

Wai

Your Manufacturer Is Stupid

Help Them

Wai

Chris Denney

CTO - Worthington Assembly



CircuitHub

Chris Denney



CircuitHub

Chris Denney

Jerk Who Tells You There's A Problem

Wai

Your Manufacturer Is Stupid

Have to act stupid

Wai

Your Manufacturer Is Stupid

Play dumb on new products



Information about your design is unclear

Phone calls needs to be made



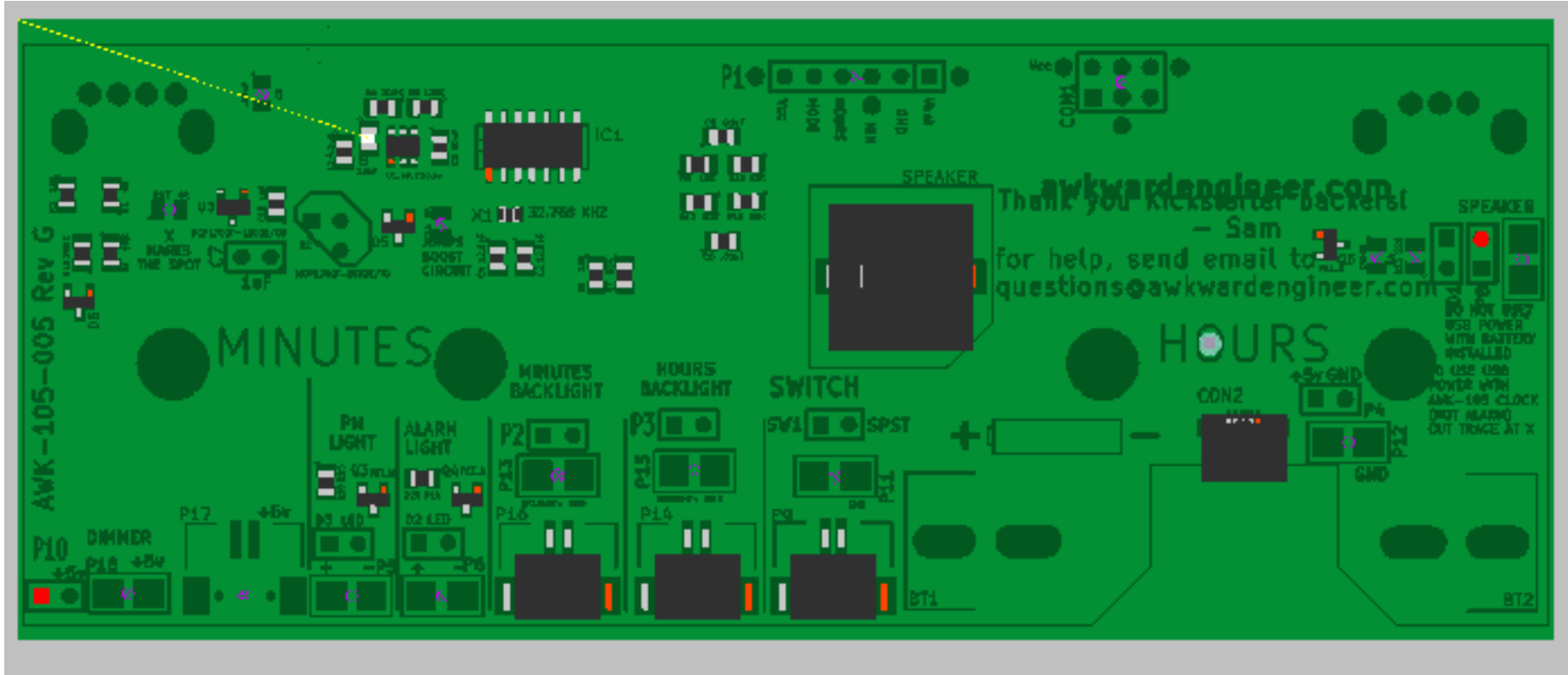
I hate people calling me.
I hate calling people.

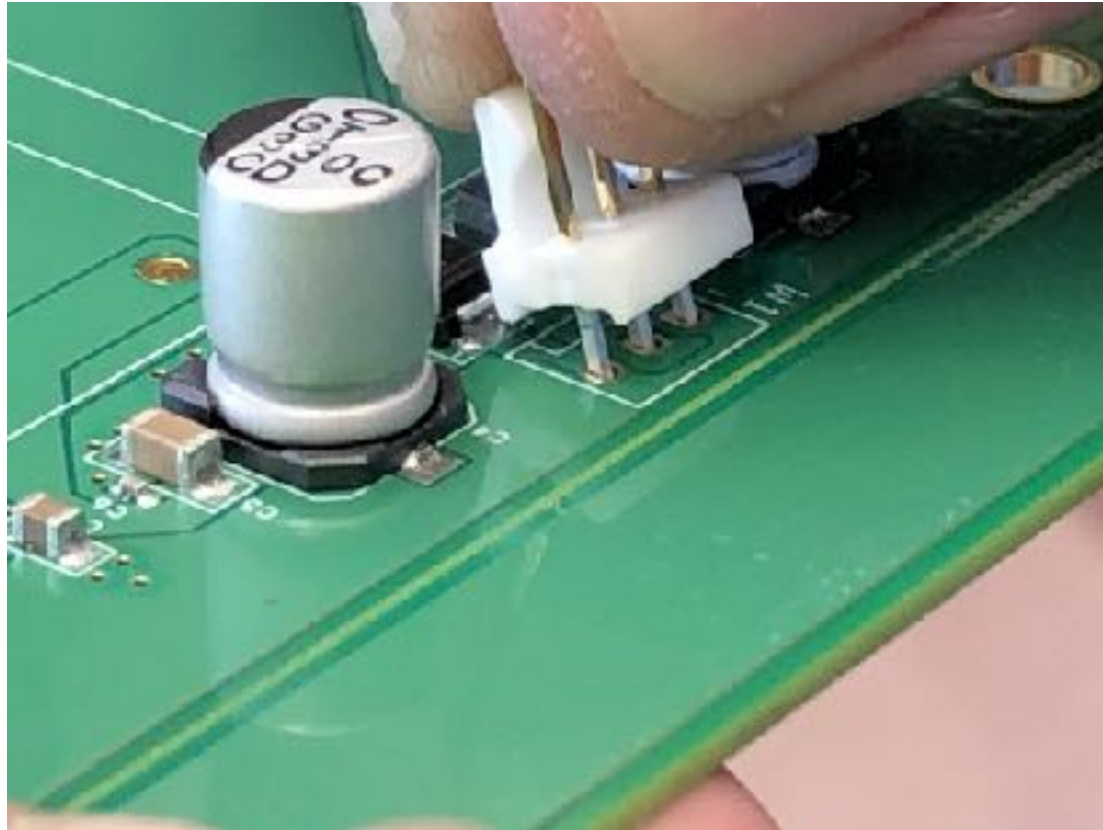




But machines build things!











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



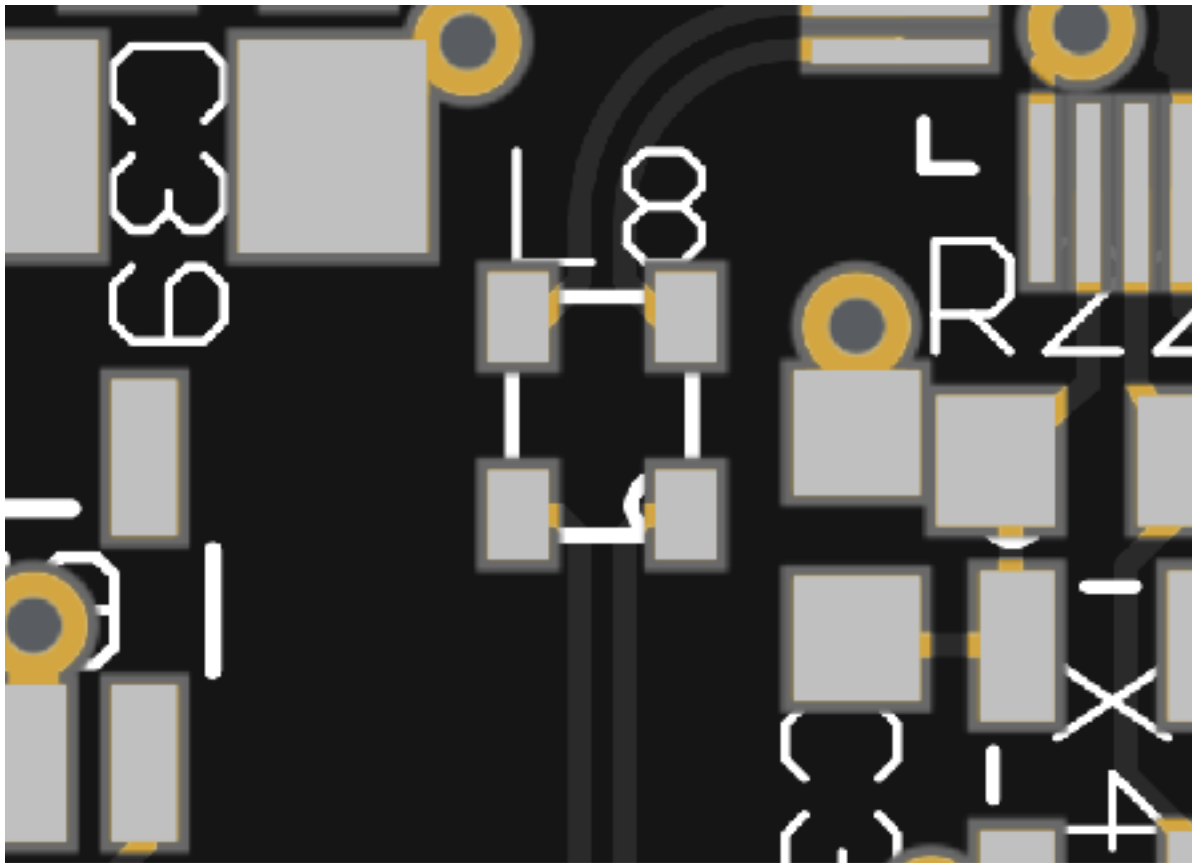
1. Identifying polarity of components
2. Silkscreen legibility
3. Panelization
4. PCB properties
5. Specific manufacturer's part numbers

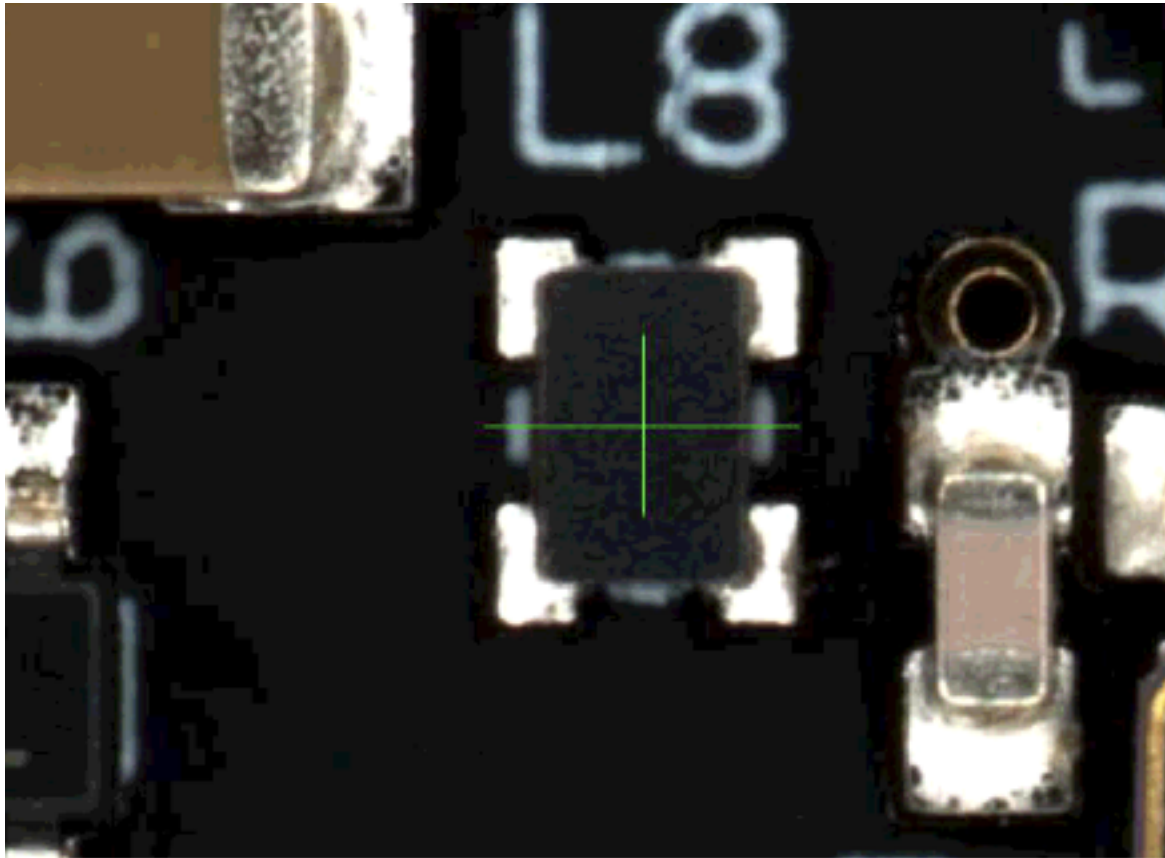


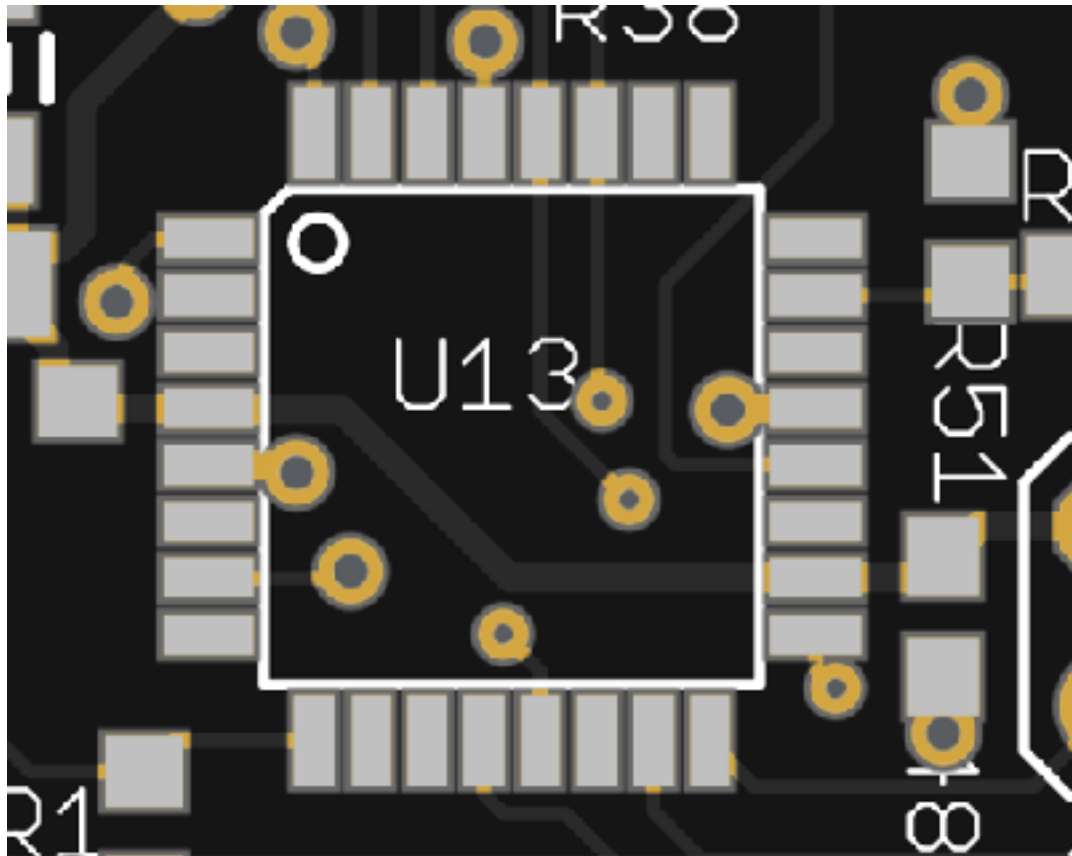
The number 1
problem

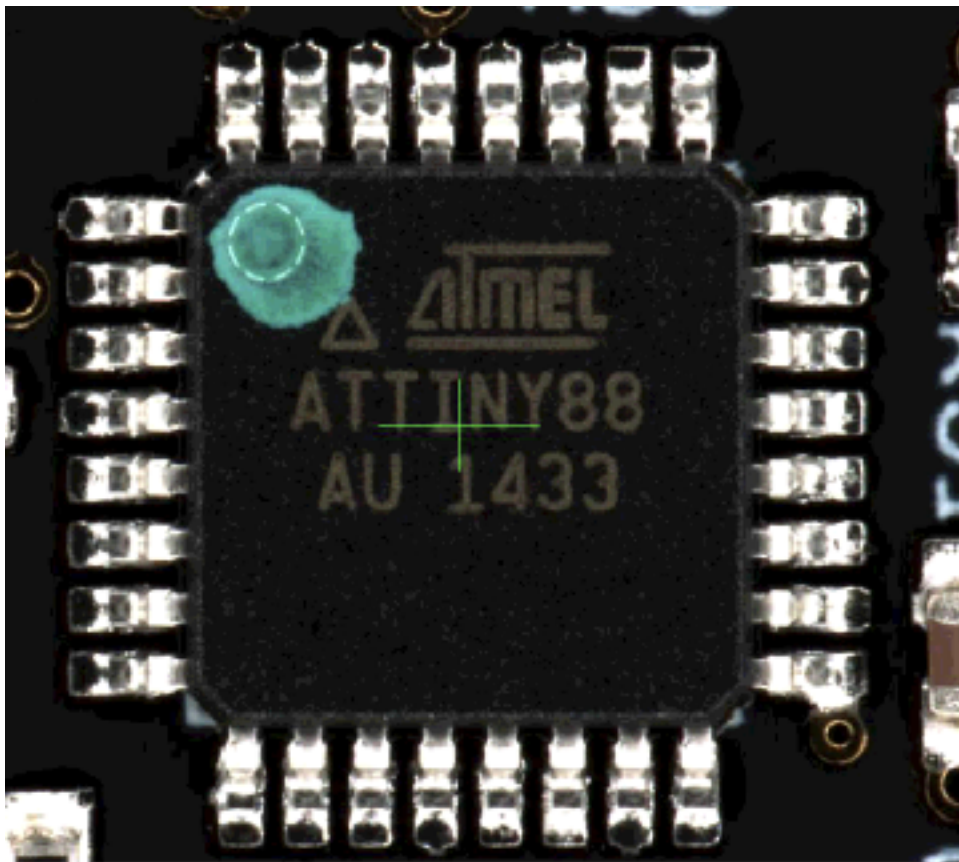


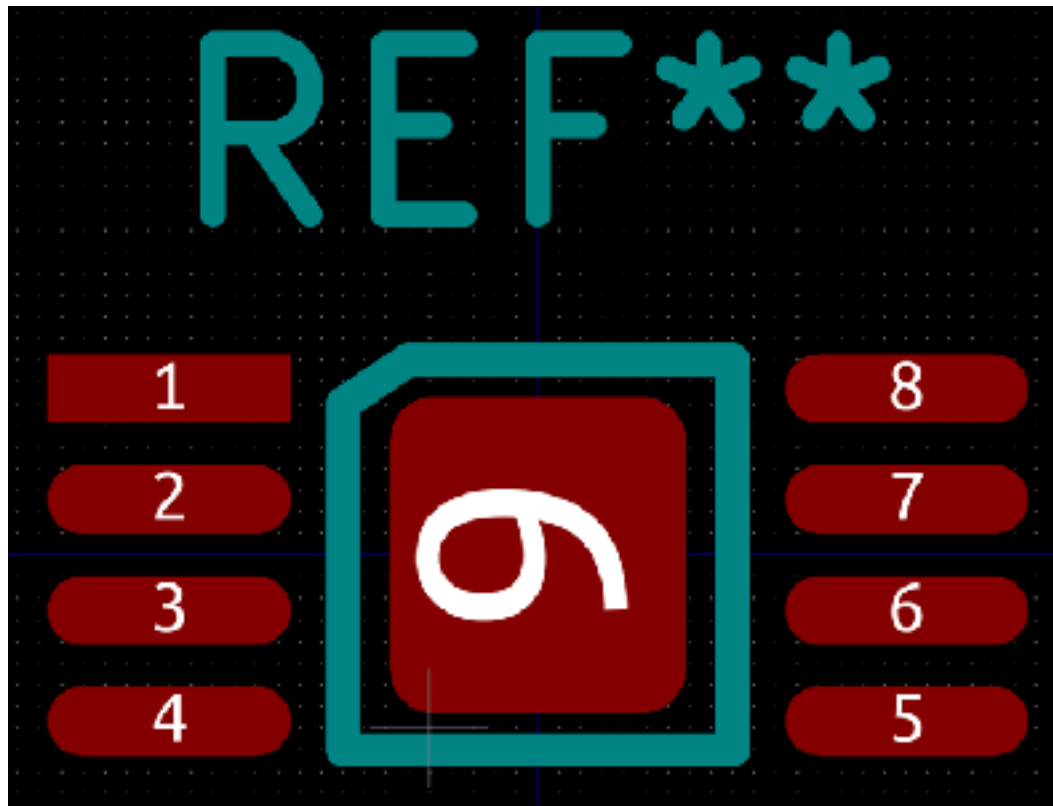
- Polarity of all IC's
 - What is this IC's reference designator?
 - Which pad is Pin 1
- Polarity of all diodes
- Polarity of all LED's
 - This LED here, what reference designator is it?
 - Which pad is the cathode?

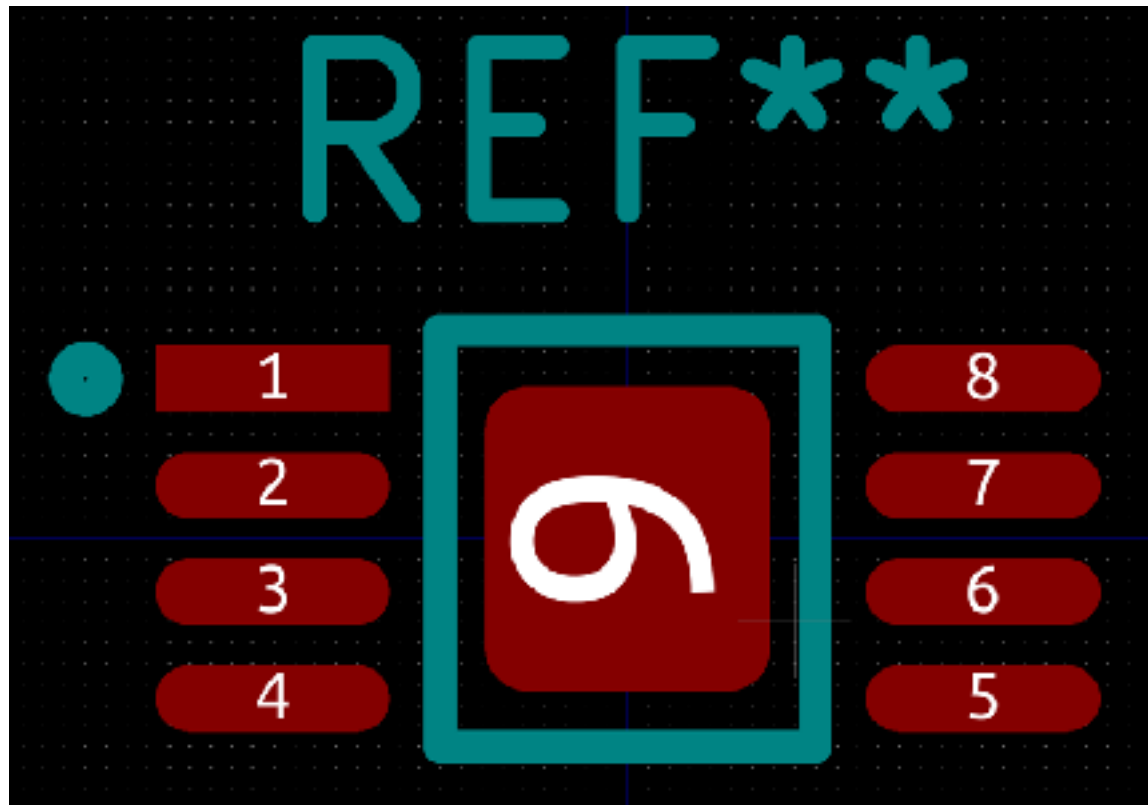


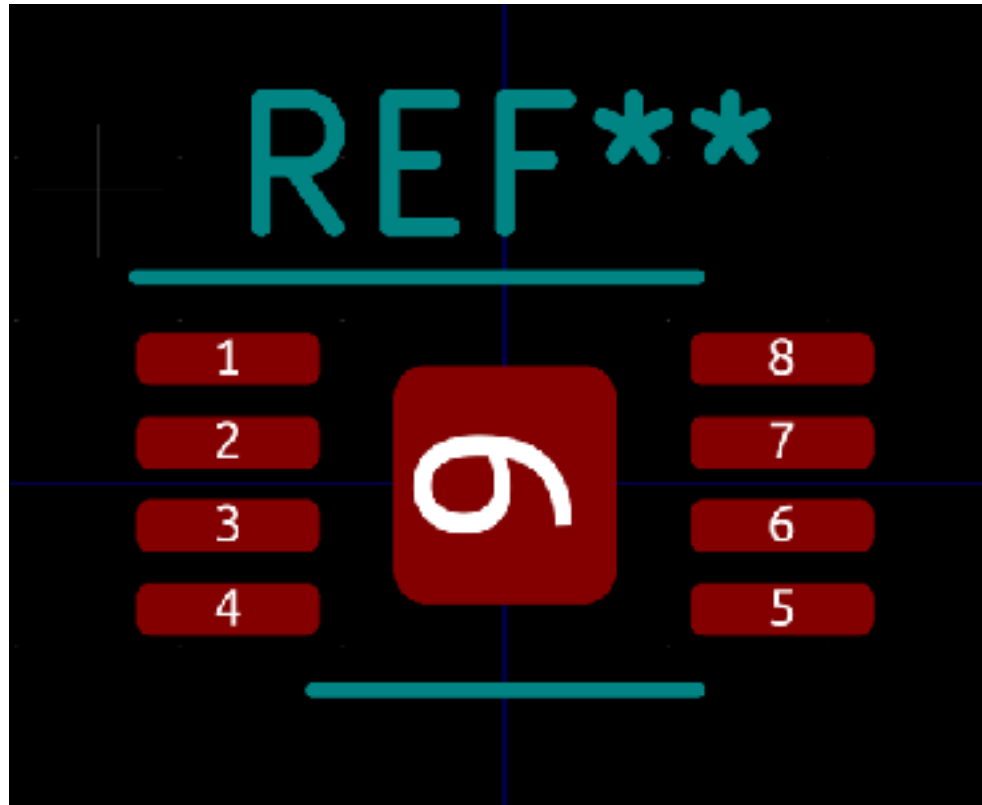


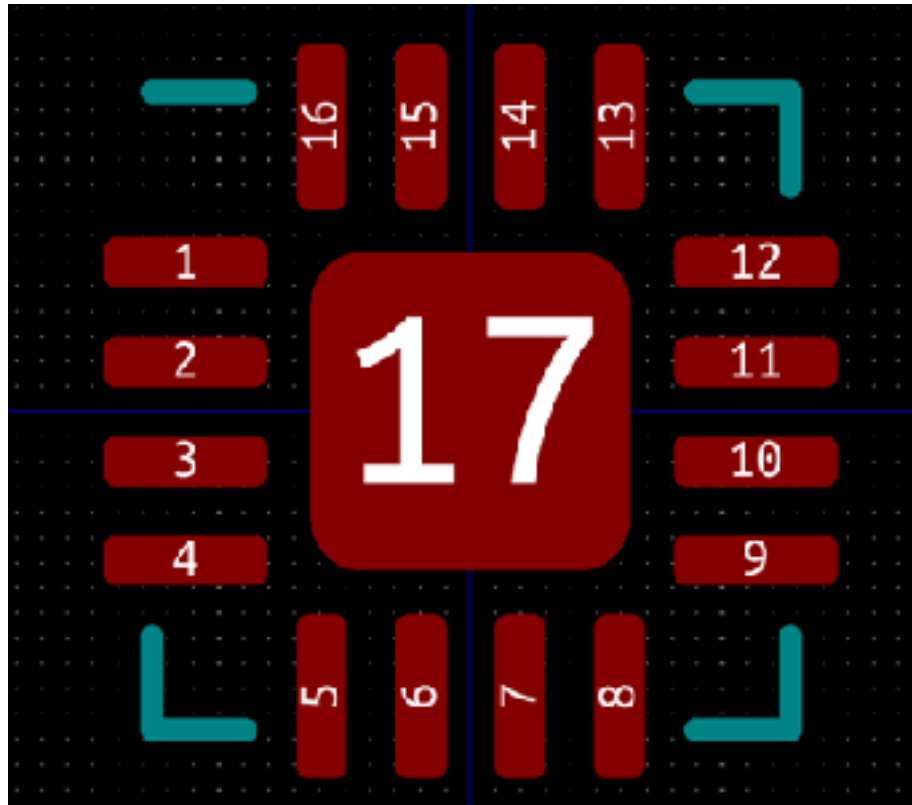


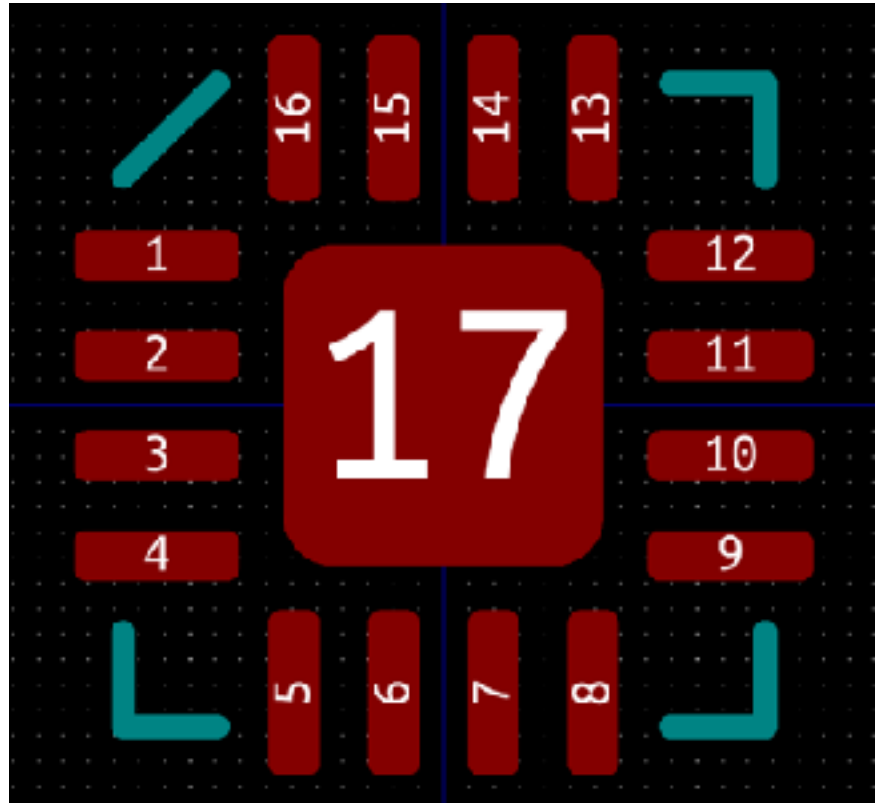


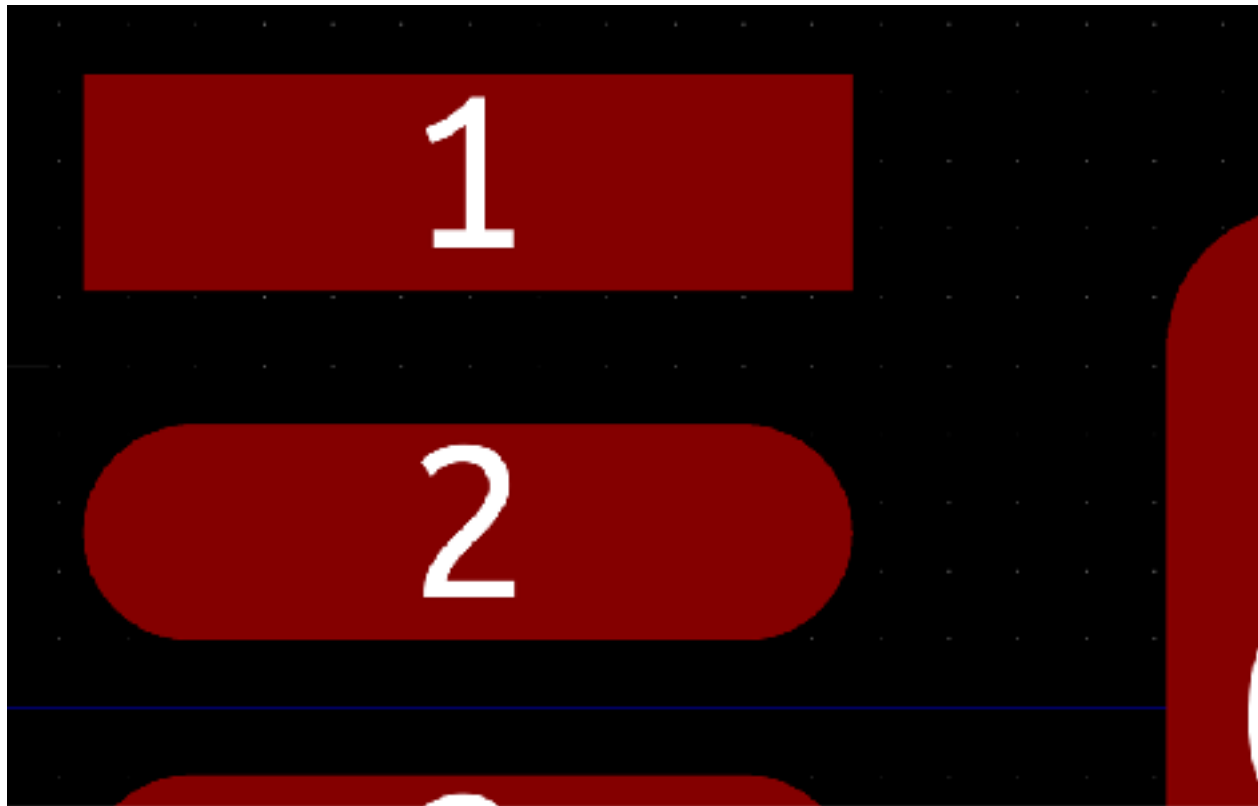


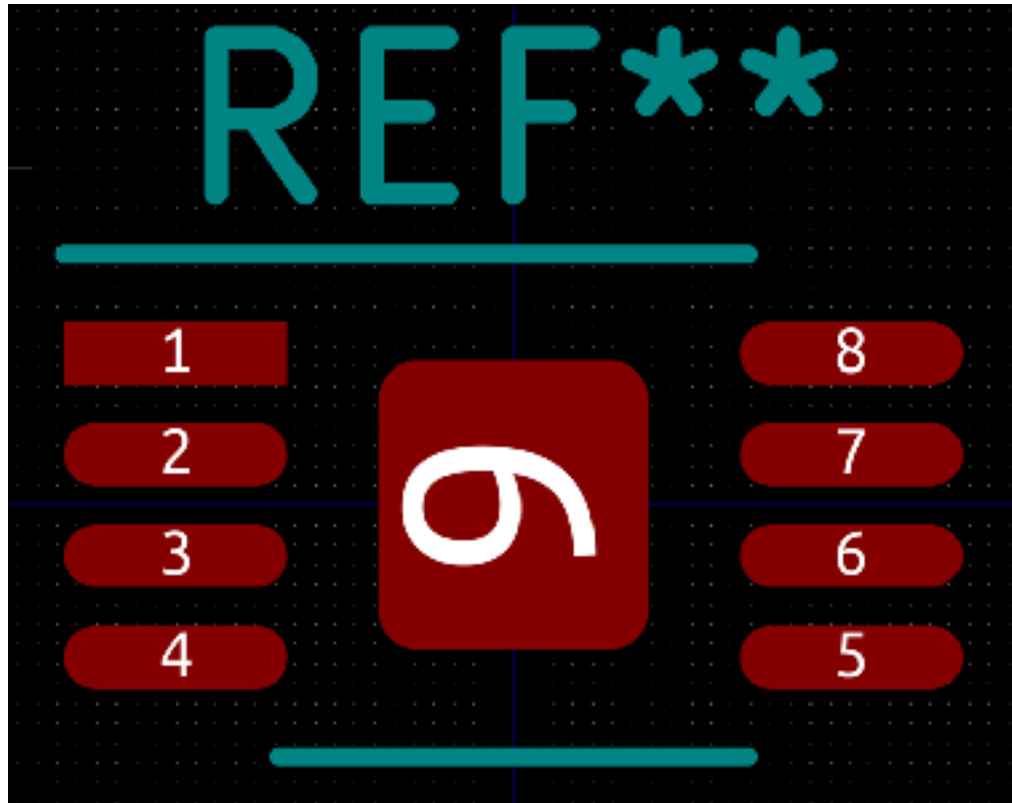


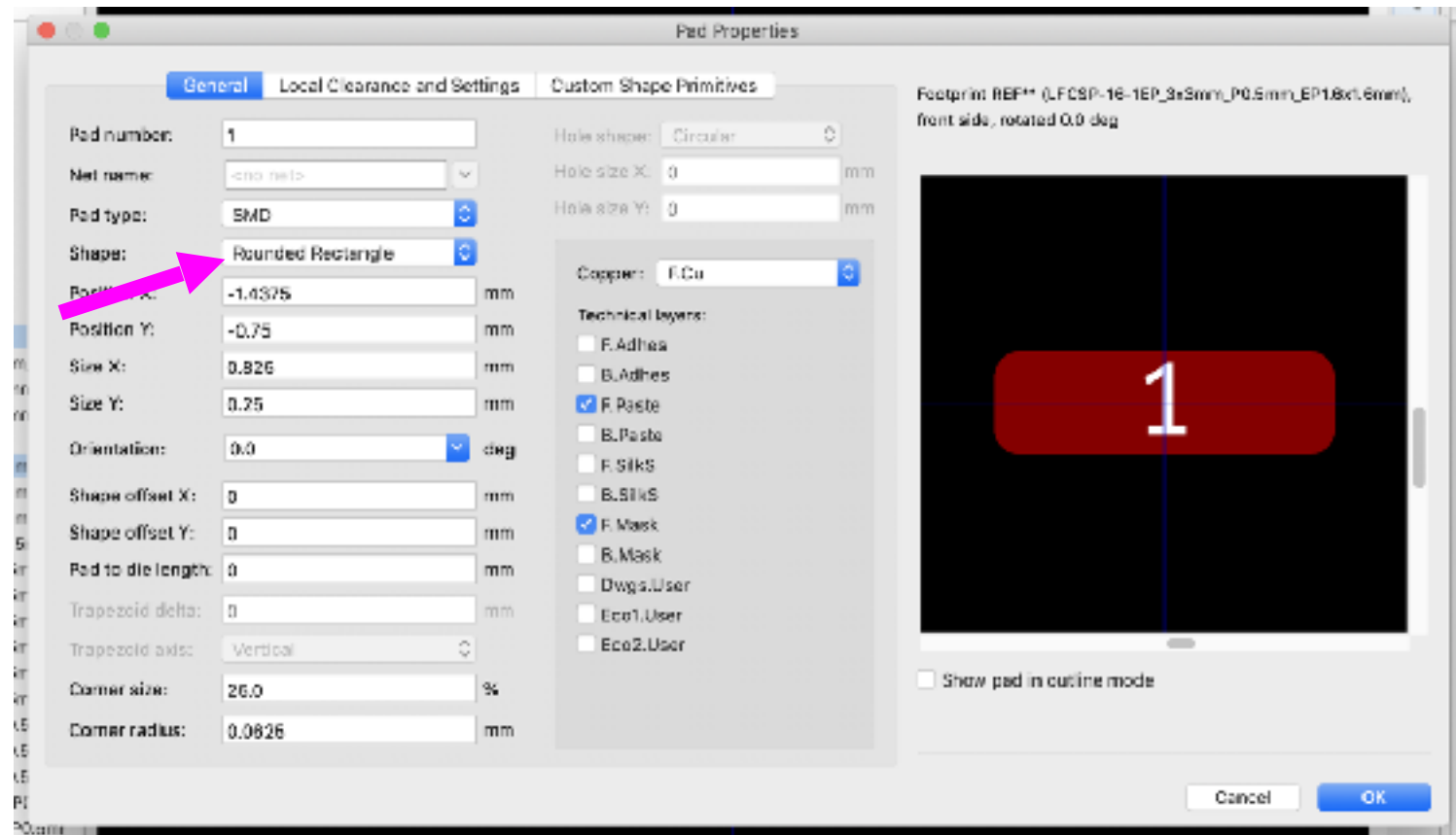


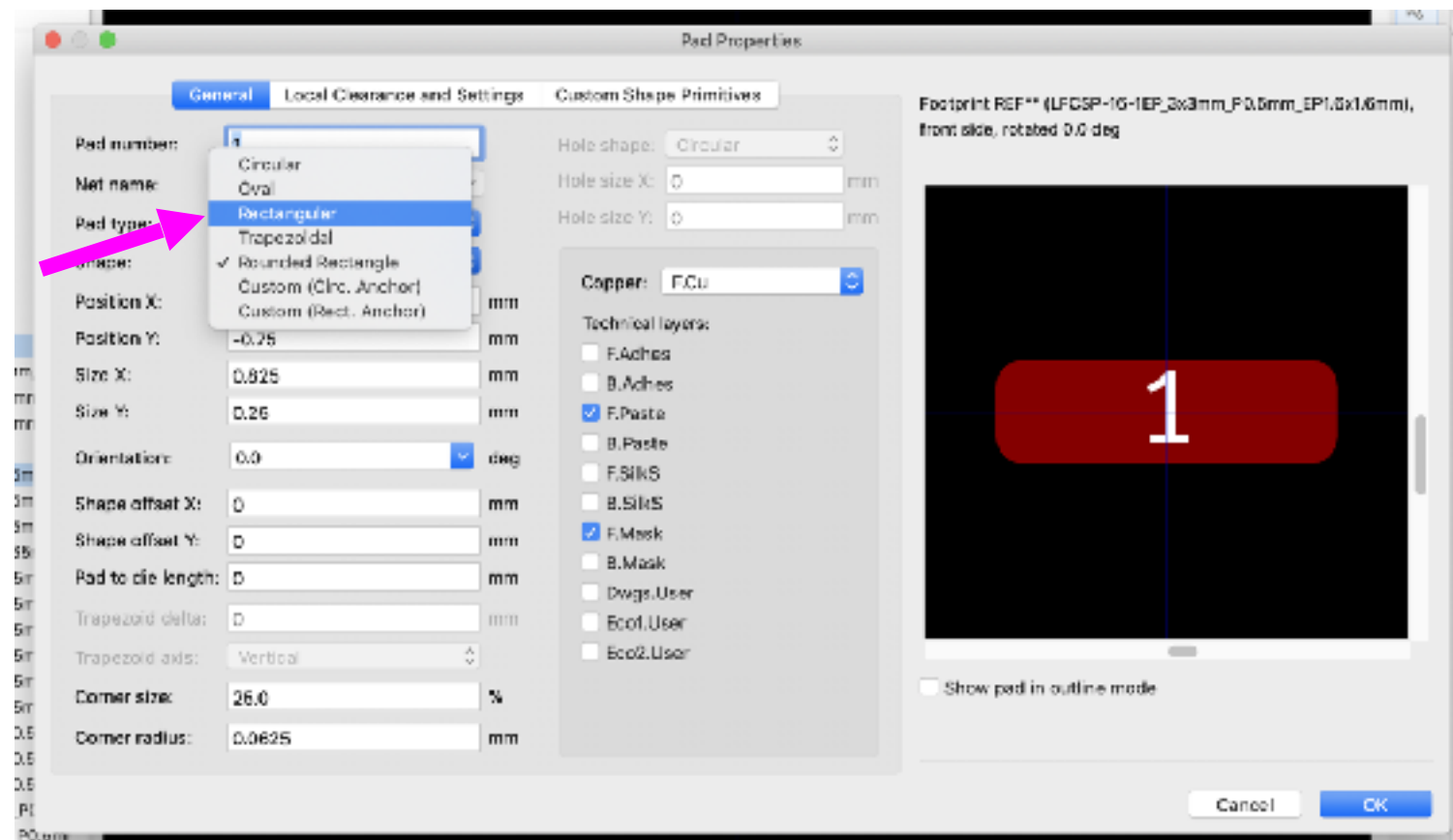


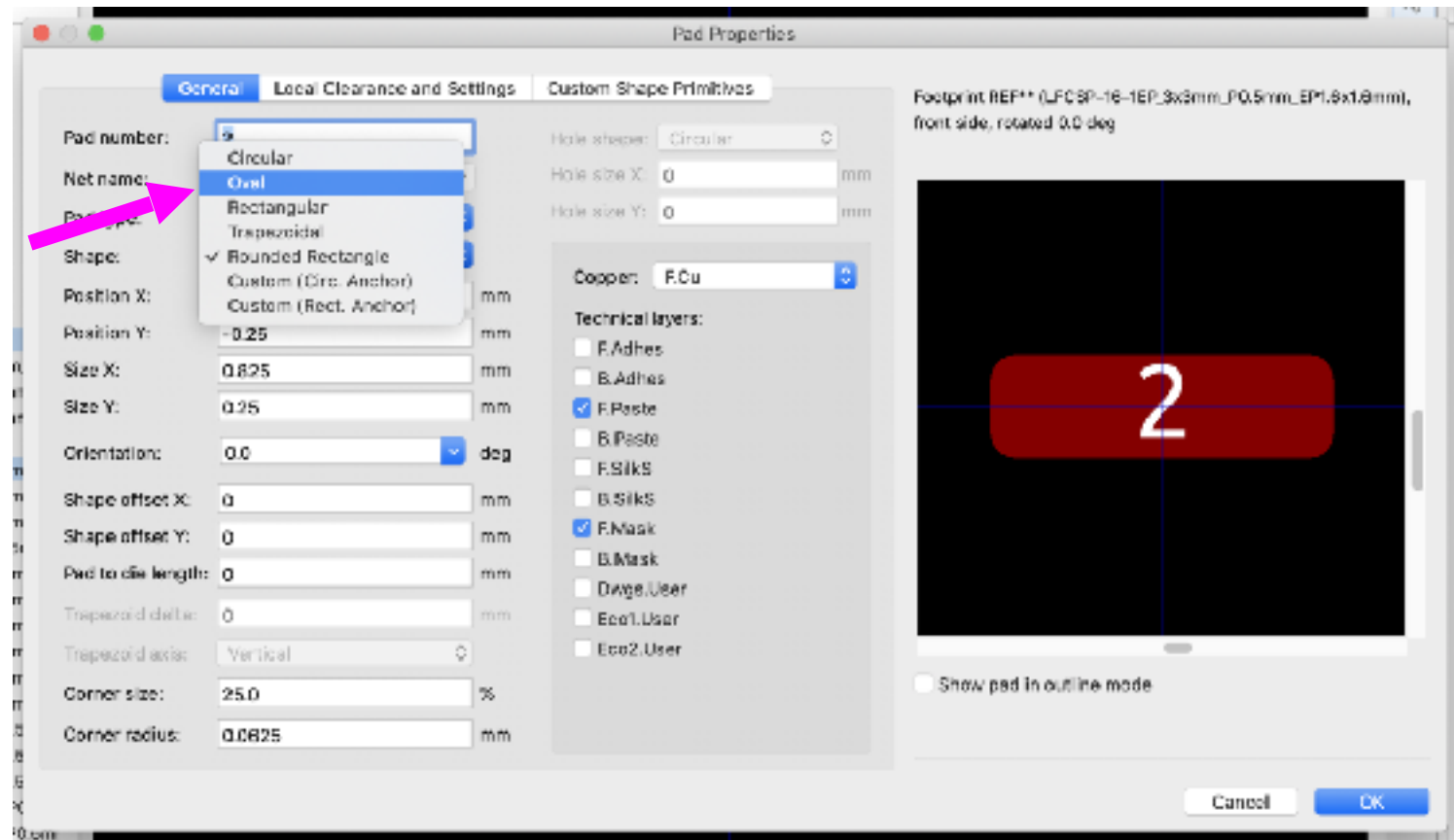


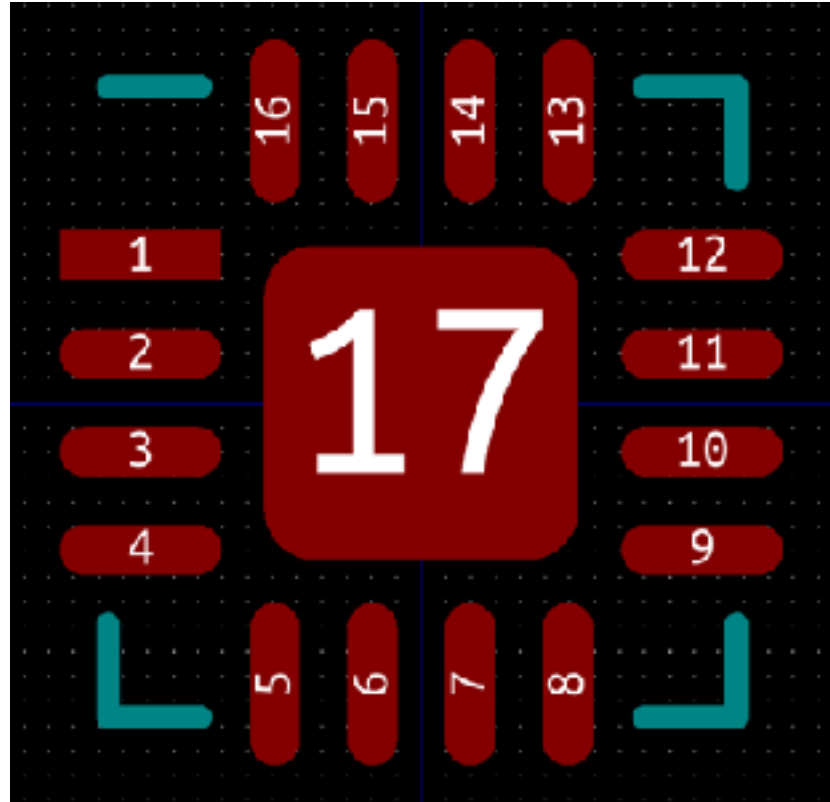


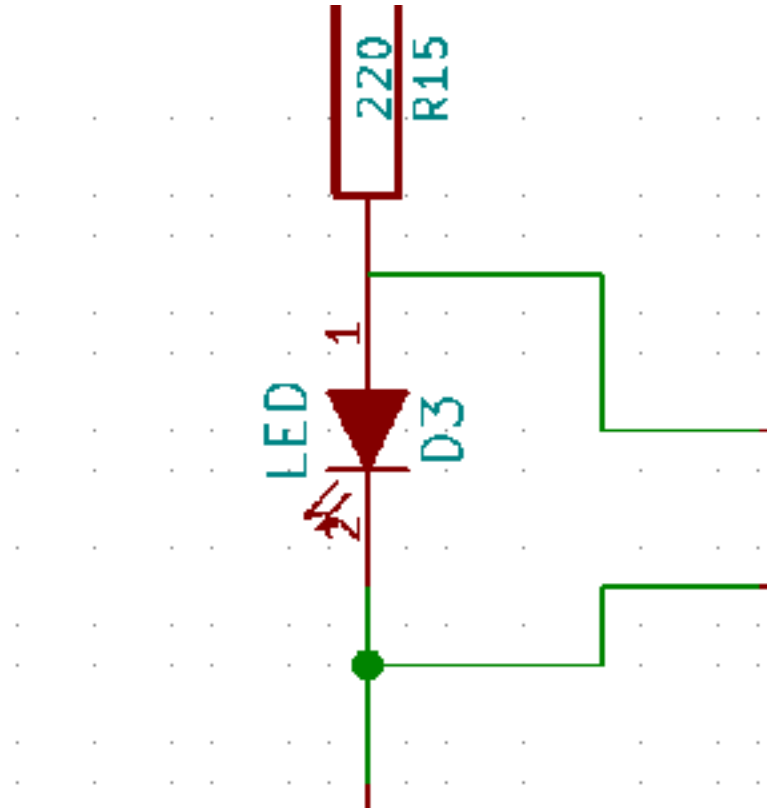


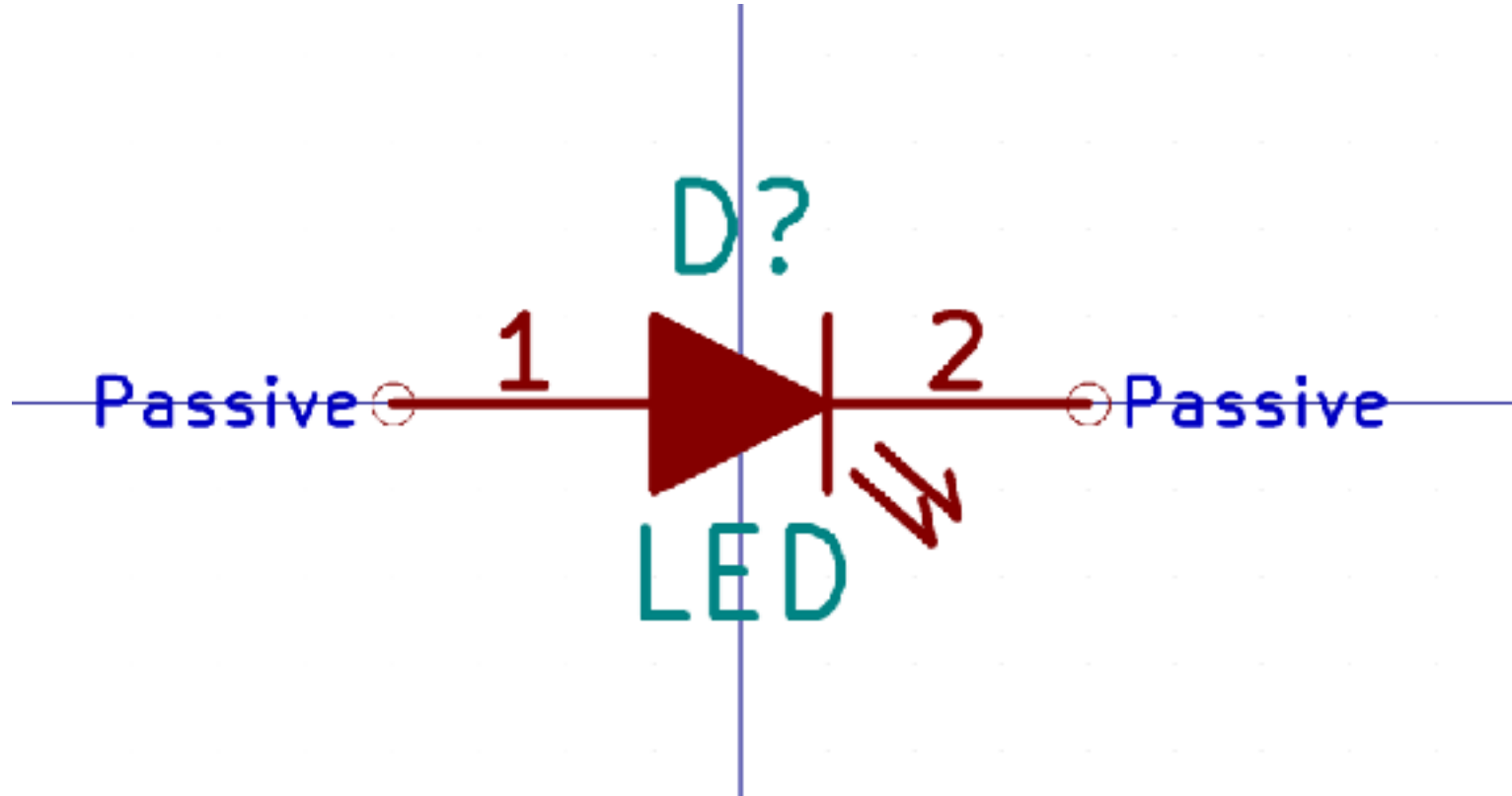


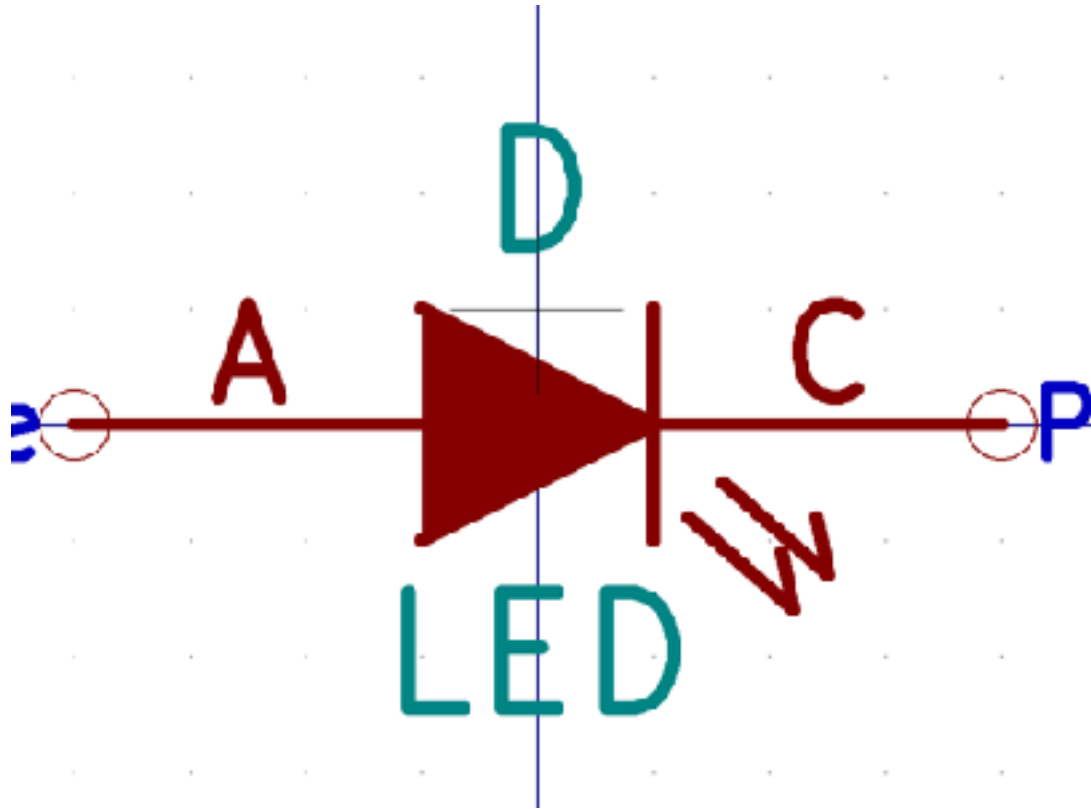













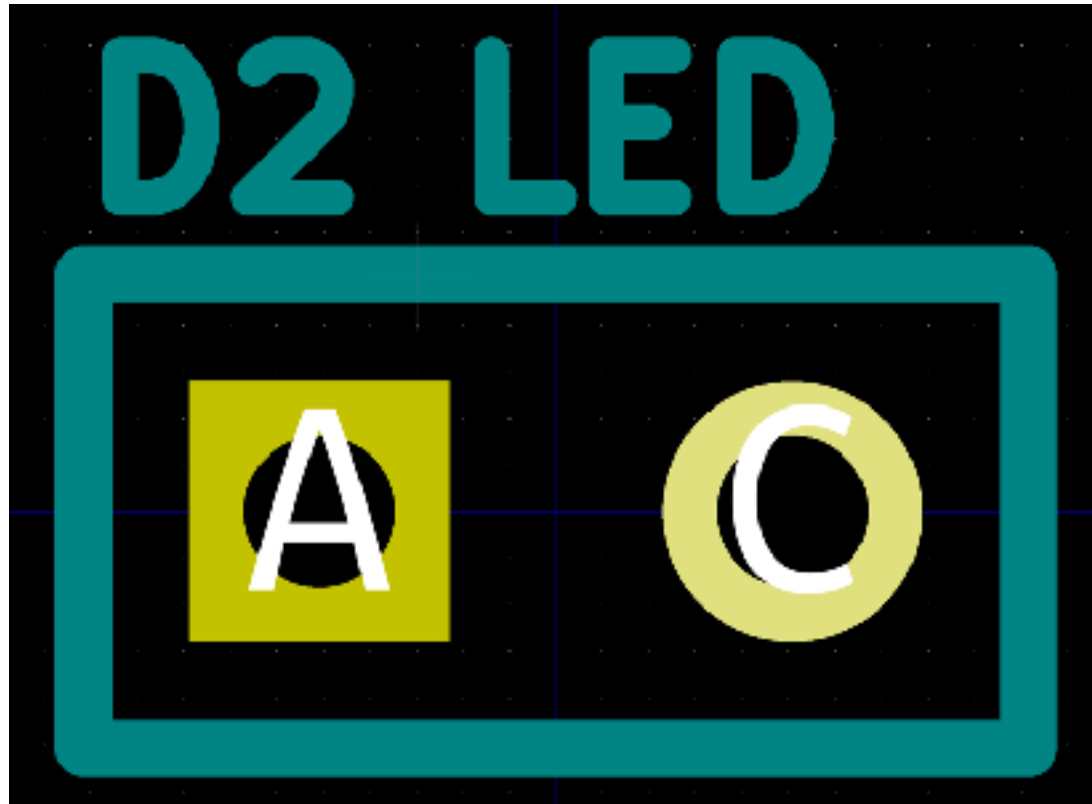


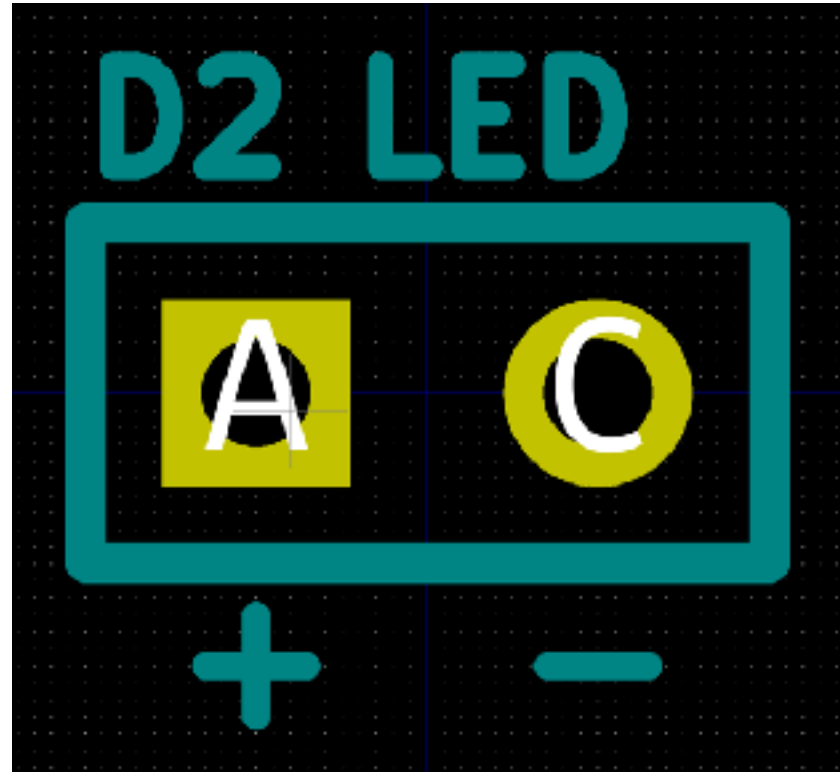
Pin Properties

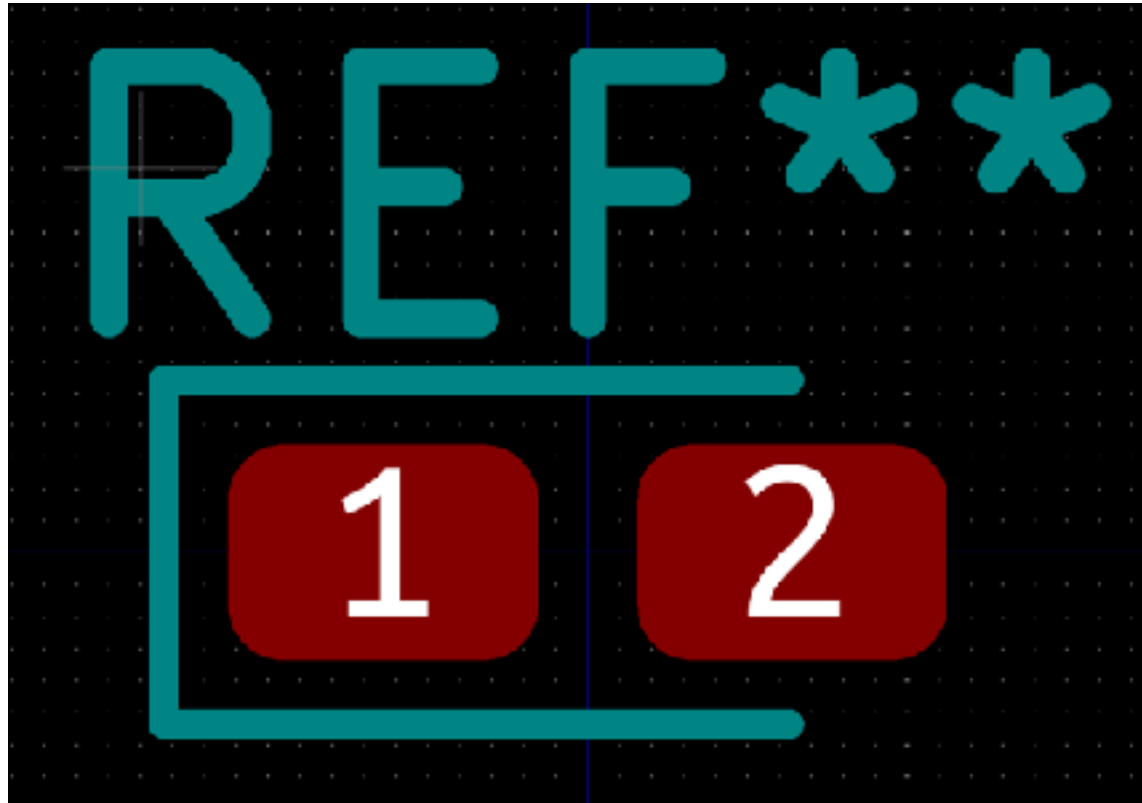
Pin name:	<input type="text" value="C"/>	<input type="checkbox"/> Common to all units in symbol
Pin number:	<input type="text" value="C"/>	<input type="checkbox"/> Common to all body styles (DeMorgan)
Electrical type:	<input type="text" value="H Passive"/>	<input checked="" type="checkbox"/> Visible
Graphic style:	<input type="text" value="Line"/>	
X position:	<input type="text" value="5.080"/> mm	
Y position:	<input type="text" value="0.000"/> mm	
Orientation:	<input type="text" value="Left"/>	
Pin length:	<input type="text" value="3.810"/> mm	
Name text size:	<input type="text" value="1.016"/> mm	
Number text size:	<input type="text" value="1.016"/> mm	

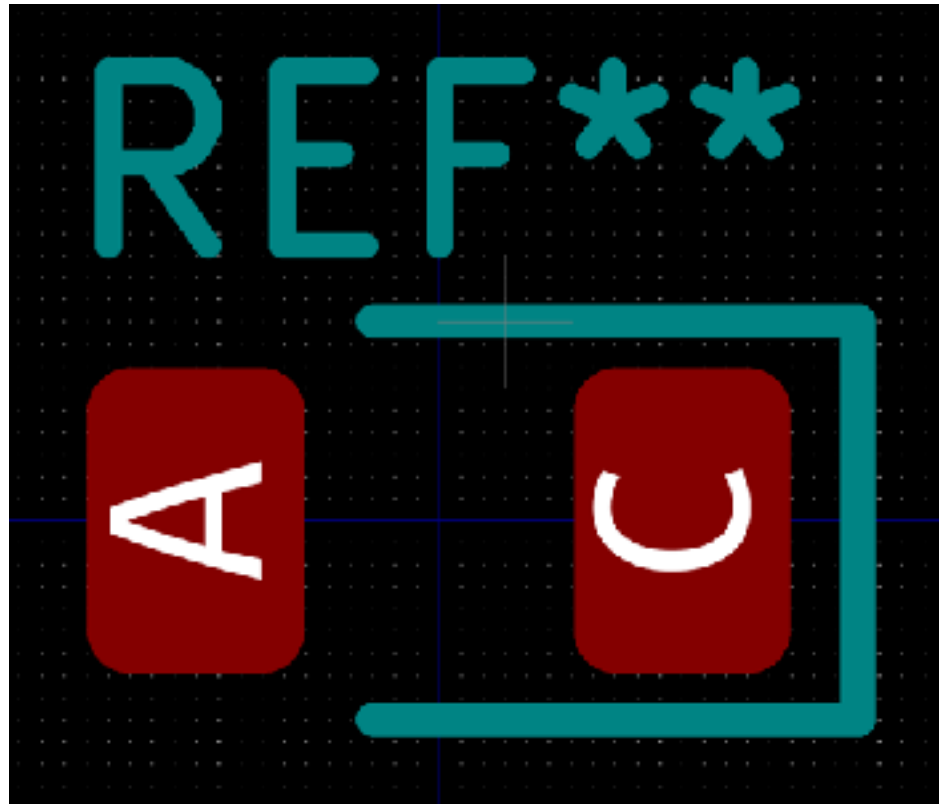


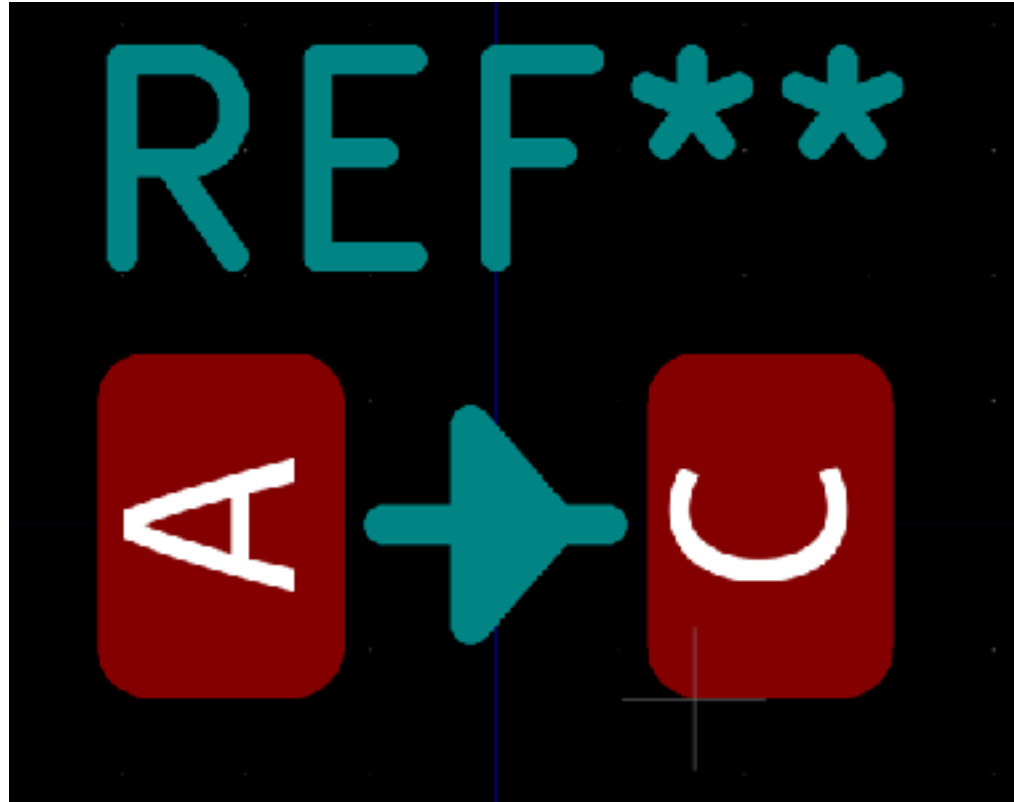
Cancel OK

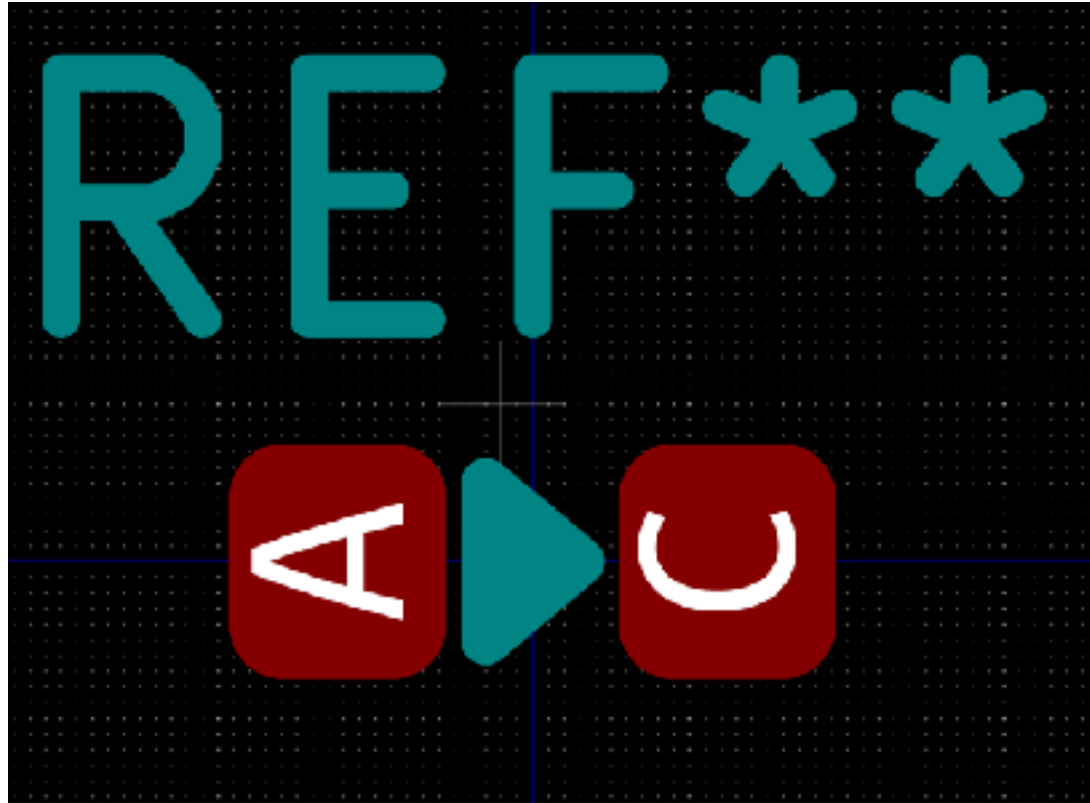










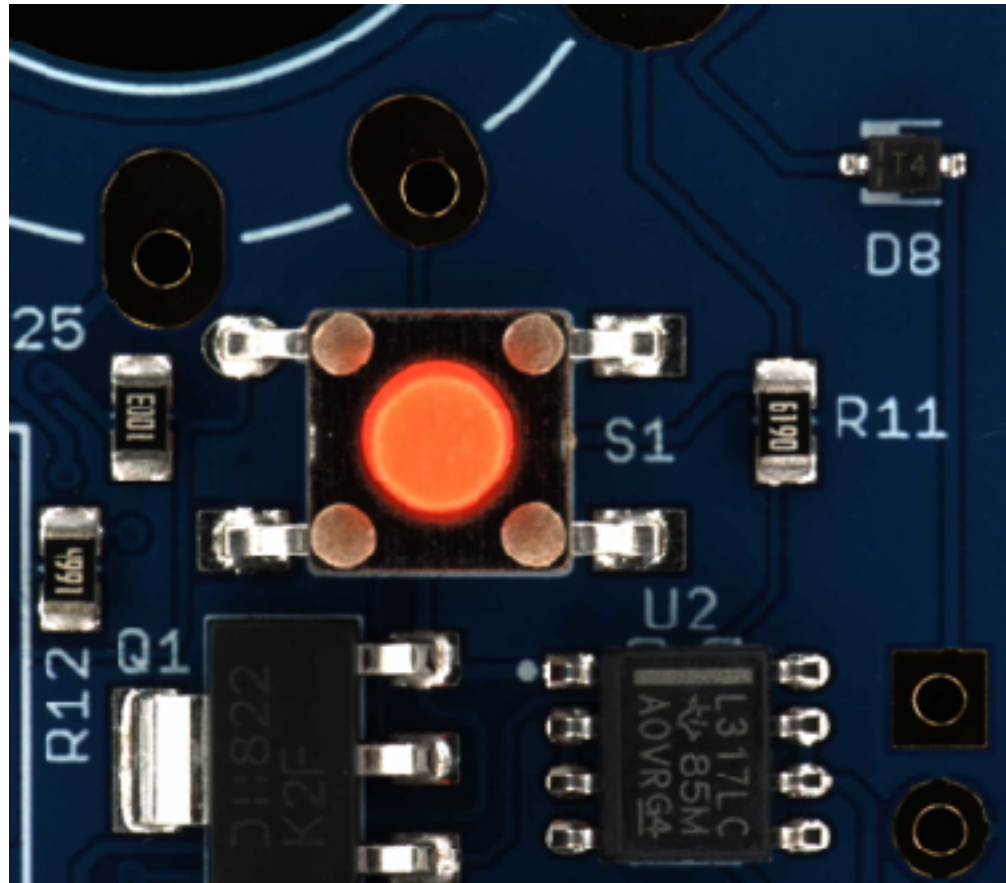




1. Silkscreen pin 1 indicators
 - a. Move them out from underneath the placed part
 - b. Square pad for Pin 1 on IC's
2. LED cathode indicators
 - a. Use a C in pin naming scheme
 - b. Use symbol in silkscreen
 - c. Use + and - symbols in silkscreen
 - d. Thru-hole: Square pad for Anode. Circle for Cathode



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





Not minimums



Not maximum



Cozy





R2  Cozy Text Height 1mm

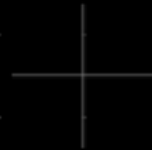




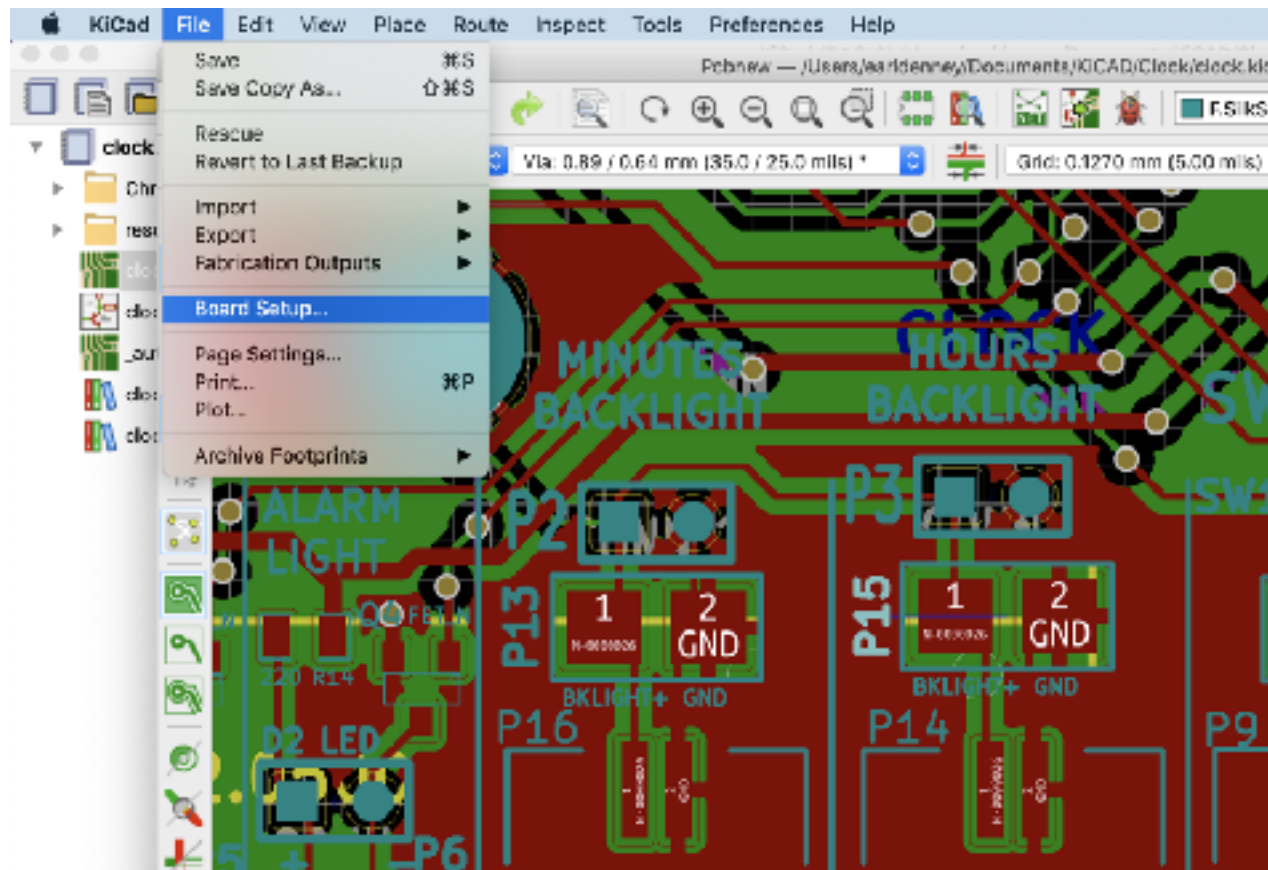
R2

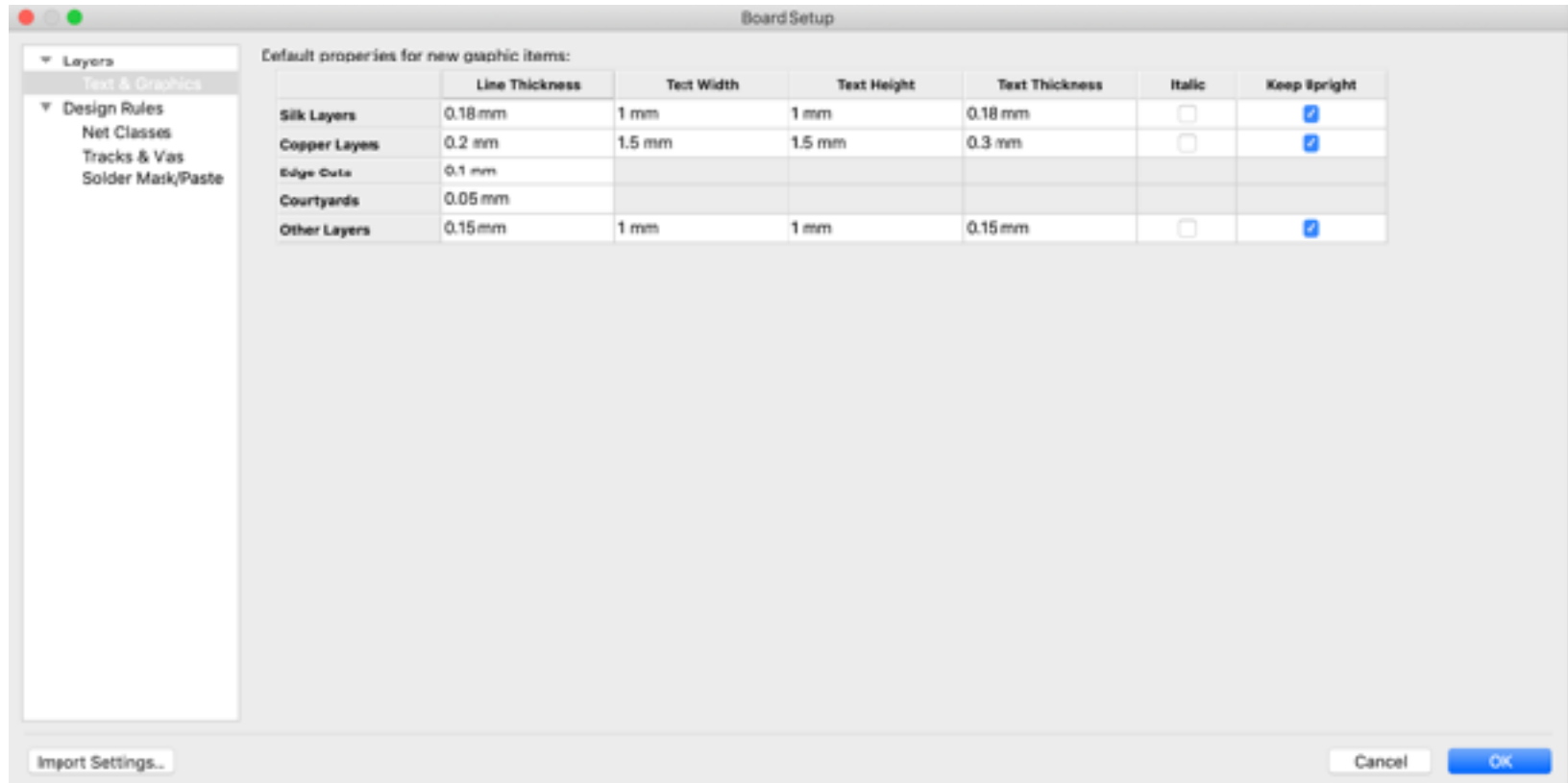


Cozy Text Width 1mm





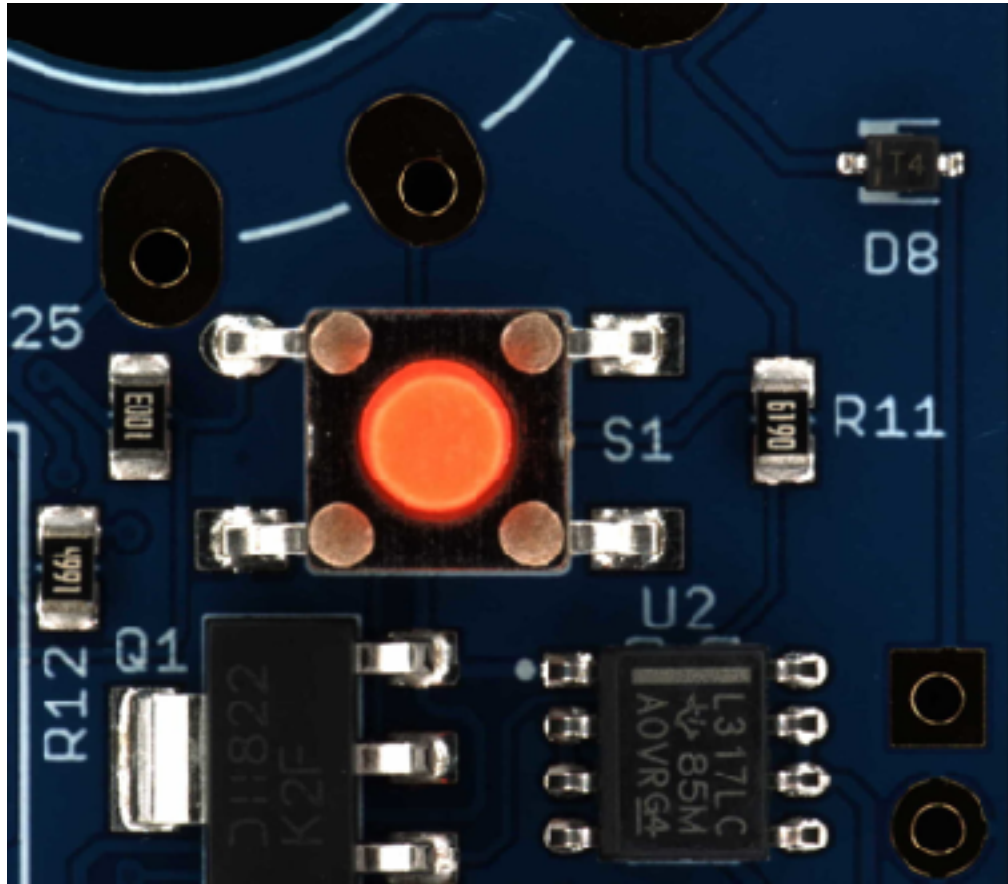


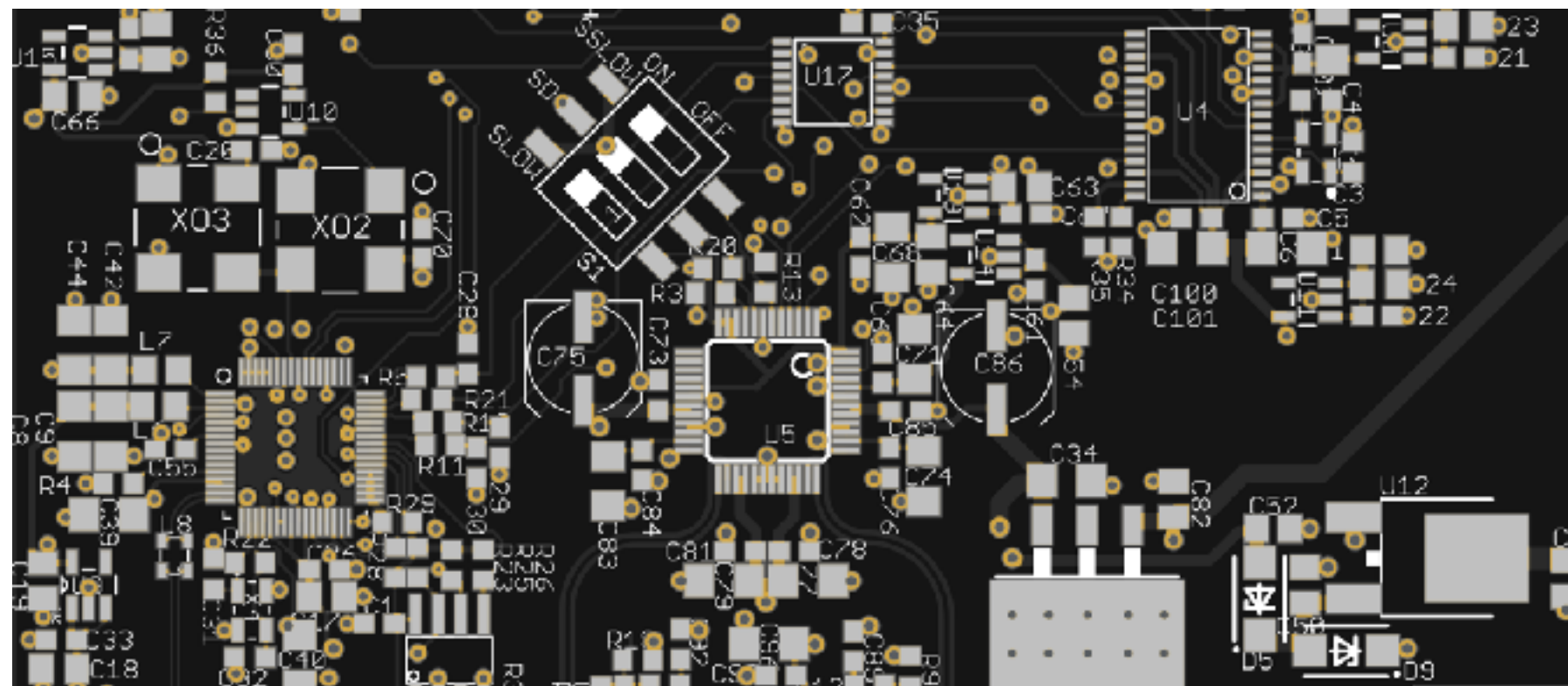


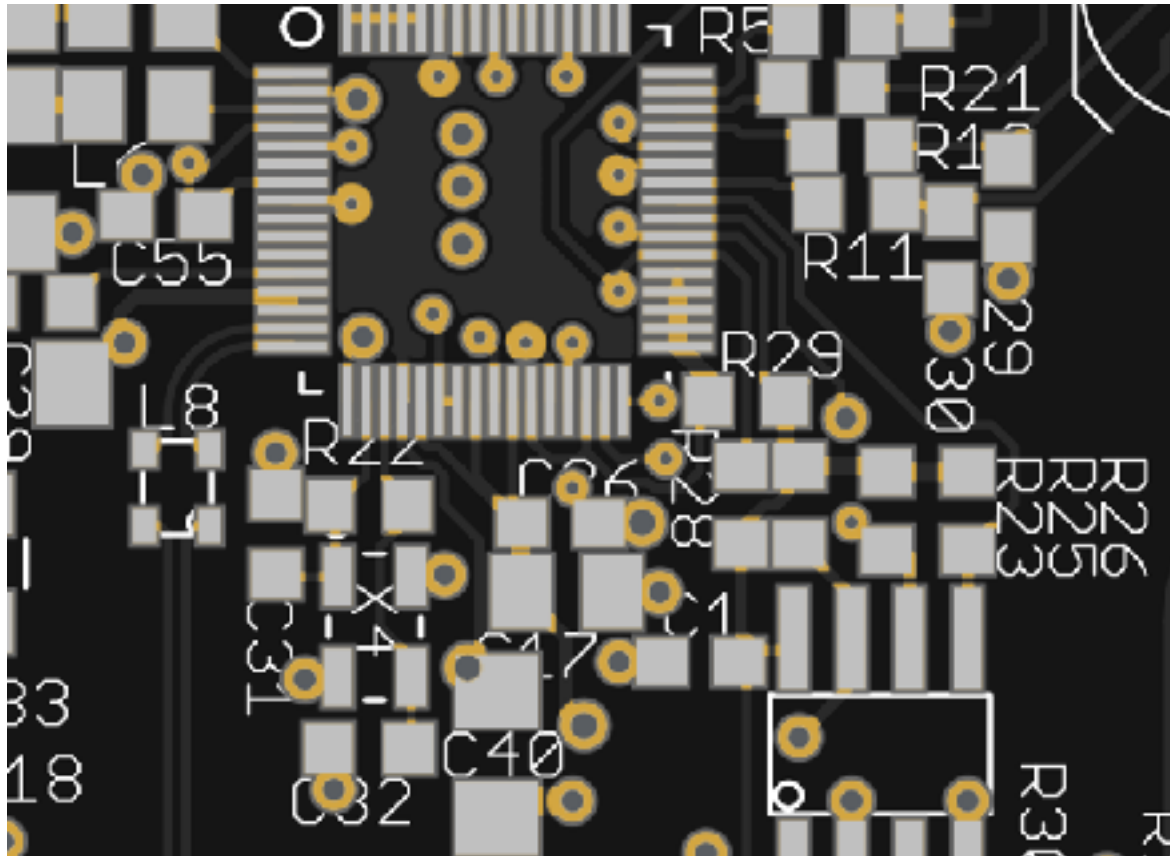


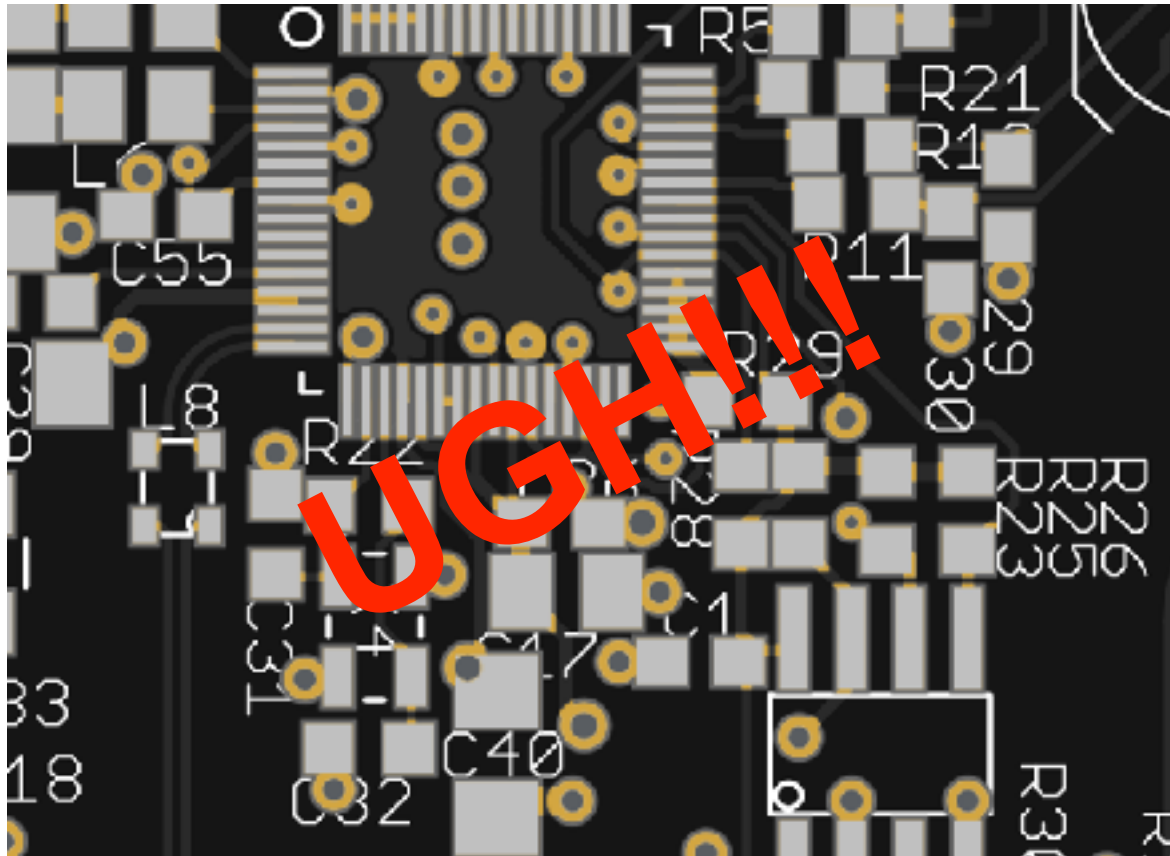
Default properties for new graphic items:

	Line Thickness	Text Width	Text Height	Text Thickness	Italic	Keep Upright
Silk Layers	0.18 mm	1 mm	1 mm	0.18 mm	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Copper Layers	0.2 mm	1.6 mm	1.6 mm	0.3 mm	<input type="checkbox"/>	<input checked="" type="checkbox"/>

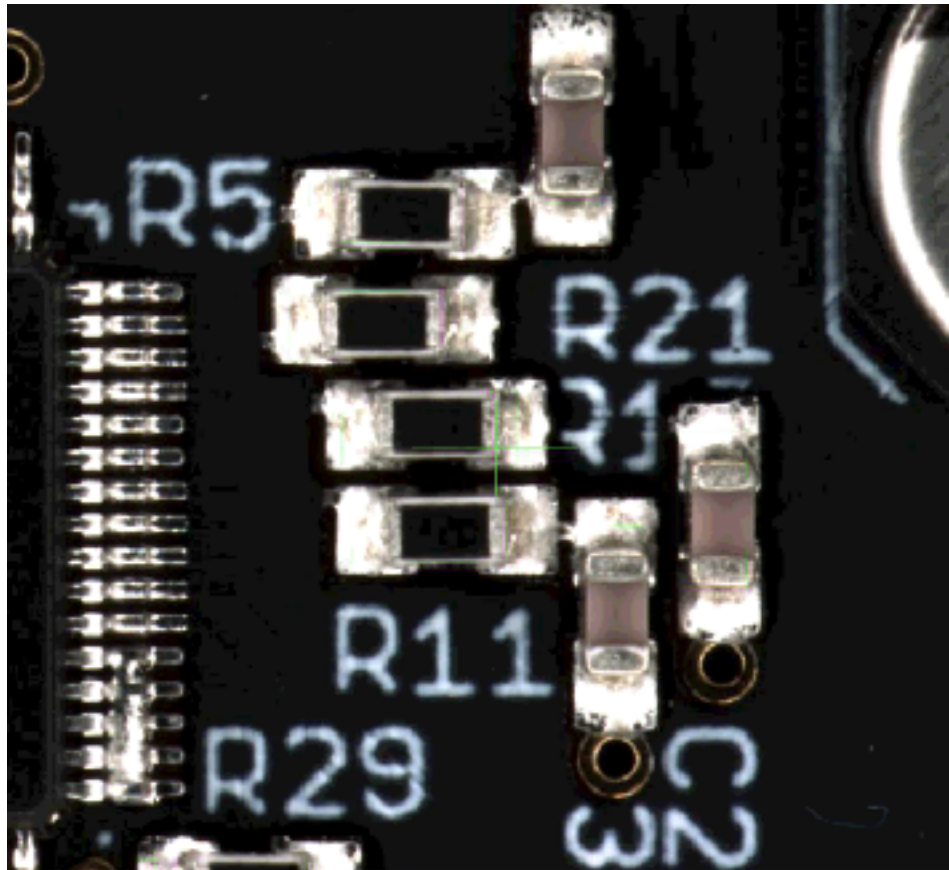


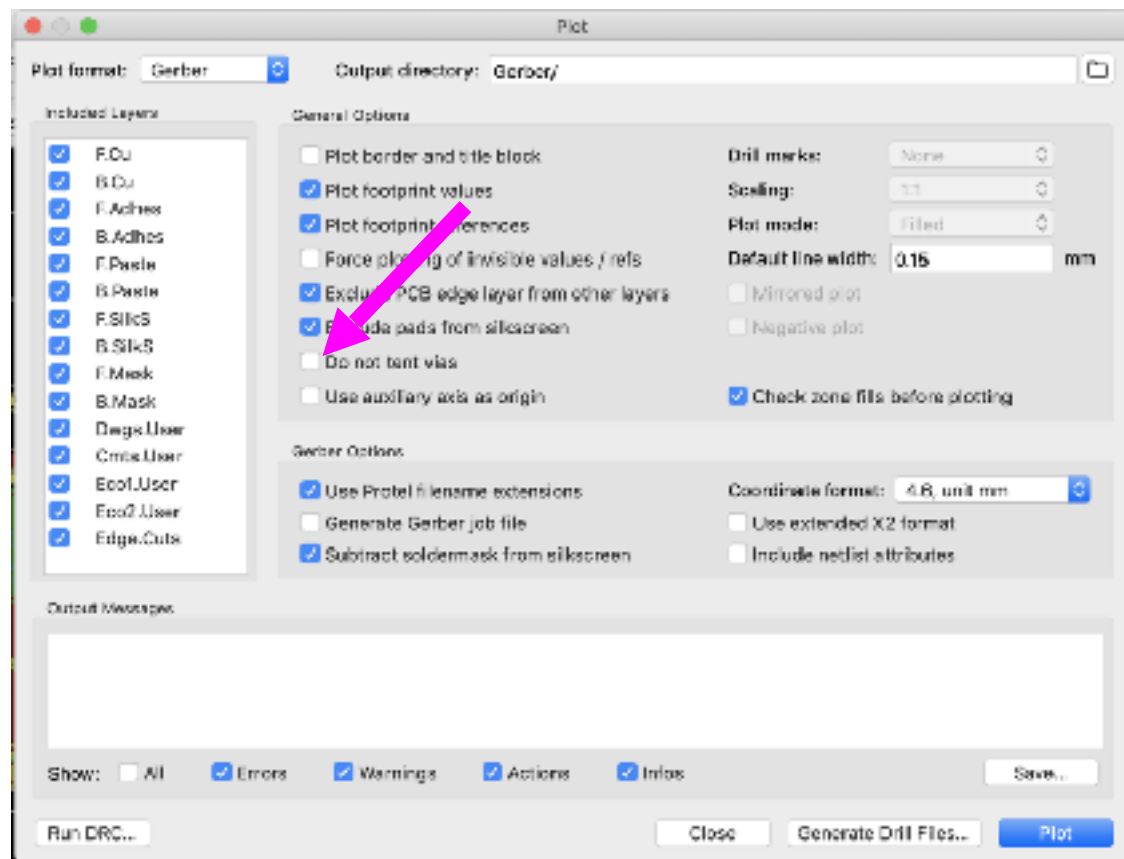


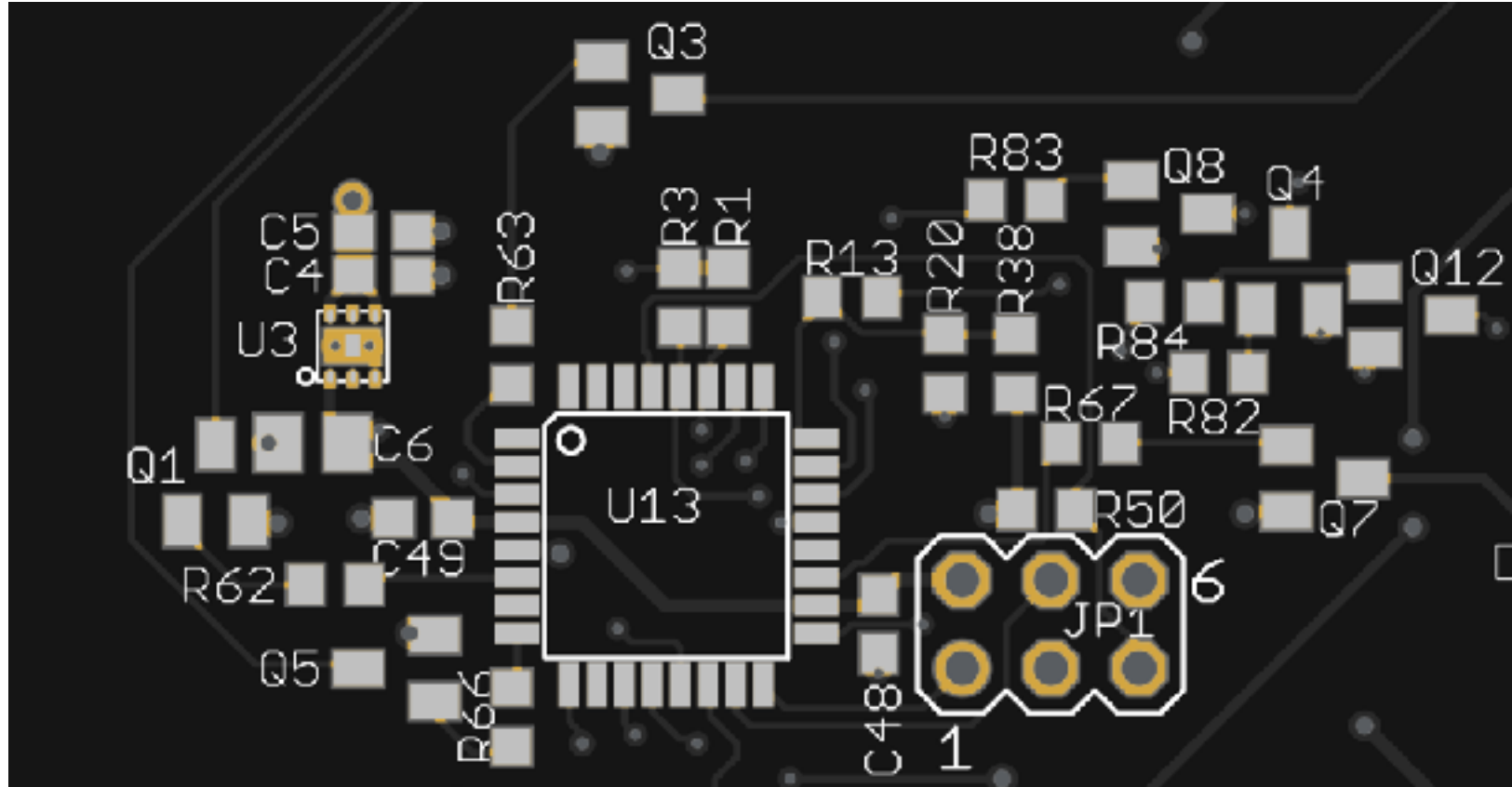


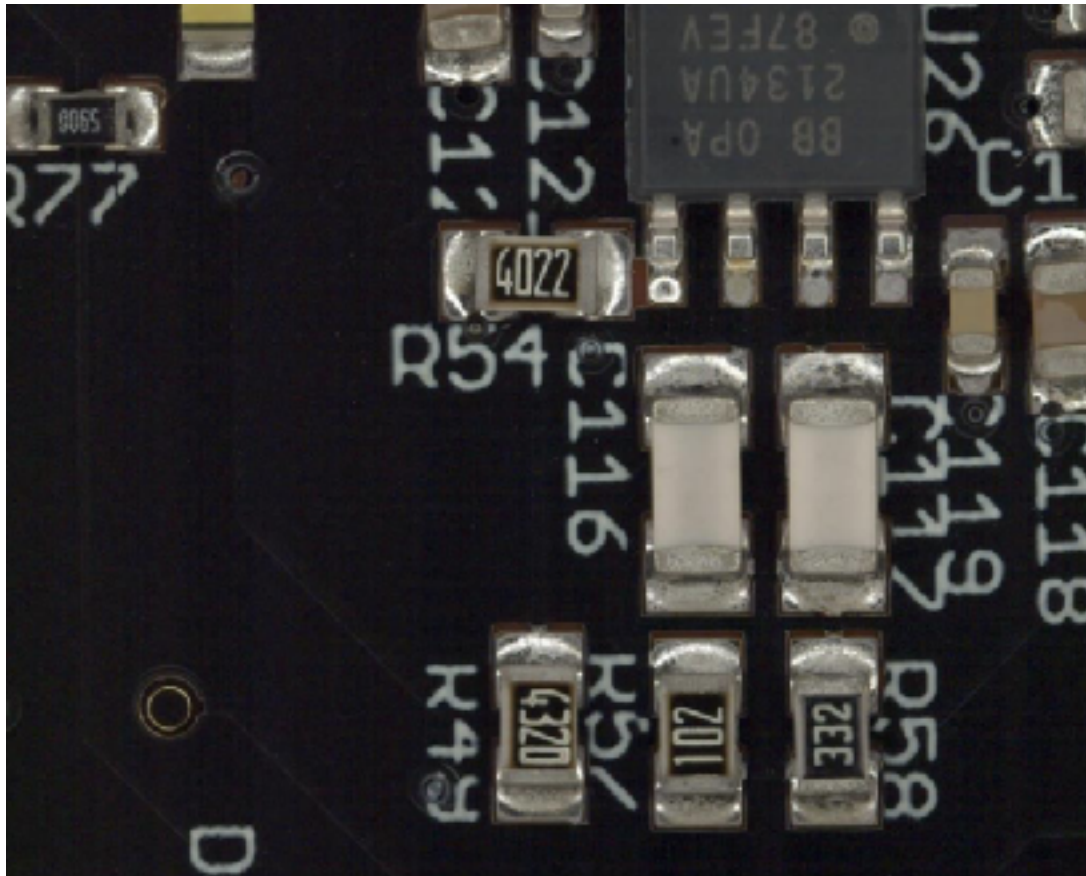












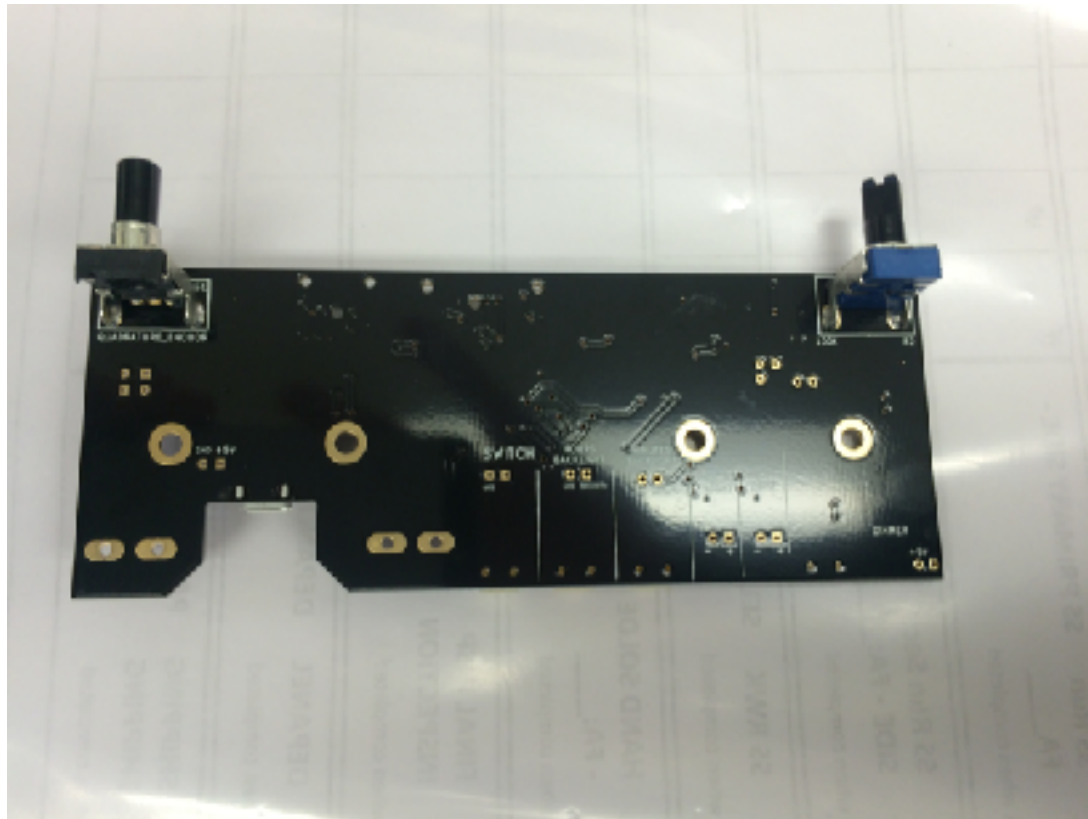


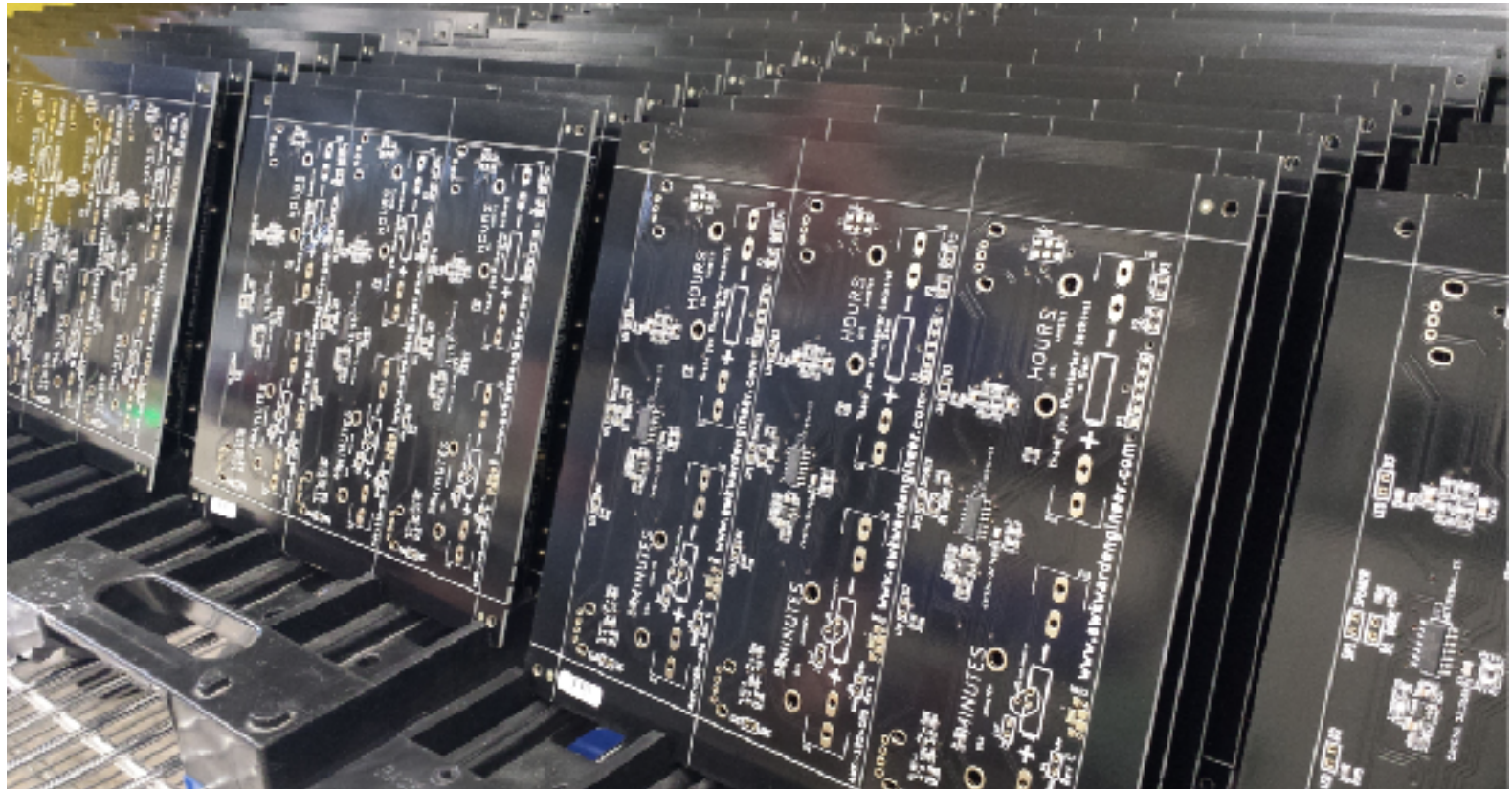


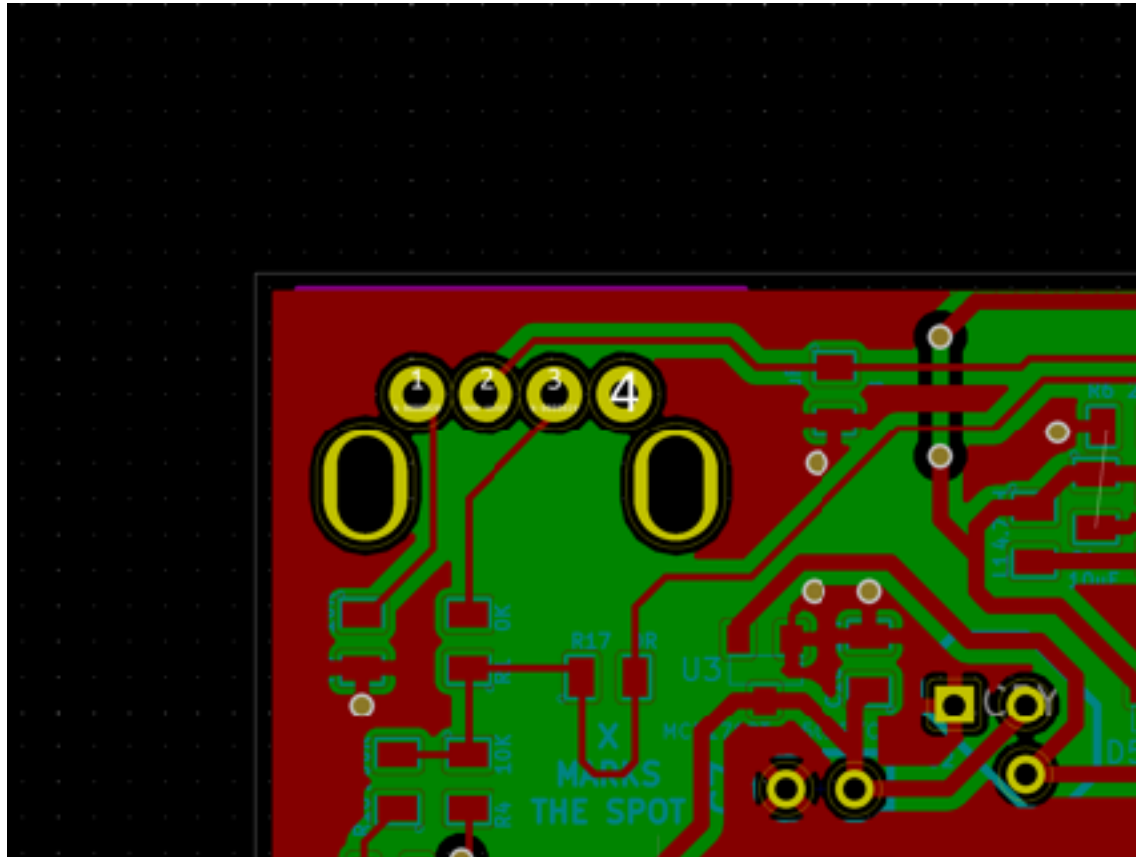
1. Cozy Text: 1x1mm characters and 0.18mm line width
2. Move silkscreen away from pads, holes, and vias
3. Tent vias to print on top of vias - but only if you must

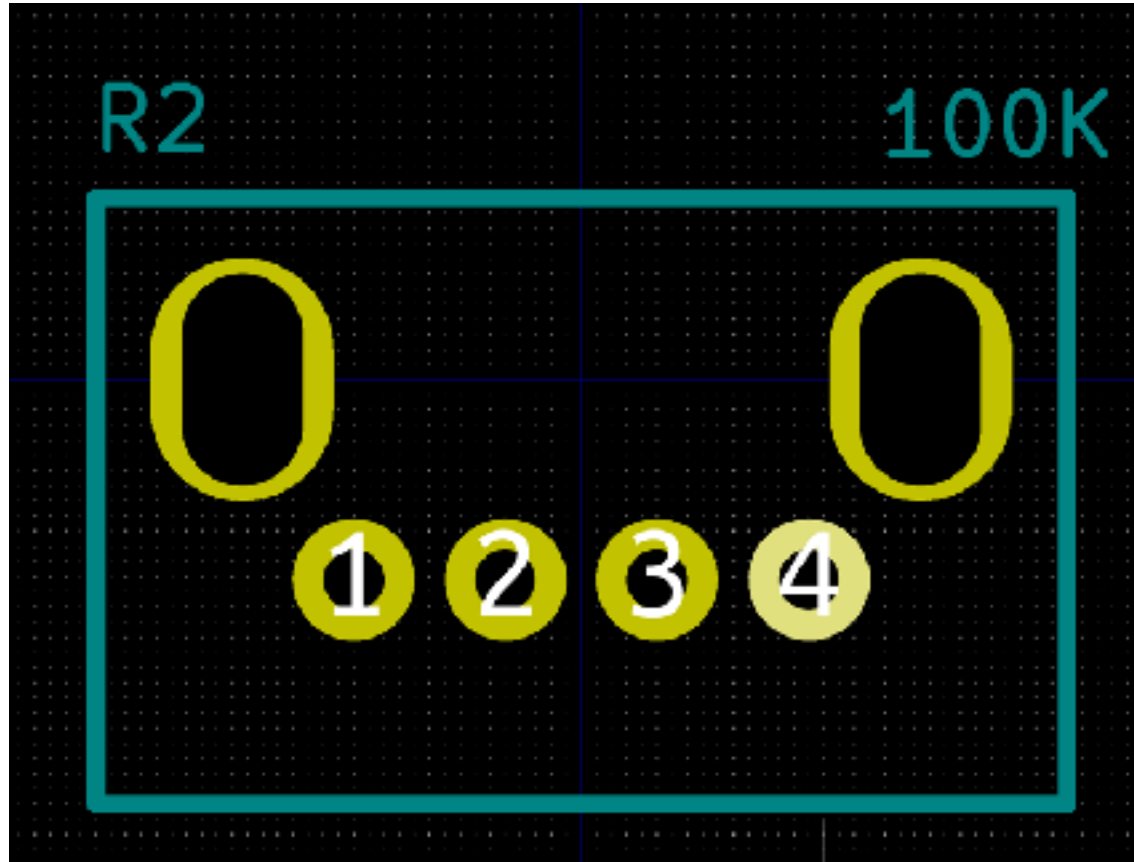


1. ~~Identifying polarity of components~~
2. ~~Silkscreen legibility~~
3. **Panelization**
4. PCB properties
5. Specific manufacturer's part numbers



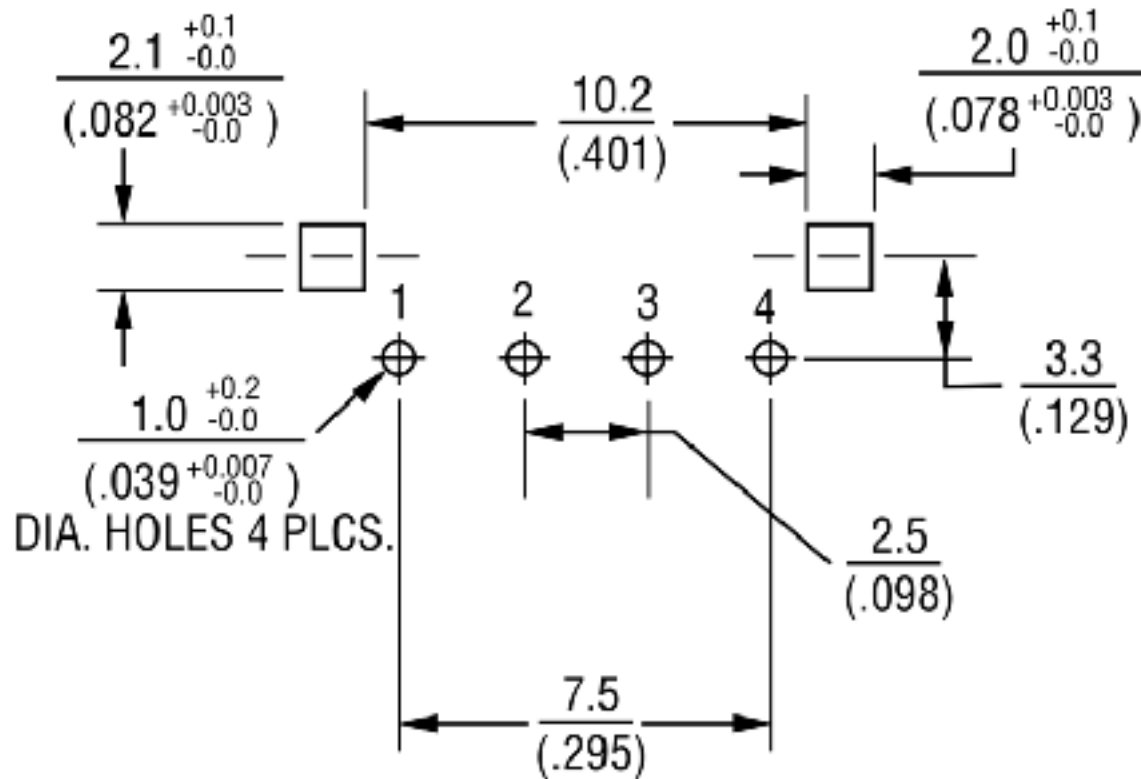






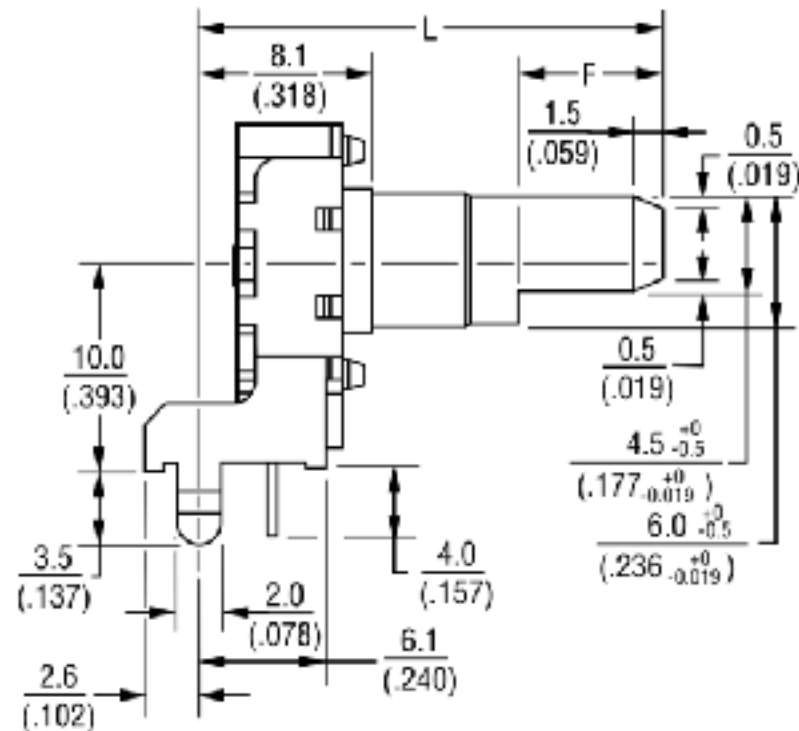


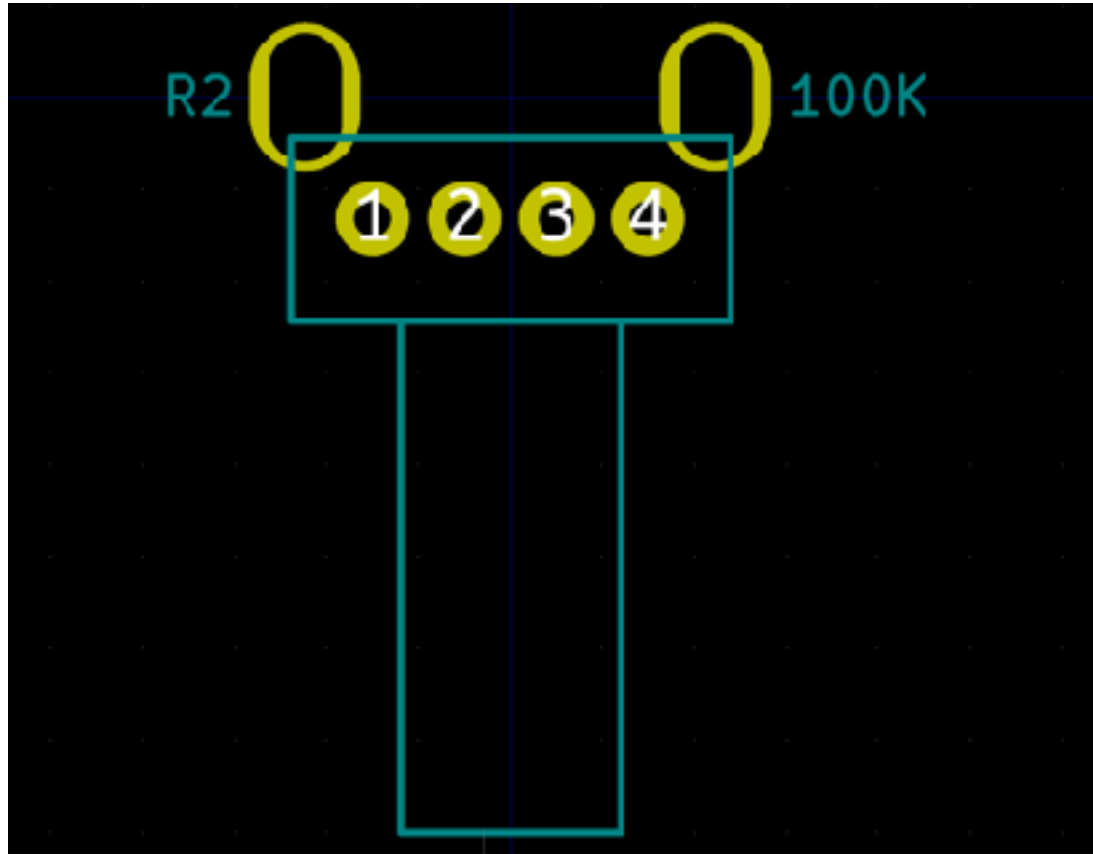
RECOMMENDED PCB LAYOUT

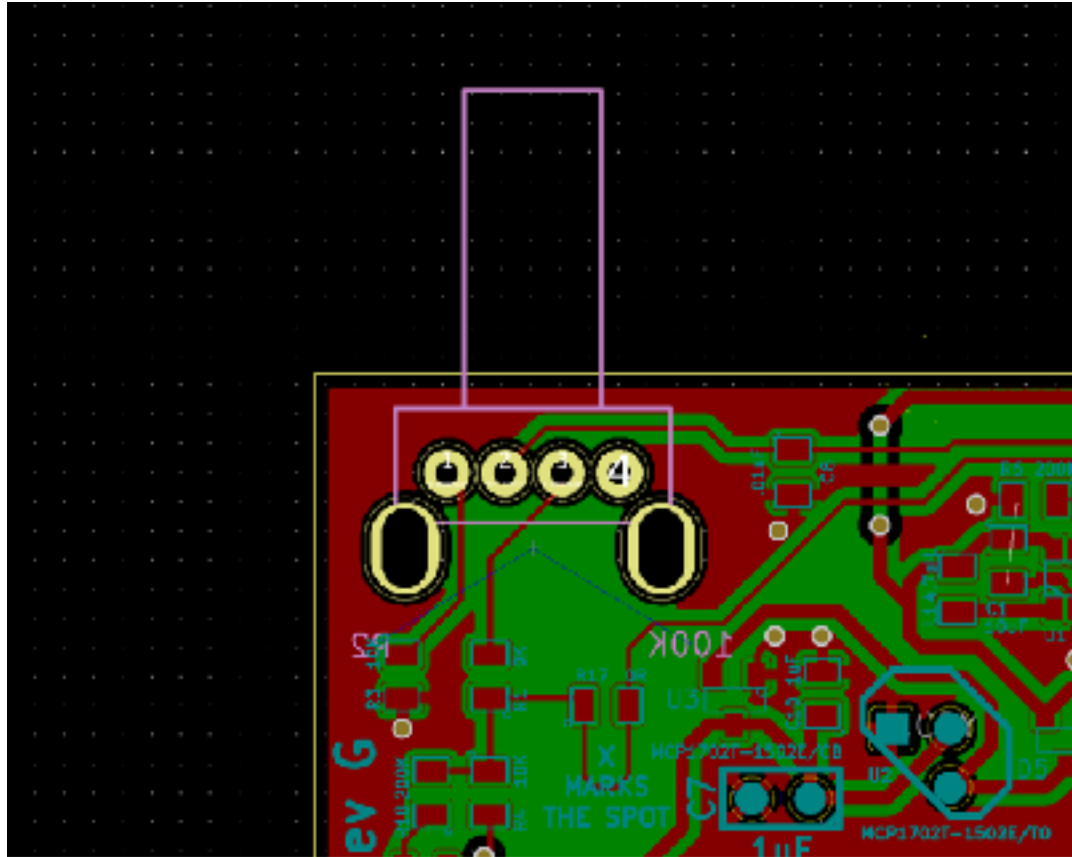


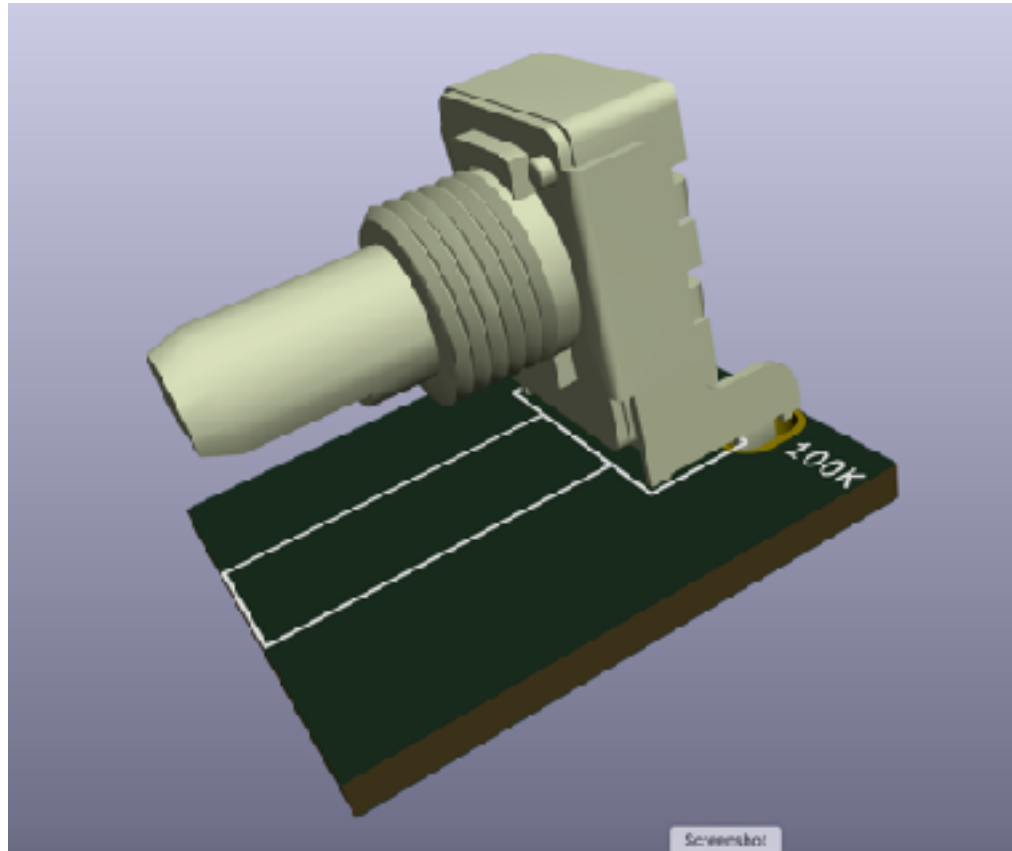


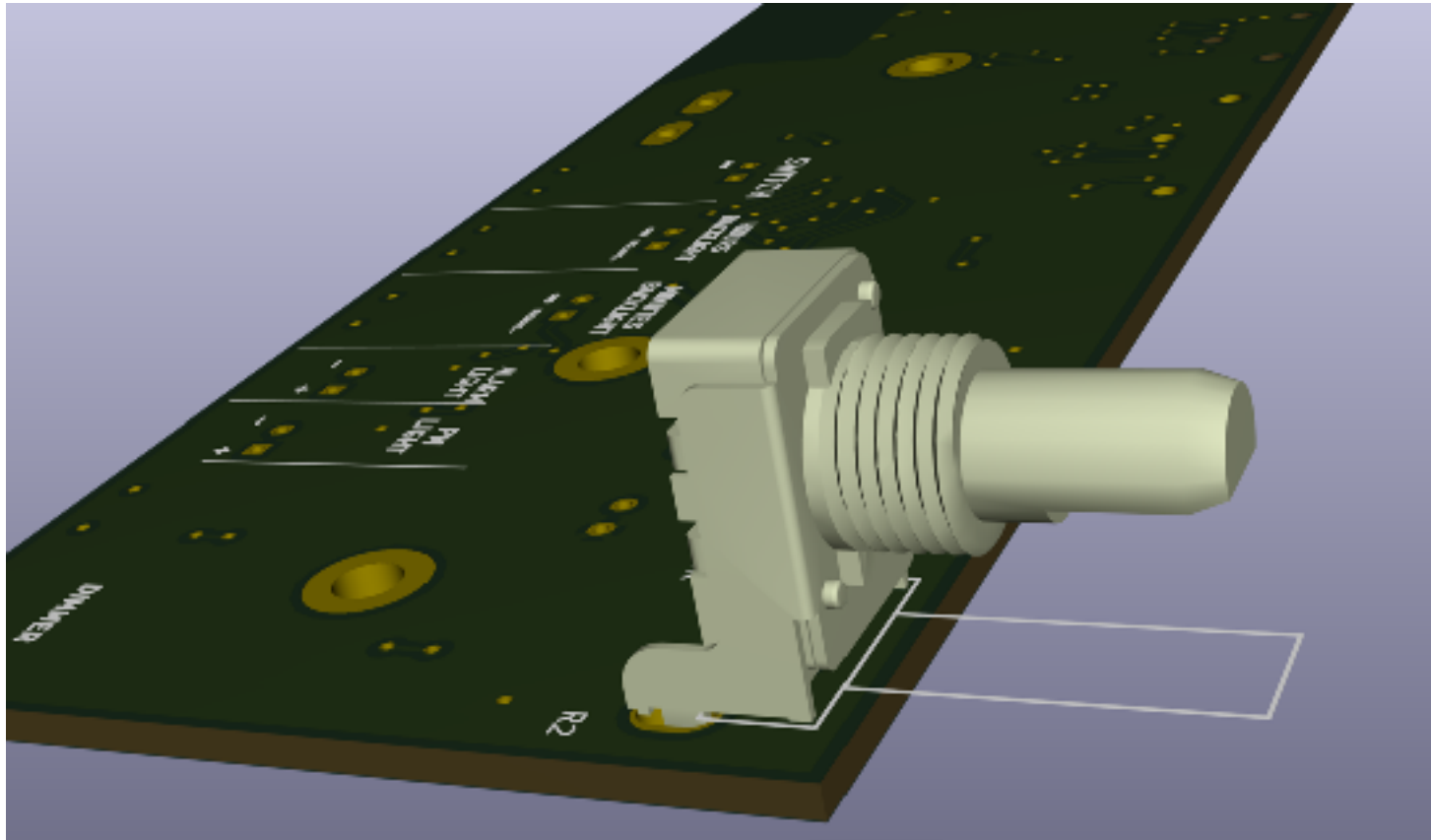
PTV111-2













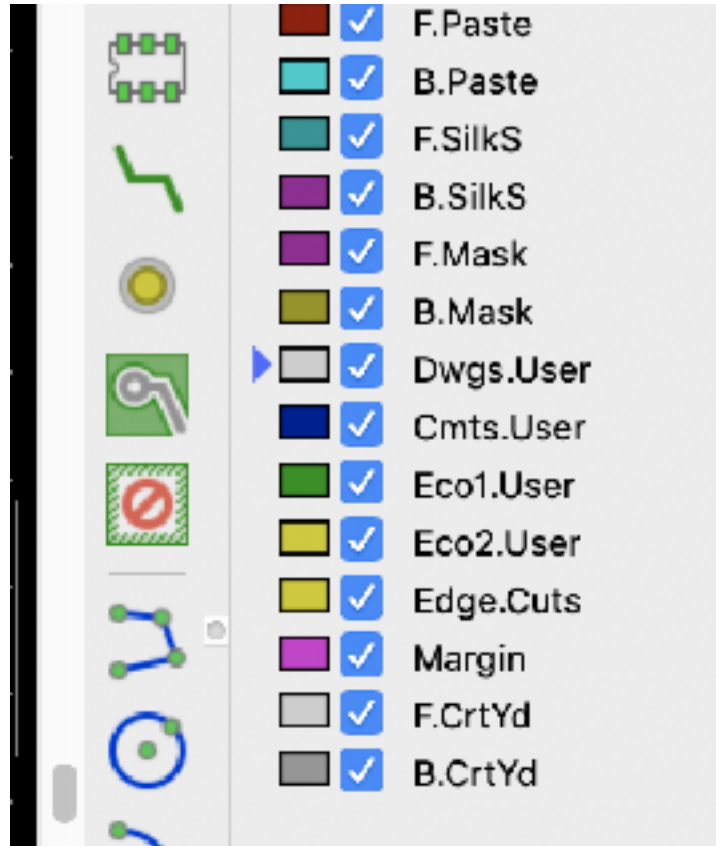
1. Add silkscreen representing body of component.
 - 1.1. Doesn't have to be elaborate, just accurate.
 - 1.2. Don't worry, silkscreen that falls outside of the Outline will be trimmed.
2. Add 3D Model if you can



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



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





Text Properties

Text:

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%)
10. E-Test Required

Layer: ☐ Dwg.User

Width: 3 mm

Height: 3 mm

Thickness: 0.5 mm

Position X: 25.019 mm

Position Y: 252.984 mm

☐ Italic

Justification: Left

Orientation: 0.0

☐ Mirrored

Cancel OK



Page Settings

Paper

Size: A3 297x420mm

Orientation: Landscape

Custom paper size:

Height: 279.4 mm

Width: 431.8 mm

Layout Preview

Title Block Parameters

Issue Date: 2019-04-27 <<< 4/27/2019

Revision: A

Title: Clock

Company: The Awkward Engineer

Comment1: Please direct all questions to Sam Feller

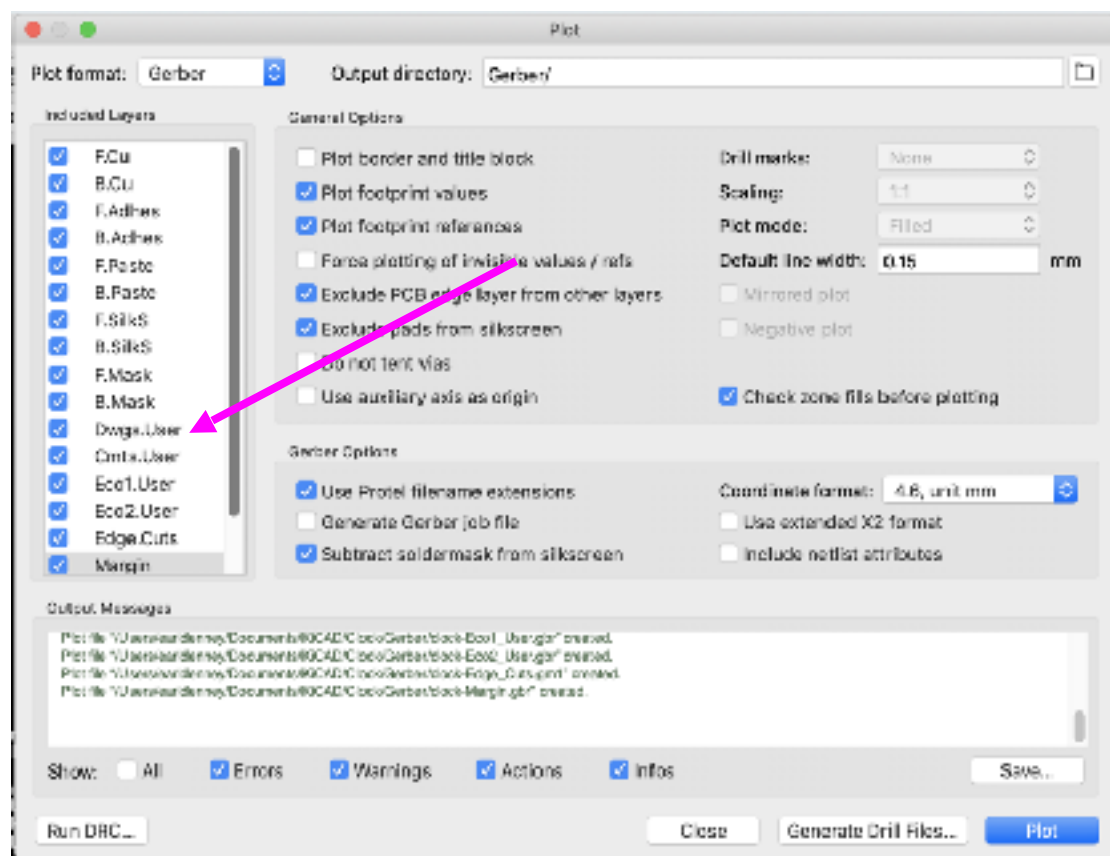
Comment2: Schematic Design: Sam Feller

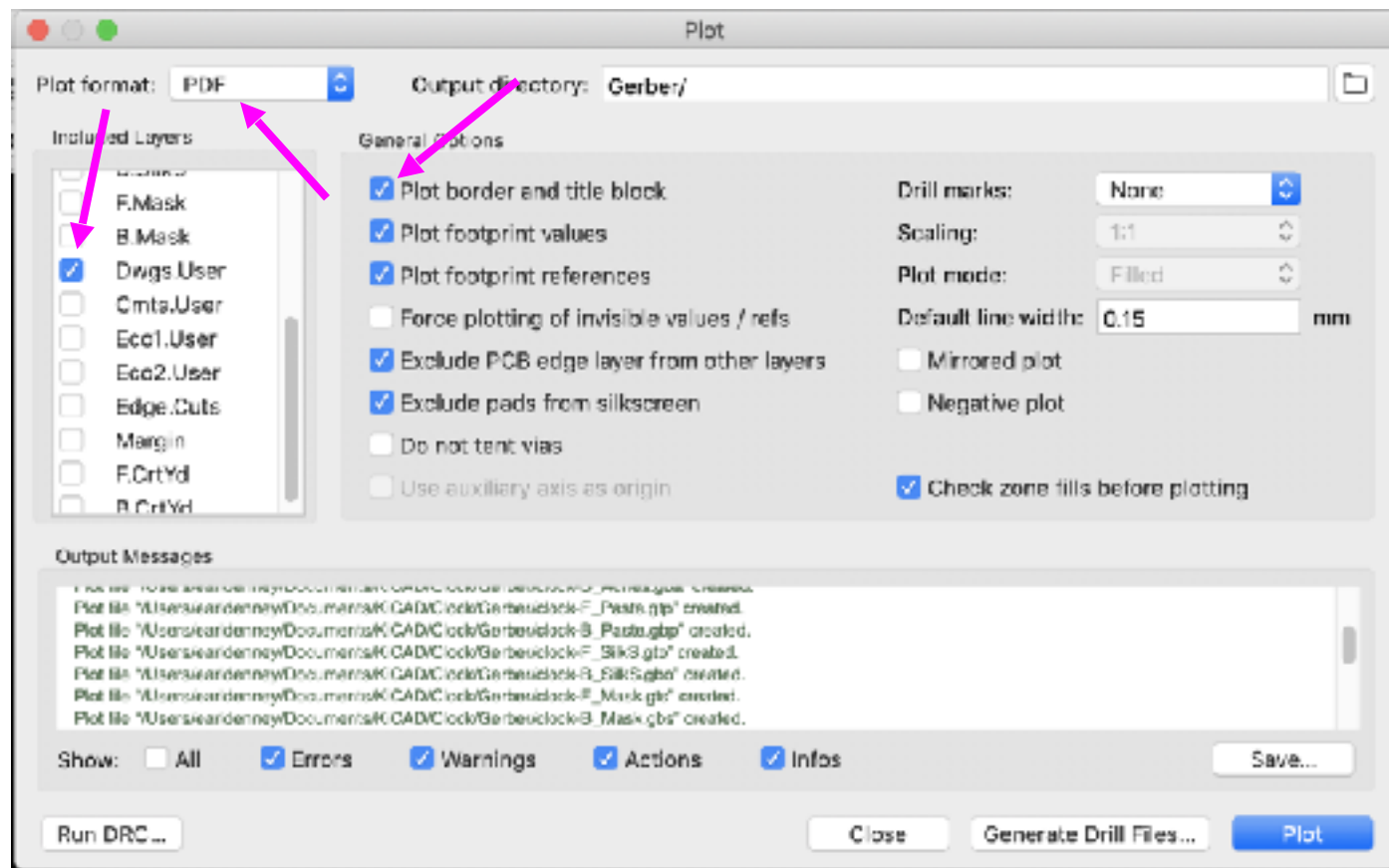
Comment3: Layout Design: Sam Feller

Comment4: sam@awkwardengineer.com

Page layout description file: Browse...

Cancel OK







contact@webdesignercode.com
 Award-Winning Web Design
 Automatic Design, Save Value
 Please direct all questions to Sam Fisher
 The Webdesigner Code
 ©2015
 Free, Open-Source, and
 Title: **Class**
 Jan 10, 2015 Jan 10, 2015 10:00
 10:00 AM 10:00 AM



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%)
10. E-Test Required



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



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



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



Symbol Properties

Fields

Name	Value	Show	H Align	V Align	Italic	Bold	Text Size
Reference	C7	<input checked="" type="checkbox"/>	Left	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.016 mm
Value	1uF	<input checked="" type="checkbox"/>	Left	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.016 mm
Footprint	C1	<input checked="" type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	0.762 mm
Datasheet	~	<input checked="" type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.524 mm
MPN	CL21B105KAFNNNE	<input type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.270 mm
Manufacturer	Samsung	<input type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.270 mm

+ ↑ ↓

Update Fields from Library...

Symbol

Library Reference:

Unit:

☐ Alternate symbol (DeMorgan)

Orientation

☒ 0
☐ +90
☐ +180
☐ -90

Aspect

☒ Default
☐ Mirror around X axis
☐ Mirror around Y axis

Unique ID:

Edit Spice Model... Cancel OK



Symbol Properties

Fields

Name	Value	Show	H Align	V Align	Italic	Bold	Text Size
Reference	C7	<input checked="" type="checkbox"/>	Left	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.016 mm
Value	1uF	<input checked="" type="checkbox"/>	Left	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.16 mm
Footprint	C1	<input checked="" type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	0.762 mm
Datasheet	~	<input checked="" type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.524 mm
MPN	CL21B105KAFNNNE	<input type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.270 mm
Manufacturer	Samsung	<input type="checkbox"/>	Center	Center	<input type="checkbox"/>	<input type="checkbox"/>	1.270 mm

+ ↑ ↓

Update Fields from Library...

Symbol

Library reference: clock-rescue:C

Unit:

☐ Alternate symbol (DeMorgan)

Orientation

☒ 0
☐ +90
☐ +180
☐ -90

Aspect

☒ Default
☐ Mirror around X axis
☐ Mirror around Y axis

Unique ID: 54A89CEC

Edit Spice Model... Cancel OK

Yes, even caps and resistors



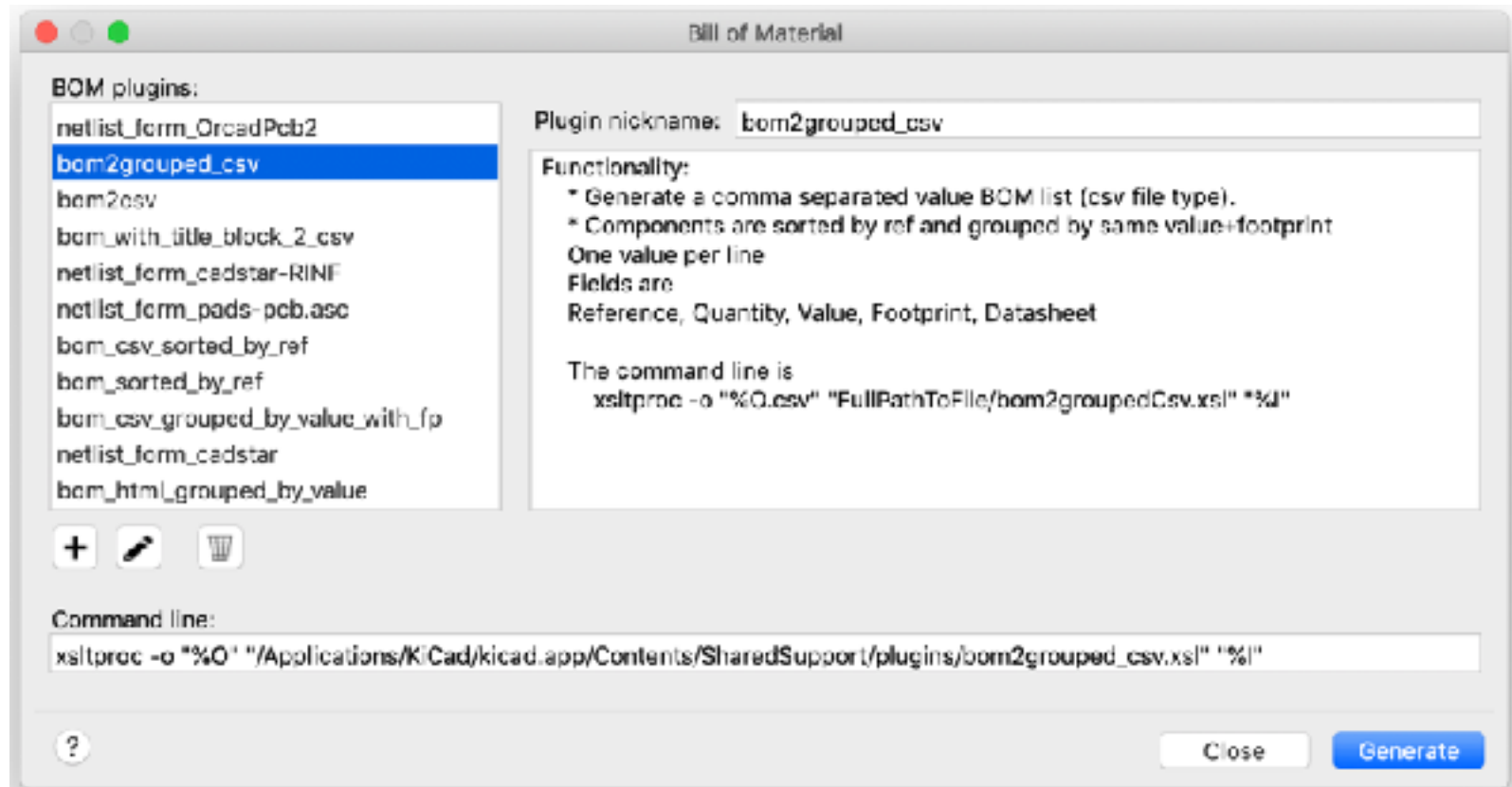
Symbol Fields

☒ Group symbols

Field	Show	Group By	Reference	Value	Footprint	datasheet	MPN	Manufacturer	Qty
Reference	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	R17	0R	SM0805	-	DNP		1
Value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	> R1, R16	0K	SM0805	~	ERJ-6GEY0R00V	Panasonic	2
Footprint	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	> C2, C4	12.5nF	SM0805	-	CL21C120JB81PNC	Samsung	2
Datasheet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	> C6, C8, C8	.01uF	SM0805	~	CL21B103KBANNNC	Samsung	2
MPN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	C7	1uF	C1	~	CL21B105KAFNNNE	Samsung	1
Manufacturer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	C10	1uF	SM0805	-	CL21B105KAFNNNE	Samsung	1
			L1	4.7uH	SM0805	~	LQM21NN4R7K10L	Murata	1
			> C1, C3	10uF	SM0805	-	CL21B106KQNNNE	Samsung	2
			> R13-R15	220	SM0805	~	ERJ-6GEYJ221V	Panasonic	3
			> R3, R4, R8, R12	10K	SM0805	-	RMCF0805FT10K0	Stackpole	4
			> R7, R8	33K	SM0805	~	ERJ-6ENF3302V	Panasonic	2
			> R10, R11	51K	SM0805	~	ERJ-6GEYJ513V	Panasonic	2
			R2	100K	Chris_Denney_Library:bourns_knob	-	PTV111	Bourns	1
			R6	130K	SM0805	~	ERJ-6ENF1303V	Panasonic	1
			> R8, R18	200K	SM0805	-	ERJ-6ENF2003V	Panasonic	2
			> D61, D62	AMMETER	ammeter		DNP		2
			IC1	ATTINY84A-S5	SD14E		ATTINY84A-SSU	Microchip	1
			CON1	AVR-ISP-6	ISPheader		DNP		1
			> BT1, BT2	BATTERY_CLIP	AA_Battery_Clip_THRU_HOLE_BK-92		92	Keystone	2
			> P2-P4, P8, P10	CONN_2	SIL-2		DNP		5

Add Field...

Apply, Save Schematic & Continue Cancel OK





CircuitHub

ExplorePartsmanual

HelpBlog

l27msDmney
Acting as l27msDmney

admin guest

Drag files here

Choose files

To receive a quote, please upload your original EDA design files.[Why?](#)

By default all your information is private.

CircuitHub accepts **Eagle**, **KiCad** and **Altium** files.

CircuitHub does not accept gerbers, as they don't provide all the information required for manufacture and assembly.

- For **Altium** projects, upload your **.pcbdoc** and all the relevant **.schdoc** files.
- For **Eagle** projects, upload your **.brd** file and one **.sch** file.
- For **KiCad** projects, upload your **.kicad_pcb**, **-coerce.lib** and **.sch** files.

Display a menu



No website or product link provided

Revision #12



New Revision



Fork

5



Download assets



Schematics



Board



Firmware



Settings

ORDER BY References



Part				Quantity	Quantity	Price
BATTERY_CLIP	AA Batter. Clip T...	92 Keystone	BATTERY CONTACT CLIP A/AA PC PIN	1,100 100 for attention	\$3.1283	\$141.5700
10uF	3V6005	00805C104KSRCTU Kemet	CAP CER 0.1UF 50V K7H0805	1,800	\$3.0294	\$30.8385

Assembled Boards



500 boards

Lead Time



Ships on May 27 (20 business days) [5 pcb, 10 assembly]

Quantity

Unit Price

Total

PCB	500	\$3.91	\$1,004.14
Parts	500	\$4.91	\$2,007.50
Assembly	500	\$8.91	\$4,452.77
Total	500	\$14.93	\$7,464.31

[Hide details](#)[Display a menu](#)

Order





No website or product link provided

Revision #12



New Revision



Fork

5



Download assets



Schematics



Board



Firmware



Settings

ORDER BY References



Part				Quantity	Quantity	Price
BATTERY_CLIP	AA Battery Clip T...	92 KeyStone	BATTERY CONTACT CLIP A/AA PC PIN	1,100 100 for attention	\$3.1283	\$141.5700
10uF	3V6005	00805C104KSRCTU Kemet	CAP CER 0.1UF 50V K7H0805	1,800	\$3.0294	\$30.8385

Assembled Boards



500 boards

Lead Time



Ships on May 27 (20 business days) [5 pcb, 10 assembly]

Quantity

Unit Price

Total

PCB	500	\$3.91	\$1,954.14
Parts	500	\$4.91	\$2,457.50
Assembly	500	\$8.91	\$4,452.77
Total	500	\$14.93	\$7,464.31

[Hide details](#)[Display a menu](#)

Order





Assembled Boards

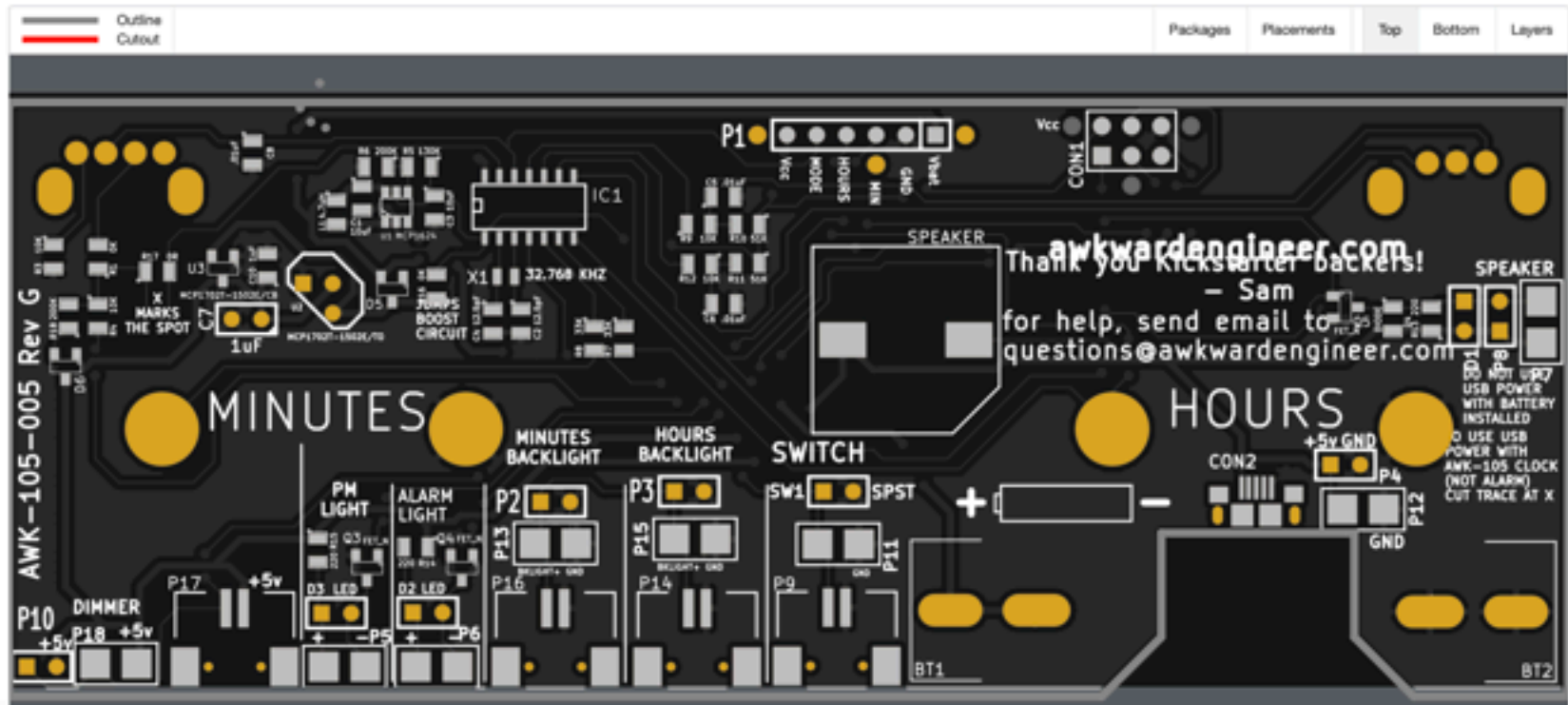


500 boards

Lead Time



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





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



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



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



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



General

Local Clearance and Settings

Custom Shape Primitives

Pad numbers:

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

☒ F.Mask

☐ B.Mask

☐ Dwg.User

☐ Eco1.User

☐ Eco2.User

Footprint REF** (LFCSP-16-16P_3x3mm_P0.6mm_EP1.6x1.6mm), front side, rotated 0.0 deg

☐ Show pad in outline mode



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:

FCu

Technical layers:

☐ F.Adhes

☐ B.Adhes

☒ F.Paste

☐ B.Paste

☐ F.Silks

☐ B.Silks

☒ F.Mask

☐ B.Mask

☐ Drgs.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



- 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



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/>