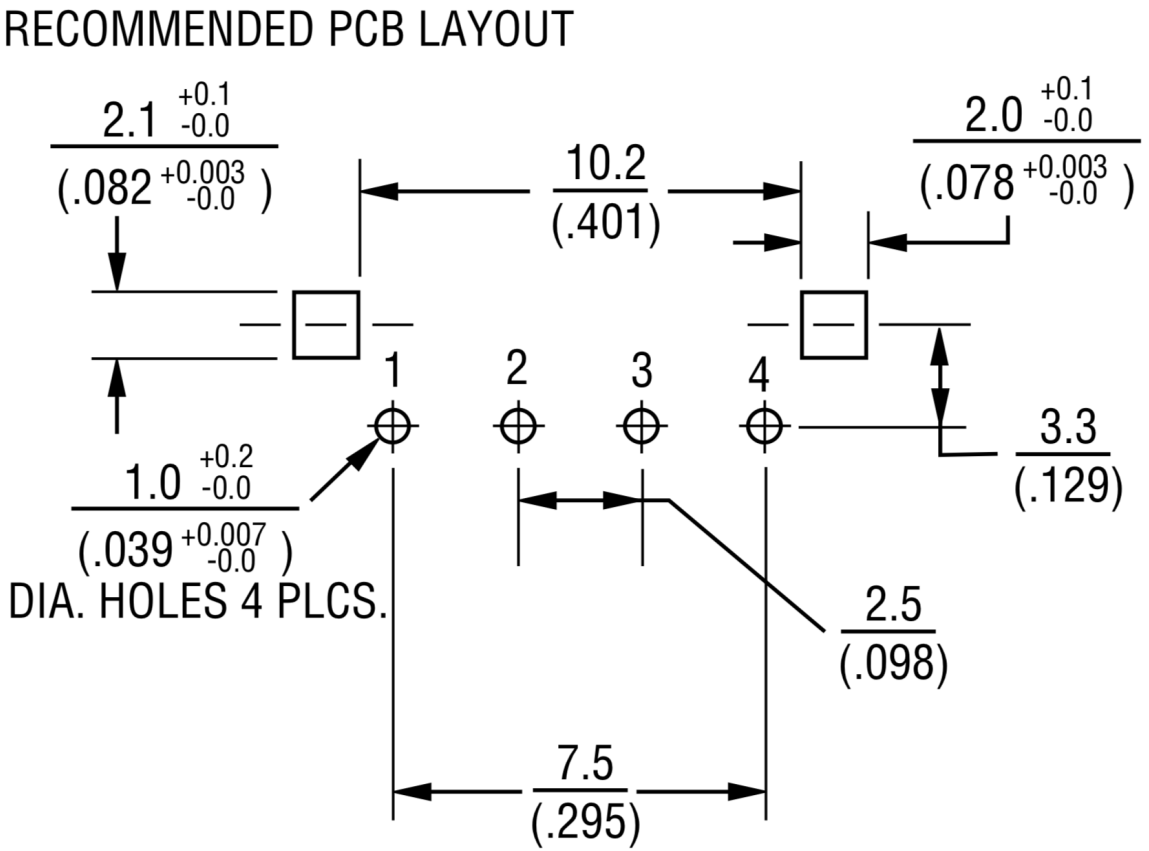
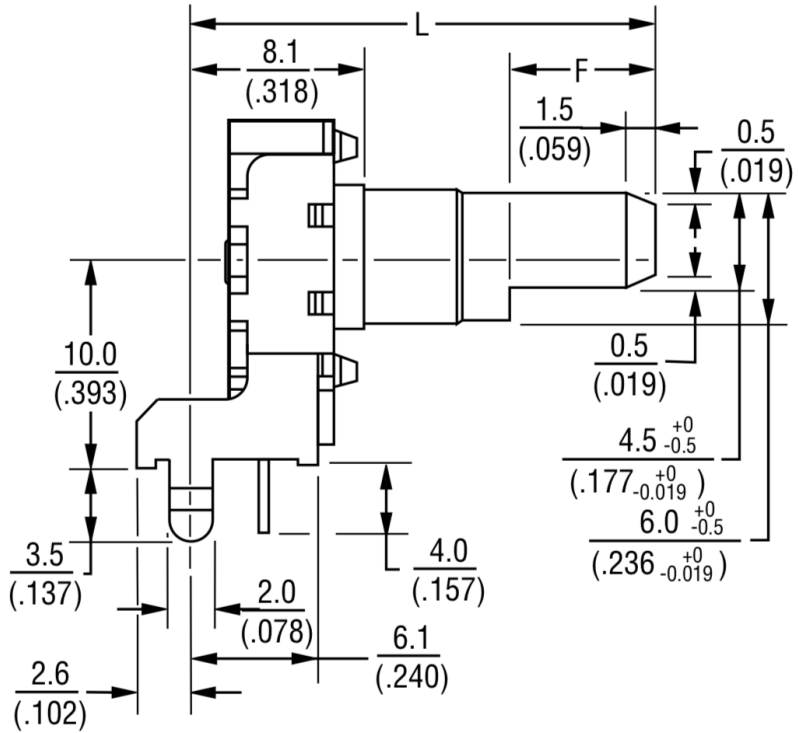


Panelization

PTV111-2



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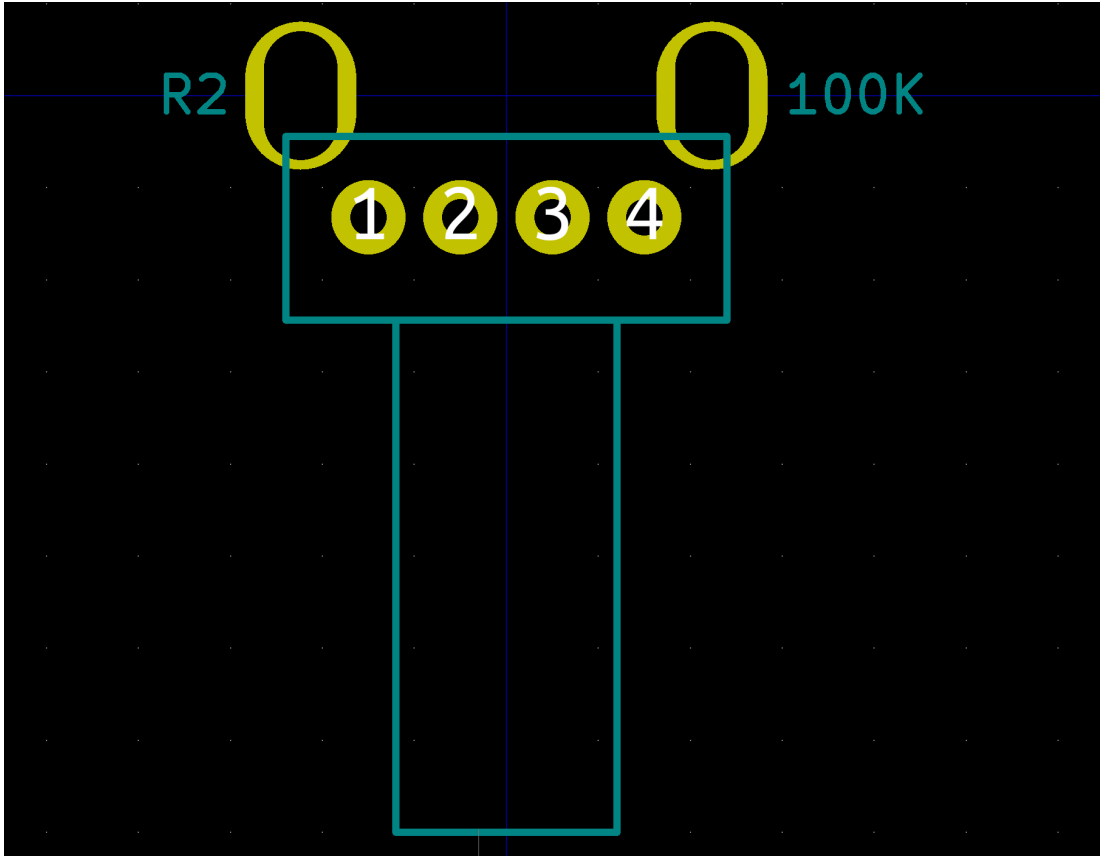
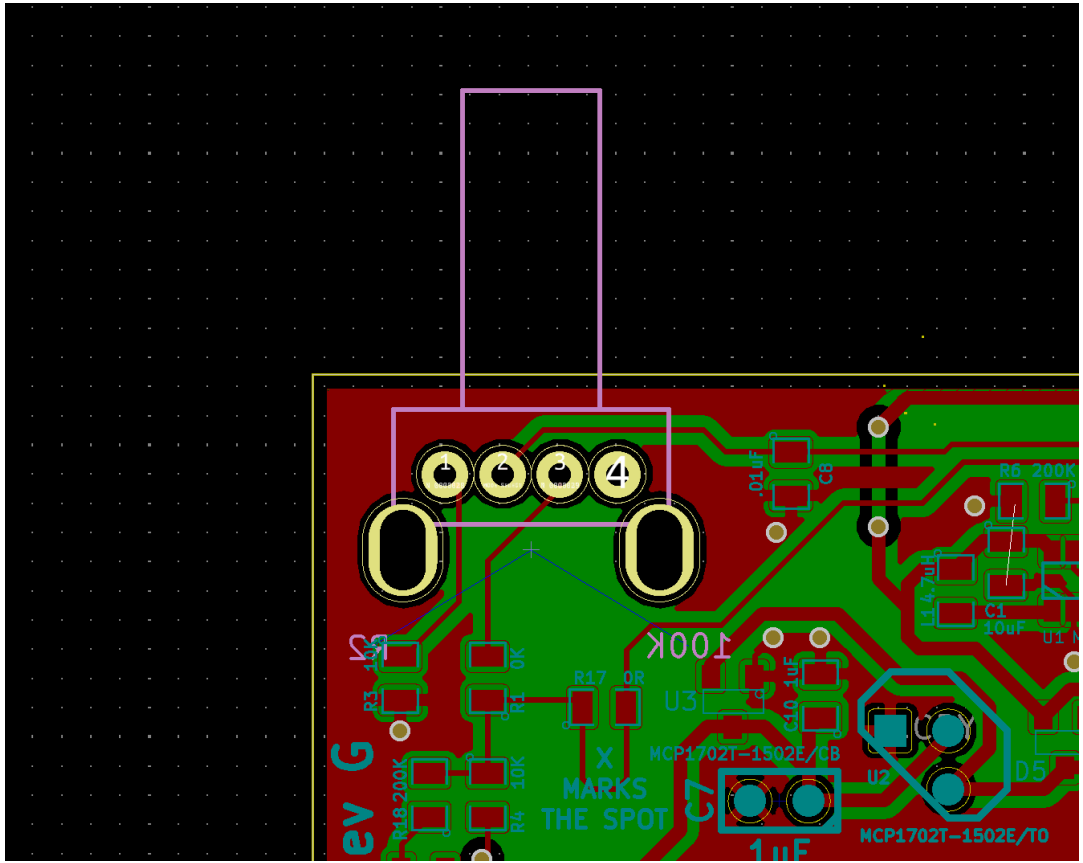


Panelization



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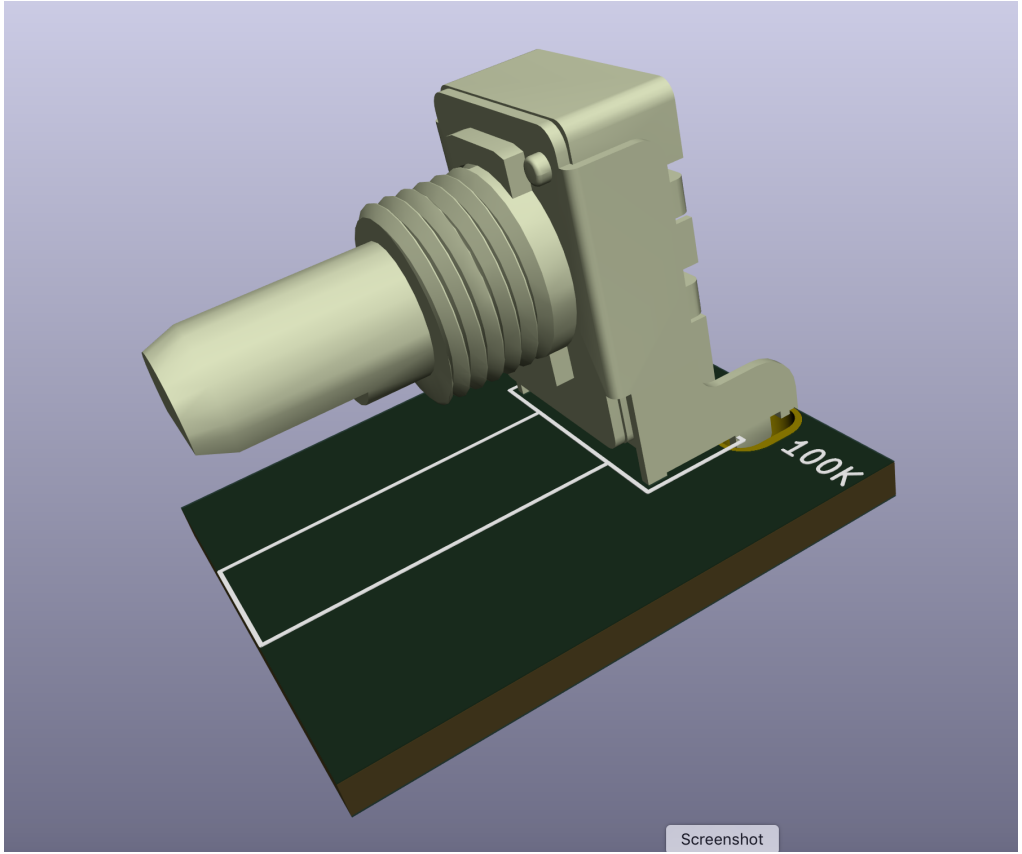

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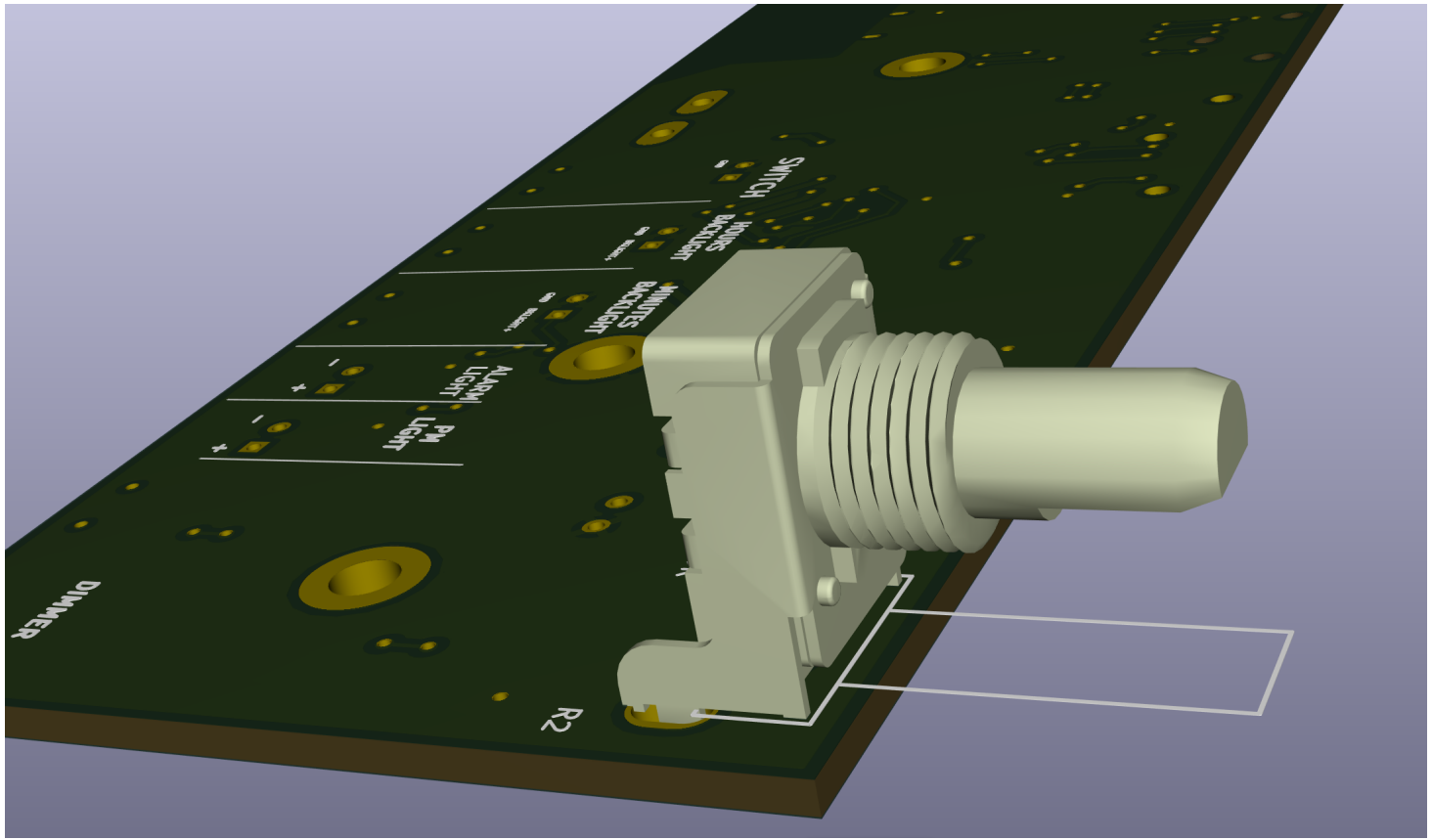


Panelization - Summary

1. Add silkscreen representing body of component.
    1.1. Doesn’t have to be elaborate, just accurate.
    1.2. Don’t worry, silkscreen that falls outside of the Outline will be trimmed.
2. Add 3D Model if you can

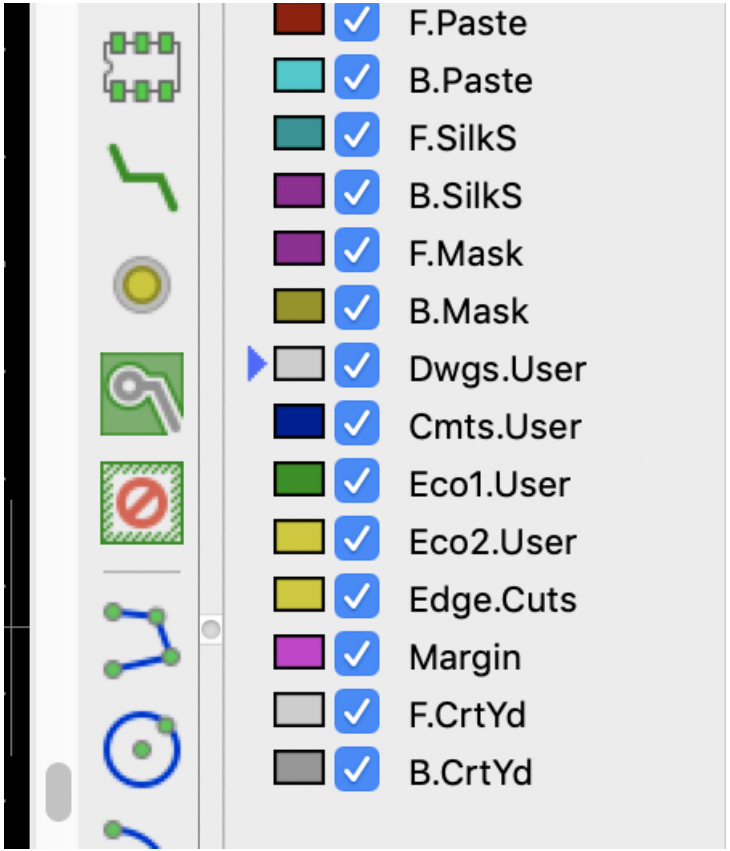
Tentpole Problems

1. ~~Identifying polarity of components~~
2. ~~Silkscreen legibility~~
3. ~~Panelization~~
4. PCB properties
5. Specific manufacturer's part numbers

Define PCB Properties

1. Number of layers
2. Overall PCB thickness
3. TG rating
4. Inner copper weight
5. Outer copper weight
6. Silkscreen color
7. Soldermask color
8. Via-in-pad
9. Impedance control
10. E-Test Required

Define PCB Properties



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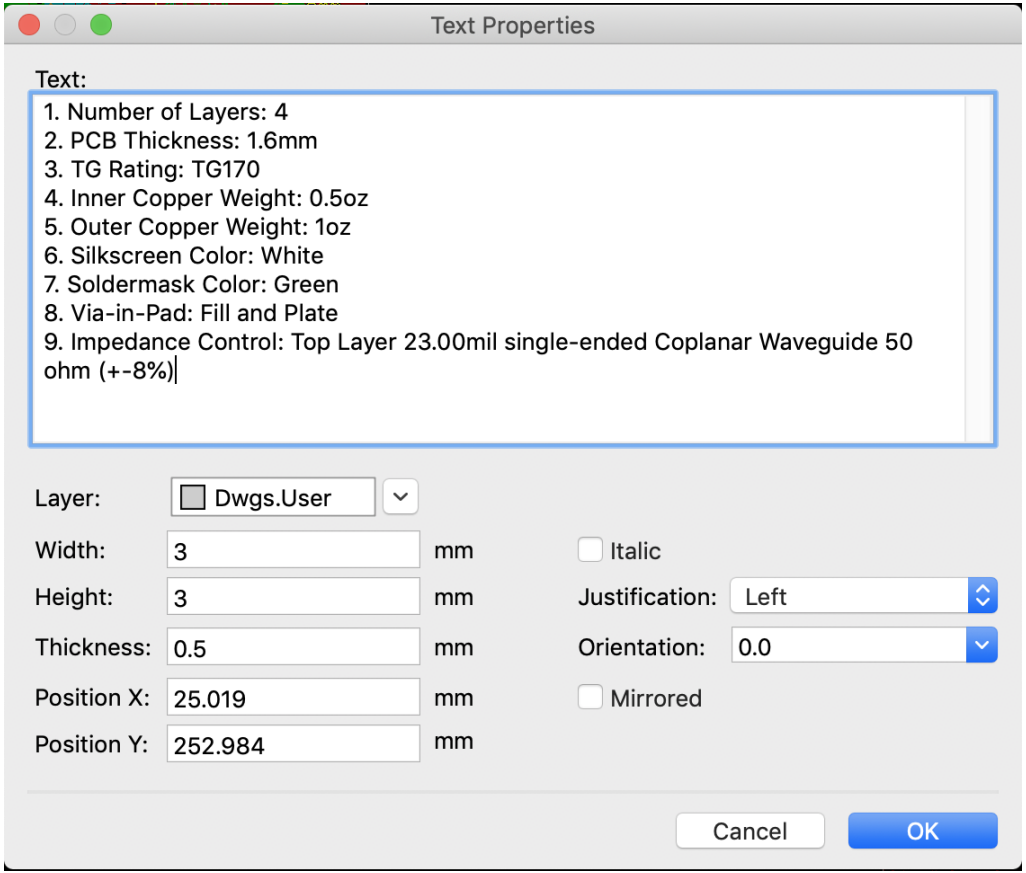

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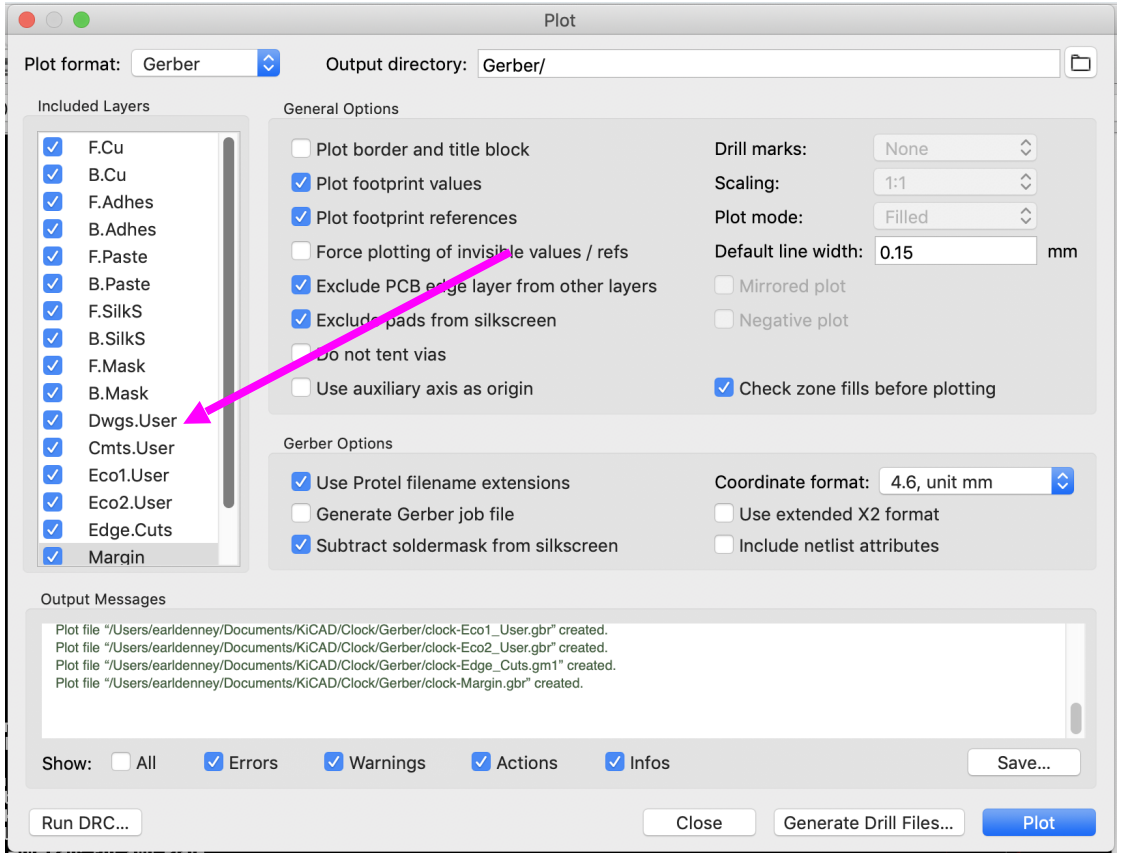

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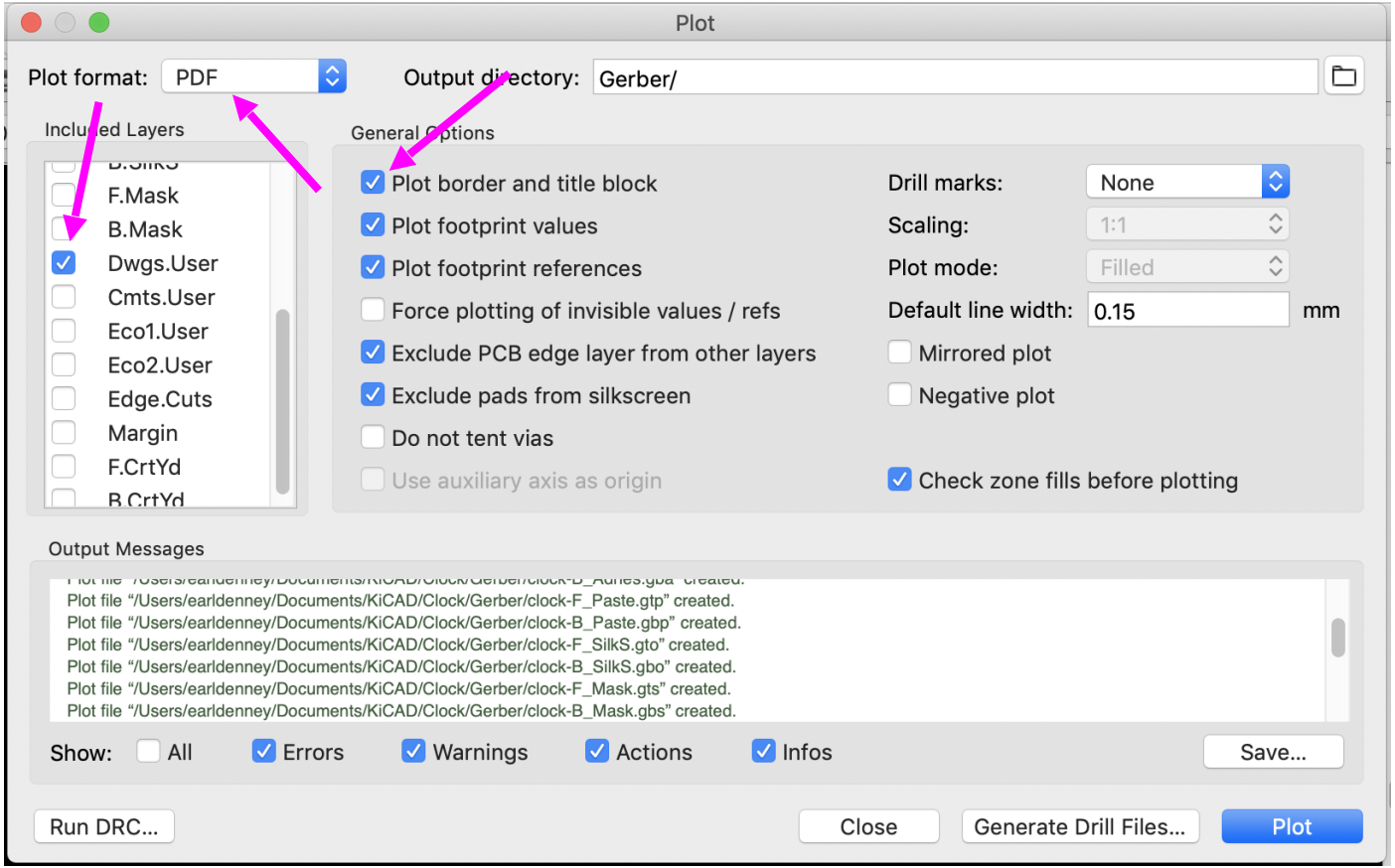
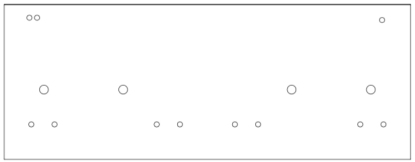


Define PCB Properties



1. Number of Layers: 4
2. PCB Thickness: 1.6mm
3. TG Rating: TG170
4. Inner Copper Weight: 0.5oz
5. Outer Copper Weight: 1oz
6. Silkscreen Color: White
7. Soldermask Color: Green
8. Via-in-Pad: Fill and Plate
9. Impedance Control: Top Layer 23.00mil single-ended Coplanar Waveguide 50 ohm (+-8%)

sam@awkwardengineer.com
Layout Design: Sam Feller
Schematic Design: Sam Feller
Please direct all questions to Sam Feller
The Awkward Engineer

Sheet:
File: clock.kicad_pcb

Title: Clock

Size: A3	Date: 2019-04-09	**Rev: A**
KiCad E.D.A. kicad (5.1.0-0)		Id: 1/1

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Size: A3	Date: 2019-04-09	**Rev: A**
KiCad E.D.A. kicad (5.1.0-0)		Id: 1/1

7 8 F

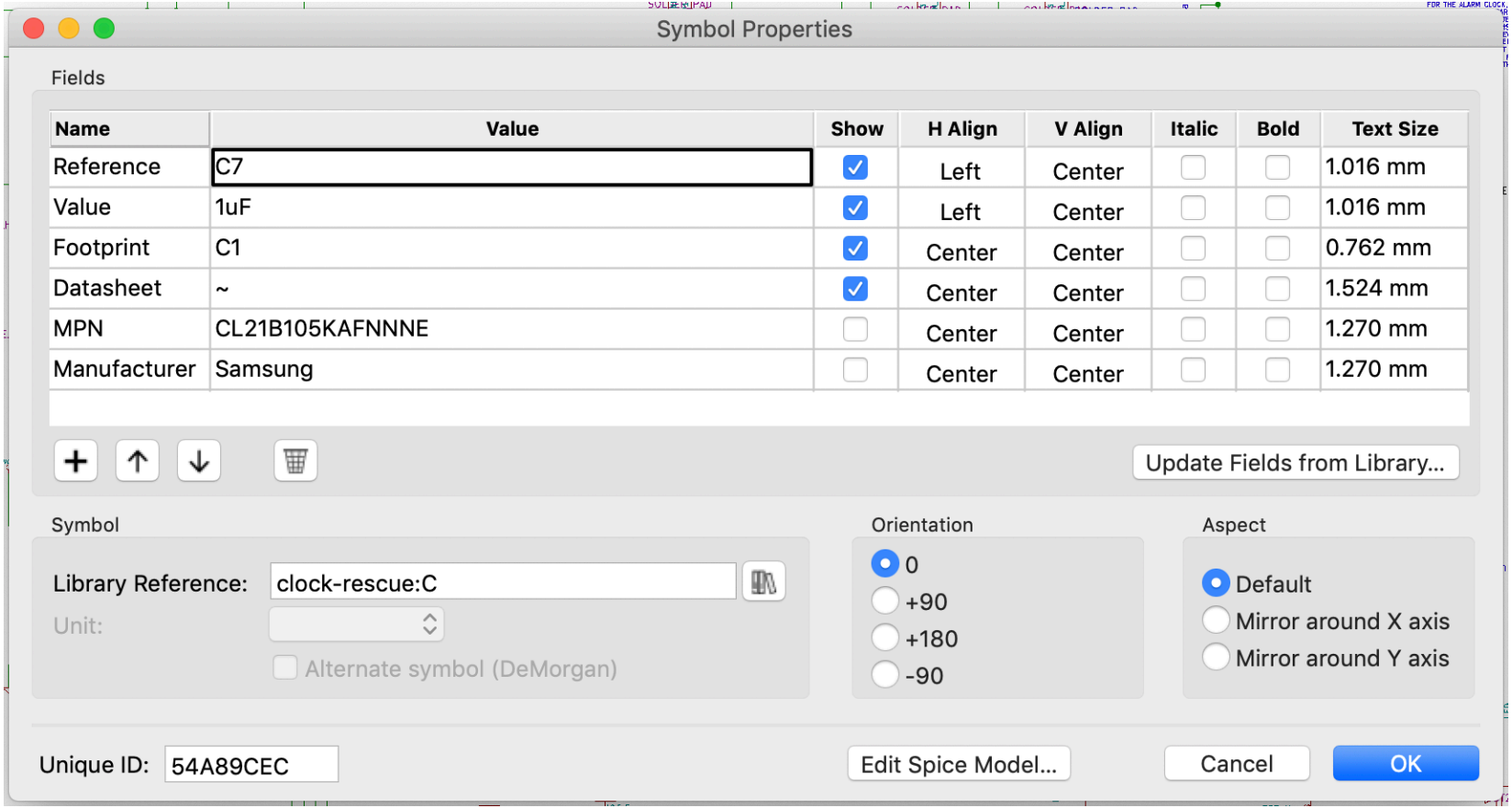
Define PCB Properties - Summary

1. Number of layers
2. Overall PCB thickness
3. TG rating
4. Inner copper weight
5. Outer copper weight
6. Silkscreen color
7. Soldermask color
8. Via-in-pad
9. Impedance control
10. E-Test Required

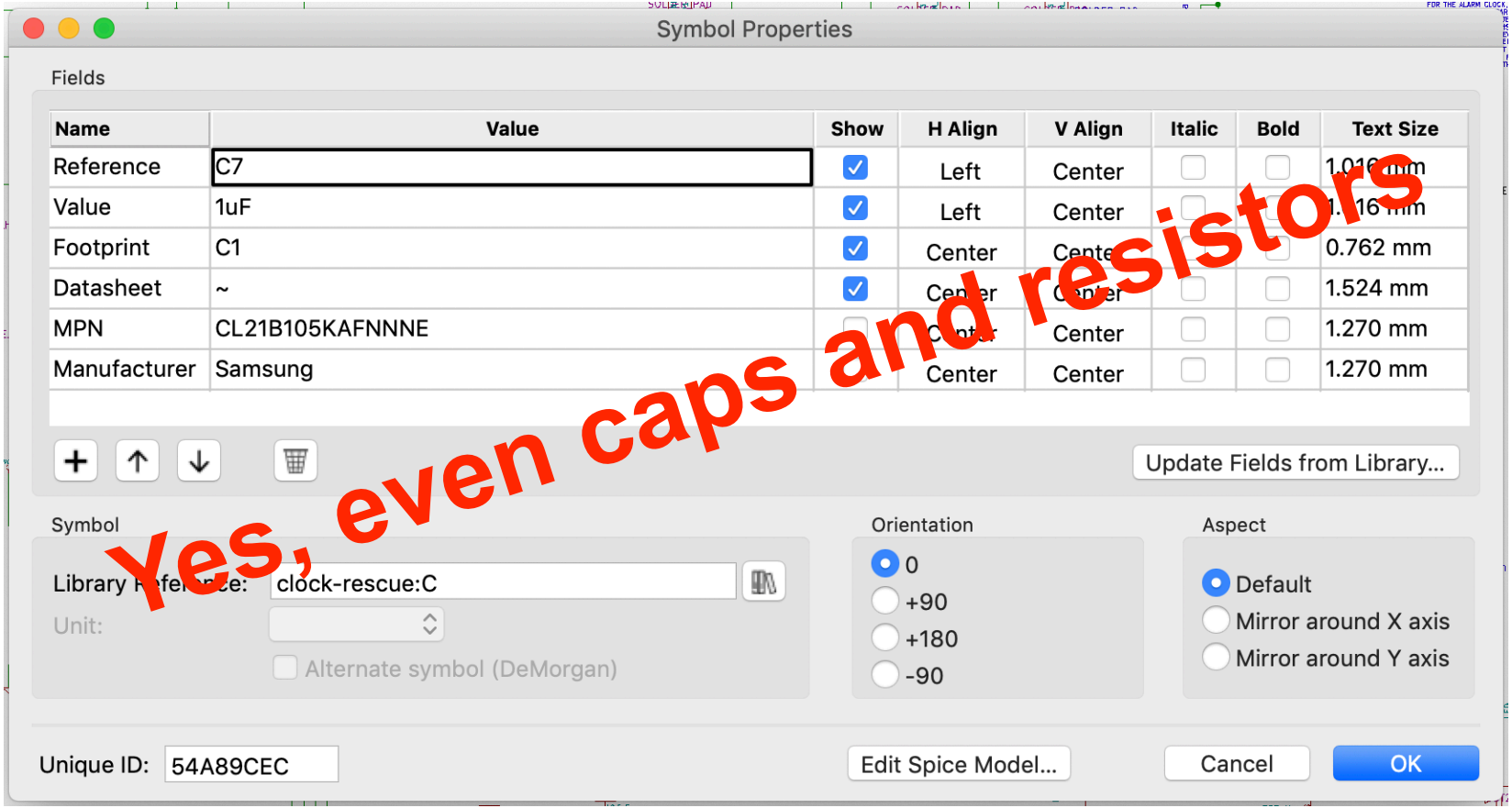
Tentpole Problems

1. ~~Identifying polarity of components~~
2. ~~Silkscreen legibility~~
3. ~~Panelization~~
4. ~~PCB properties~~
5. Specific manufacturer’s part numbers

Specific Manufacturer's Part Numbers



Specific Manufacturer's Part Numbers



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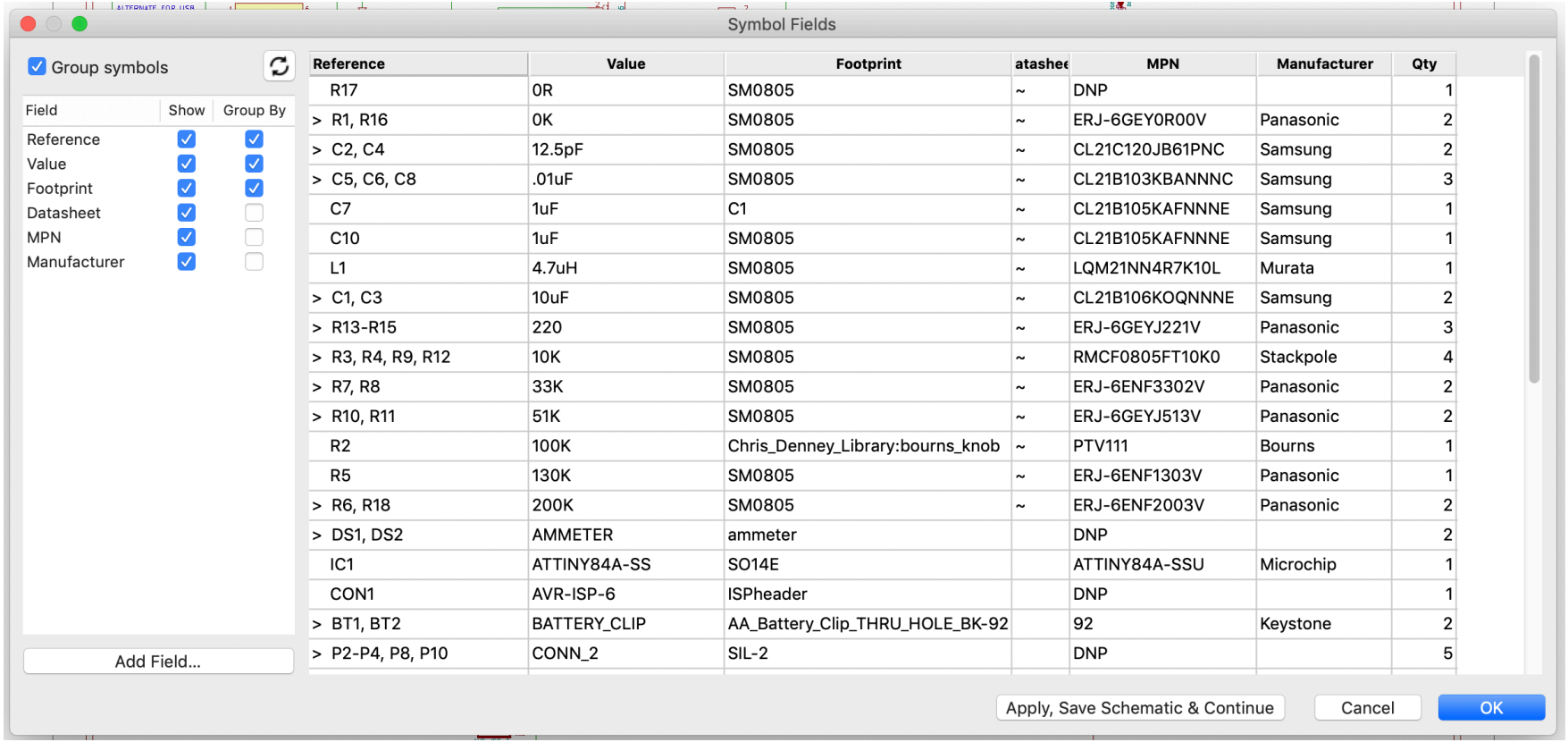

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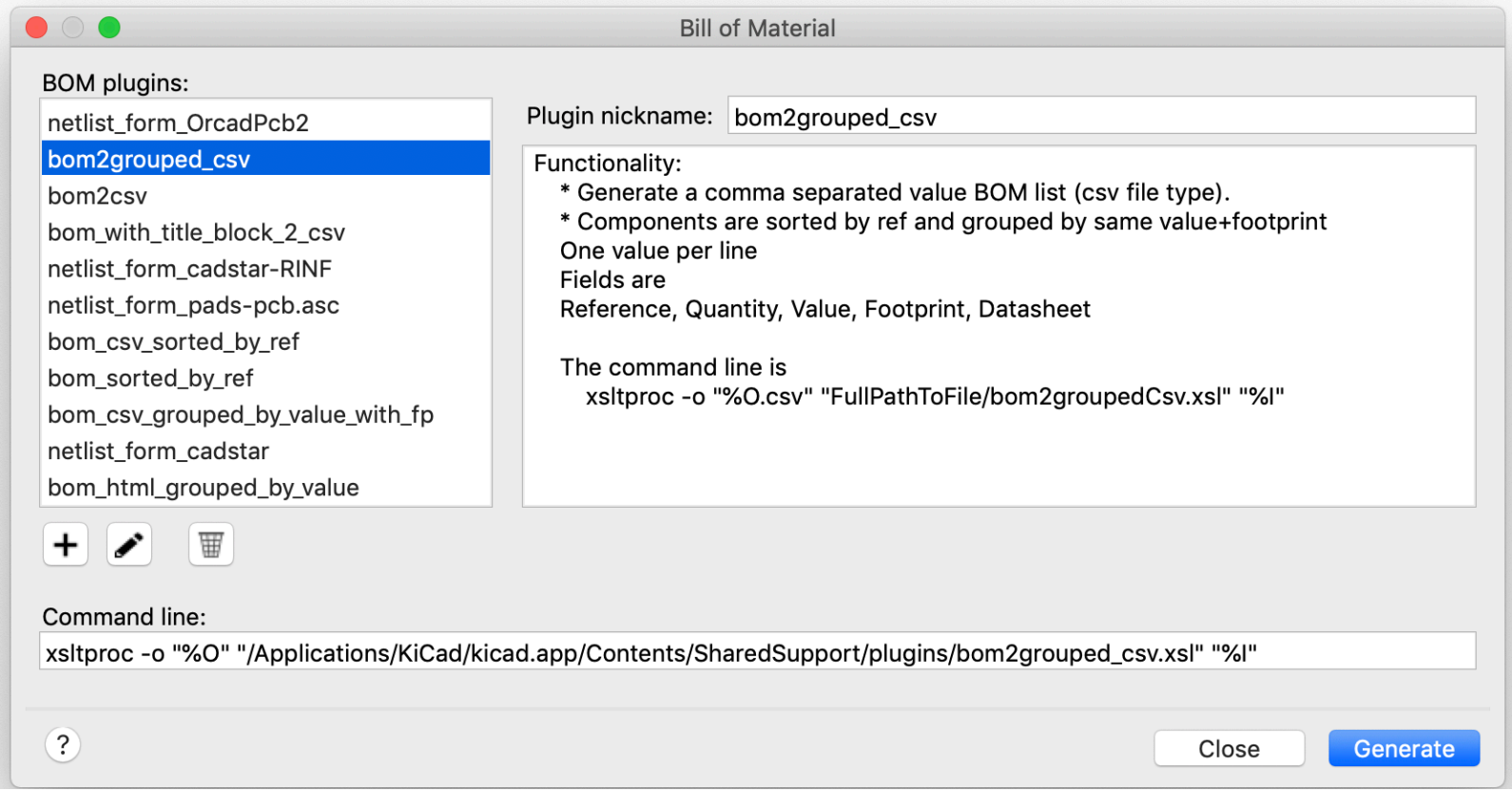

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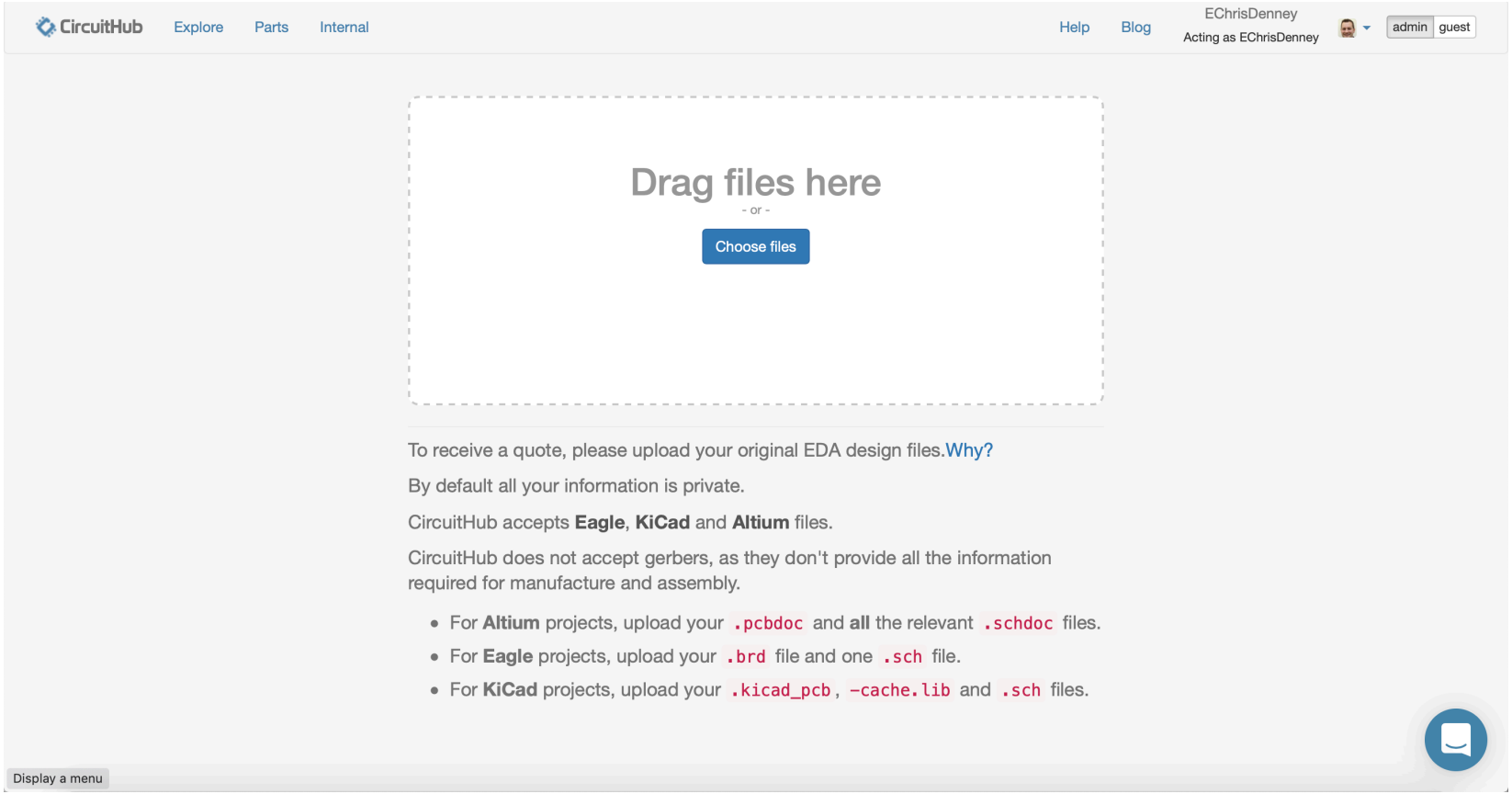

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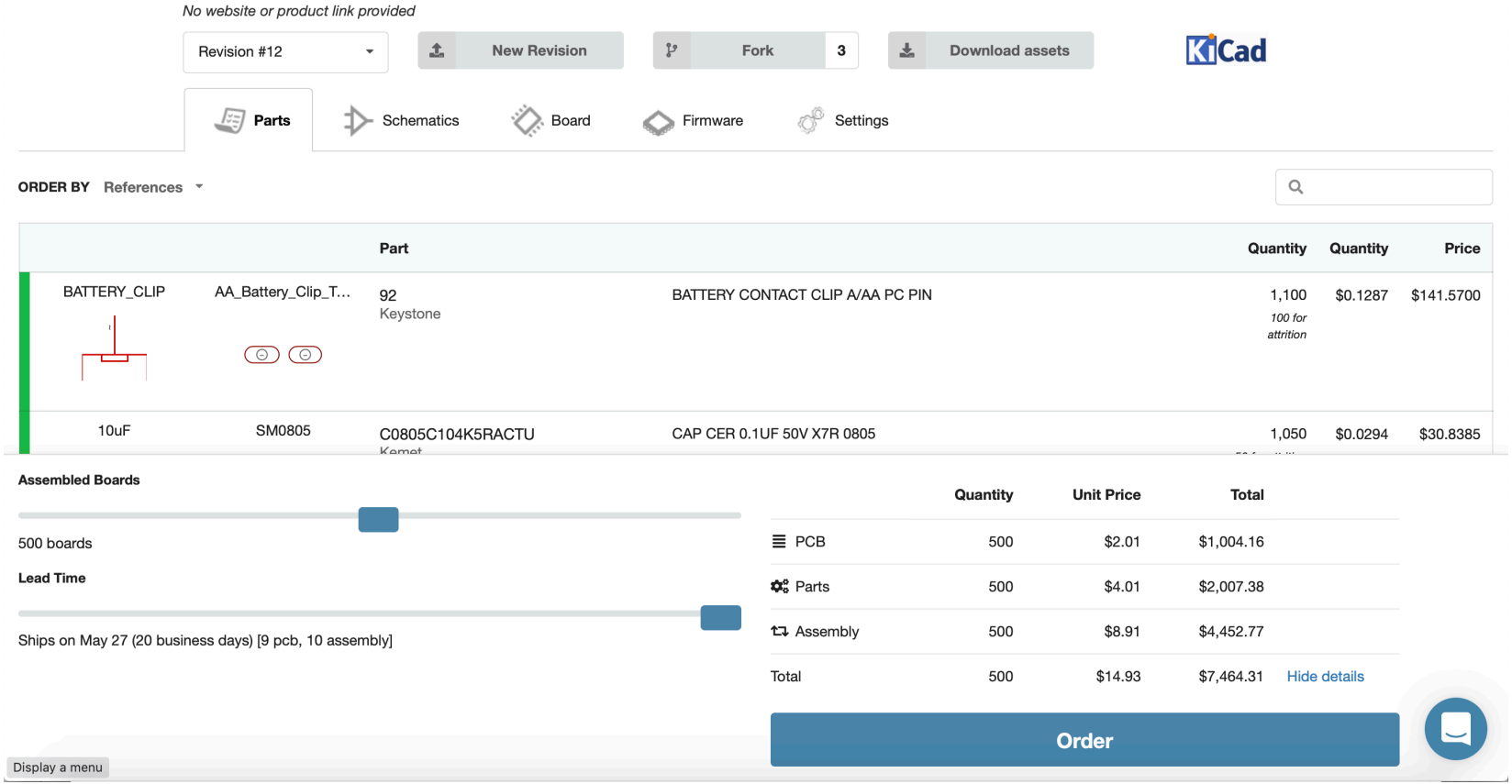

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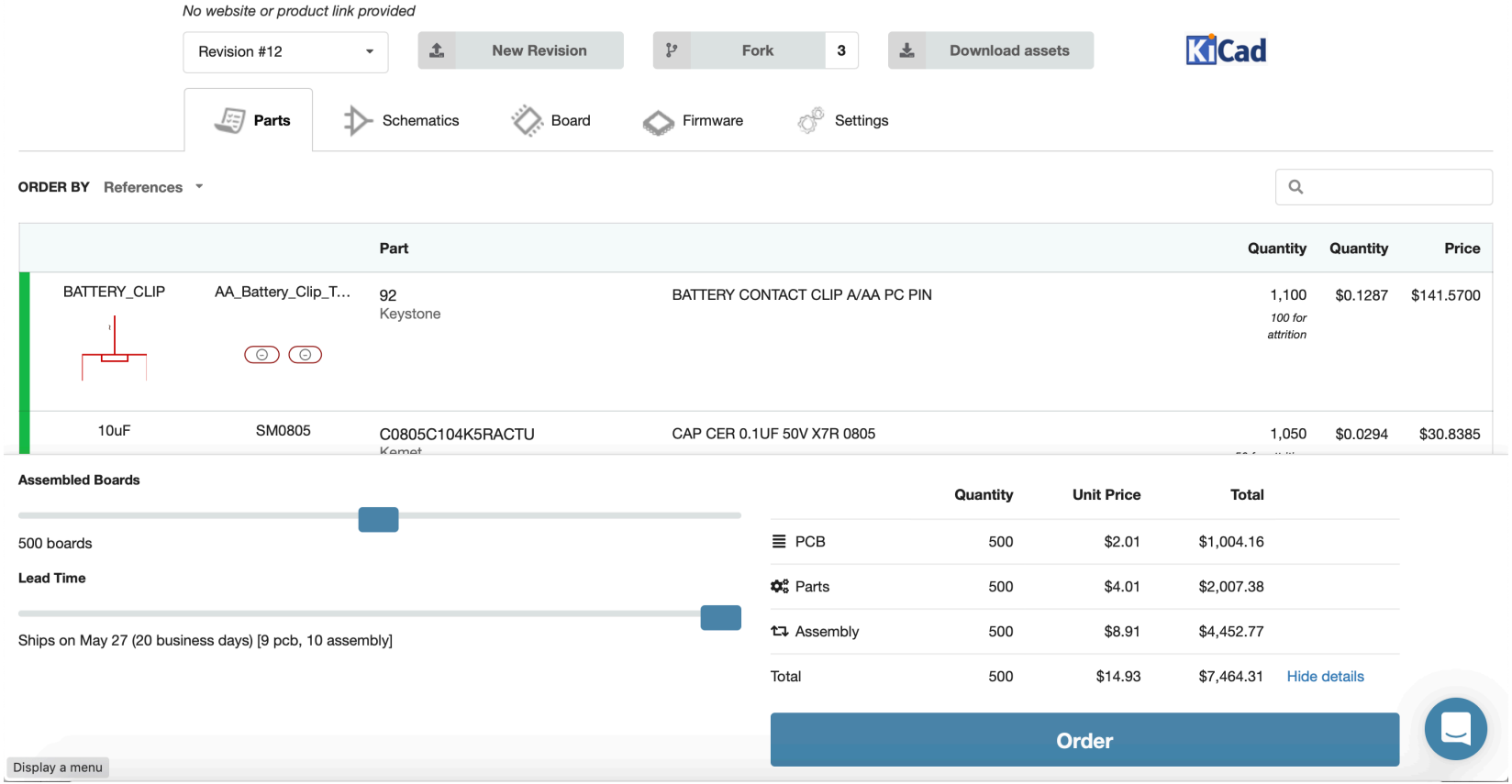


Specific Manufacturer's Part Numbers

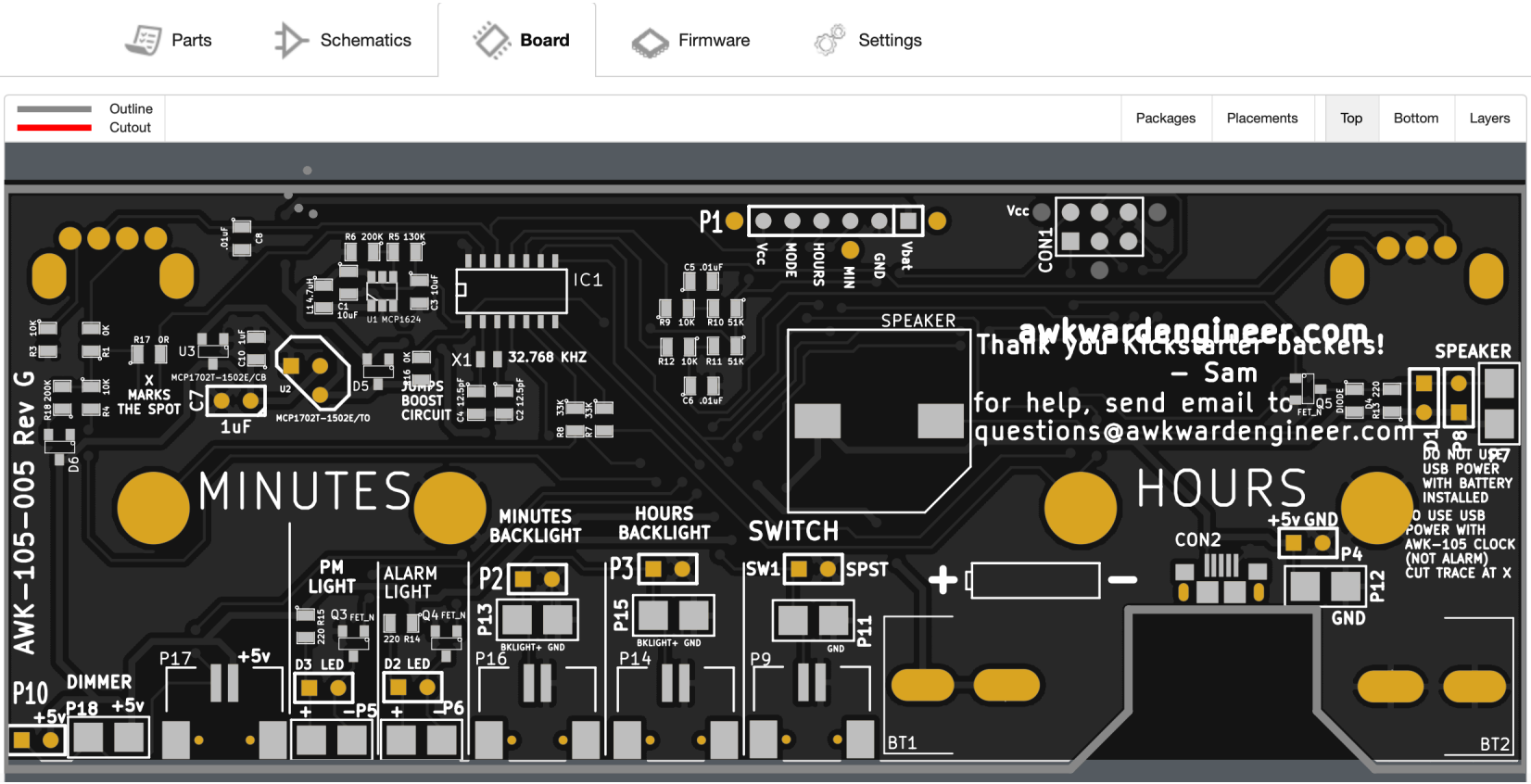
Assembled Boards

500 boards

Lead Time

Ships on May 27 (20 business days) [9 pcb, 10 assembly]

Specific Manufacturer's Part Numbers



Specific Manufacturer's Part Numbers

Color

Soldermask color

Black

Silkscreen color

White

Edit

Miscellaneous

Cutouts

Board does not contain cutouts

Via fill

No via fill required

Add via fill locations

Via in pad

No via in pad fill required

Add locations which require filling and plating

Castellated edges

Does not require castellated edges

Blind/Buried layer sets

0

Stackup

Board thickness

1.6

Copper weight

Outer 1

Inner Not specified

Material FR4 TG 130-135 FR4 High TG

Custom stackup

Add custom stackup

Edit

Specifications

Width	133.35	mm
Length	50.81	mm
Number of layers	2	

Specific MPN - Summary

1. Include Manufacturer
2. Include MPN
3. Do this when you assign footprint
4. Real legitimate quotes in seconds - not days - using CircuitHub

Tentpole Problems

1. Identifying polarity of components
2. Silkscreen legibility
3. Panelization
4. PCB properties
5. Specific manufacturer’s part numbers

Tentpole Problems - Summary

1. Use square pads or clear silkscreen.
2. 1x1mm character size. 0.18mm lines.
3. Draw overhanging parts
4. Include PCB properties in dwgs.User
5. Add Manufacturer and MPN to symbols

Bonus Tip

Center Pad of QFN/QFP

General | Local Clearance and Settings | Custom Shape Primitives

Pad number:	17		
Net name:	<no net>		
Pad type:	SMD		
Shape:	Rounded Rectangle		
Position X:	0	mm	
Position Y:	0	mm	
Size X:	1.6	mm	
Size Y:	1.6	mm	
Orientation:	0.0	deg	
Shape offset X:	0	mm	
Shape offset Y:	0	mm	
Pad to die length:	0	mm	
Trapezoid delta:	0	mm	
Trapezoid axis:	Vertical		
Corner size:	15.6	%	
Corner radius:	0.2496	mm	

Hole shape:	Circular	
Hole size X:	0	mm
Hole size Y:	0	mm

Copper: F.Cu

Technical layers:

- [ ] F.Adhes
- [ ] B.Adhes
- [ ] F.Paste
- [ ] B.Paste
- [ ] F.SilkS
- [ ] B.SilkS
- [x] F.Mask
- [ ] B.Mask
- [ ] Dwgs.User
- [ ] Eco1.User
- [ ] Eco2.User

Footprint REF** (LFCSP-16-1EP_3x3mm_P0.5mm_EP1.6x1.6mm), front side, rotated 0.0 deg

- [ ] Show pad in outline mode

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Topics Cut From Presentation

- Gang soldermask problems
- Plated hole sizes
- Fiducials
- Smallest component sizes
- Single sided vs double sided
- SMT parts being too close to thru-hole
- Cutouts
- Wrong footprints or part numbers
- Your 0402 footprint is probably awful
- Solder paste 1:1 with copper
- Overhanging microUSB ports
- Paste on hybrid components (SMT and Thru-hole in one part)

More Info

worthingtonassembly.com/best-practices

echrisdenney.com

Thank you!

Chris Denney - CTO - Worthington Assembly Inc.
Chris Denney - Jerk That Tells You There's a Problem - CircuitHub Inc.

cdenney@worthingtonassembly.com
@WAssembly on Twitter

Thank to Sam Feller (aka The Awkward Engineer) for letting me use his project in this presentation https://www.awkwardengineer.com/