

Carlson's SuperProbe MK3 Kit Assembly

MK3 Superior Kit including a Stainless Steel Probe & 42 Parts

This is an advanced SMD skill PCB build. Please take your time!

First, thanks for purchasing this kit. These instructions are for our MK3 probe kit with 42 unique components including all parts needed for the hand-held shielded metallic probe. There are many implementations of this non-contact probe on the web, but most seem to have stuck to Paul Carlson's design rather closely. Since neither kit includes the cases, probe tip, battery or speaker needed to arrive at a final working probe. You can't go wrong reviewing and following the implementations presented on the Instructables website. In particular, this kit is based on the PCB designs from Yannick99. Certainly you should watch Carlson's original YouTube video on the probe. I can't do better in describing its adjustment and use.

Original MK1 Kit

The original kit provides all of the parts for the 2 PCBs, the 2 pots & lamp. Everything else must be builder sourced.

MK2 Kit

The MK2 version of the Super Probe kit contains essentially all of the parts for both the Amp and Probe except the *cases, battery & holder, probe tip & speaker*. It includes everything for the PCBs, knobs for control POTs, probe shielded connection cable, probe plug & jack, power switch and LED, #22GA Teflon inter-connect wire & shrink tube.

New MK3 Kit

The superior MK3 version adds 7 components to complete the shielded metallic probe. (See parts list included.) First assemble the complete SuperAmp and SuperProbe PCBs according to the following instructions. Then assemble the SS probe.

Amp & Probe PCB Assembly

The PCB parts are almost exclusively SMD 0805/1206 size components, and will require a skill level and tool set commensurate with these parts. Some form of microscope is also highly desirable for assembly and inspection. The amplifier PCB has 4 mounting holes to match suitable for #4-40 screws. These may be slightly modified with a round file to fit your particular enclosure. (You can just as easily use hot glue!) The probe PCB has 3 #0-80 mounting holes located in ground pads which are used to attach the PCB to the carrier boat used in the probe. The 2 pads on top next to the probe tip input are grounded to the back-plane. Use these for reinforcing the tip support or mounting the PCB. At the output end opposite there is a ground pad on the top.

There are 34 different components shared between the two PCBs, each in its own plastic bag (including wire & shrink tube). They are each numbered and labeled to match the parts list. I recommend sorting the poly bags by number so you don't lose track of any. For a sane and successful assembly, **DO NOT OPEN MORE THAN ONE BAG AT A TIME!** I don't think that there is a good or bad sequence to the assembly, and you do not need to follow the bag numbering. But you had best attach all of one type of component to both PCBs before opening another bag, and check off the parts on the part list as you go. (For most components, there are 1-2 extras, but not for the expensive parts!)

Use a good quality clean or no-clean liquid or gel flux. But clean your assembly with soap & water or acetone (as appropriate for the flux used). Use caution in washing the probe PCB switch & pot. I recommend mounting these thru-hole components last.

Only 3 components are polarized (5 - 22uF caps, 1 - Schottky diode & 1 - LED). Unfortunately the original drawings don't easily show this, so look closely at the pictures and schematics where I have added "+" marks and arrows. In particular, note that the Schottky diode banded end should point **toward** BJT T5 base pin and C9. It is easy to get this wrong. R16 (10K) in the output EF (T6) of the probe PCB is not normally installed. But if you choose to test or use the probe PCB as a stand-alone circuit you will need this to bias the emitter follower. Then you can drive any audio amplifier through its input filtering network.

The LM4871 amplifier uses a floating output, so neither speaker terminal is grounded, so take care that you never let a speaker lead touch the common or it may permanently damage the LM4871 chip.

There is a risk in testing or use that the probe power wire may be shorted to common accidentally. This WILL destroy the 2K voltage regulator pot. To protect against this, the design includes a 6V-40mA lamp that should be placed in series with the voltage regulator pot wiper. When cold the lamp is just 10s of ohms, but if the power lead is shorted the lamp will glow to protect the pot wiper by acting as a dynamic ballast resistor. Fit the lamp anywhere that makes sense. *(The lamp will protect against intermittent shorting when the stereo plug is inserted and removed.)*

PCB Testing

Because this kit is only part of the complete SuperProbe, there are many ways of testing each PCB. Check the power rail for shorts or very low resistance. Check for bridged solder joints. Use a current limited supply or series resistance and measure power supply current. The probe PCB draws only hundreds of micro amps, while the amp PCB uses noticeably more current with the speaker attached. If you have problems with the SuperAmp, check your power supply connections and contacts. This LM4871 requires 100-200 mA to power up, where it then idles at 10-20mA. A poor power supply will cause motor-boating where the amp repeatedly powers up and down. The SuperAmp schematic shows the expected DC node voltages with VCC=4.5V.

Amplifier Case

Almost anything can be used to house the amplifier, and we have included a quality 3.5mm stereo jack & plug. The amplifier can be powered using 3.5-5.5VDC from a variety of sources. But 4-AA batteries are the limit for the integrated power IC in the amplifier. Do stick with some form of 4 ohm 2 watt speaker, as reviewers complain about performance with other speakers.

SS Probe Body Assembly

The probe case *must* be all metal and connected to the common of the probe PCB (bottom). This is also connected to the shield of the wire probe tip and shield & common of cable to the amplifier. A bare metal probe case can be a hazard around high-voltage circuits. Use insulation and safety techniques any time the voltage is greater than 48VDC. And even then, remember that a 10A 48V supply can do some real damage! A length of 1" heat-shrink tubing is provided for optional external insulation.

The probe is assembled last by attaching the 3-conductor signal wire to the PCB output end and feeding through the back of the SS probe. Next attach 3.5mm stereo plug to the free end of the cable. Make note of wire colors so that you wire the 3.5mm jack in the SuperAmp correctly. Trim and attach the probe tip to the front of the PCB using the photos as a guide. The rigid coax shield is trimmed and flattened and used as a ground and bottom support for the probe wire. When completed, check carefully to see that the inner conductor is not shorting to the shield at the PCB. Make every effort to contain the shield solder within the span of the cutout in the mounting boat (carrier).

Fasten the PCB to the carrier with the provided #0-80 screws (3) and attach the adhesive side of the copper strip to the bottom of the carrier and up to the probe end ground and solder it to the front ground shield. Slide the carrier into the front section of the probe (carefully adjusting the probe coax by bending) and fasten the carrier with a 4-40 screw, piercing through the copper foil. Slide the rear probe body onto the front. Trim the probe tip as desired for about a 1/16" - 1/8" exposed tip.

The included 1" heat-shrink tubing can be used in a variety of ways to insulate the probe, and some creativity is needed to fit it. The tube can be shrunk on to the SS probe after assembly and the switch & LED trimmed out with an Exacto knife. Alternately, the shrink tube can be trimmed at the SS tube joint to facilitate servicing the internal PCB.

Compromises

Carlson designed this probe to be as simple as possible yet have flexibility. Because the probe operates from a variable power supply, both amplifier controls affect the probe sensitivity. I find the LED pop indicator to be tricky to adjust & use. The LED is biased through 1K ohm to the probe supply. Since this supply has a rather high output resistance (the pot), the LED can't be made really bright. Yes it can be made to flicker, but you have to be looking at it. So physical positioning of the LED should be considered early in the probe case design.

Master Poly-package Part List

The following list indicates all of the parts included in the kit. While I stuck to the parts specified by Yannick99 where I could, some were not available or were unreasonably expensive. The GREEN backgrounds are the kit part numbers (along with some alternates).

I have also indicated both the required component count and the included kit component count, so you can lose a component in some cases. **Each package contains ALL parts of a particular type and are fitted to the amp & probe PCBs according to the schematic reference designators for each PCB. For instance Poly-package 2 contains 6-22uF caps, 2 for C2/C6 on the amp PCB & 3 for C2/C5/C7 on the probe PCB, with 1 extra. Note that schematic reference designators are NOT unique across the 2 PCBs!**

Poly-pack SuperProbe Kit MK1(26) or MK2(35)

4/24/24

V3.1

bag line #	desc	part #	alt part #	qty-req	qty-kit	val	size	pol
MK1 Kit								
1	C	CL21B103KBANNNC		3	5	0.01uF	0805	none
2	C	TAJA226K010TNJ		5	6	22uF	1206	+band
3	C	CL21B104KBCNNNC		3	5	0.1uF	0805	none
4	C	CL21A475KOFNNNE		4	5	4.7uF	0805	none
5	C	80-C0805C361J5G		1	2	360pF	0805	none
6	C	CL21B105KAFNNNE		1	2	1uF	0805	none
7	D	1N5711WS	1PS76SB70,115	1	2	1N5711	SMD	K band
8	Q	MMBT3904		7	9	2N3904	SMD	
9	R	ERJ-6GEYJ335V		5	7	3.3M	0805	
10	R		CRGCQ0805F15K	3	5	15K	0805	
11	R		CRGCQ0805F2K7	1	2	2.7K	0805	
12	R		CRGCQ0805F1K0	5	7	1K	0805	
13	R		CRGCQ0805F330K	1	2	330K	0805	
14	R		CRGCQ0805F10K	1	2	10K	0805	
15	R		CRGCQ0805F22K	3	5	22K	0805	
16	R	ERJ-6ENF6802V	CRGCQ0805F68K	1	2	68K	0805	
17	R		CRGCQ0805F100R	1	2	100	0805	
18	VR	CT-6EX104		1	1	100K	TH	
19	VR	eBay	P160KNP-0EC15B2K	1	1	2K	PNL	LIN
20	VR	987-1736	P160KNPD-4QA15A5K	1	1	4.7K	PNL	AUD
21	SW1	EG2350	OS102011MA1QN1	1	1	SPDT	TH-RA	
22	U	LM4871MX/NOPB		1	1	LM4871	SMD	
23	PCB			1	1	SupAmp		
24	PCB			1	1	SupProbe		
25	LED	SSL-LX3054SRD	noise	1	1	320mcd	T1-red	320mcd
26	LMP	560-1730	CM683	1	1	6V-40mA		
Plus MK2 Kit								
27	Knob	Amazon	1106WA	2	2	6mm	knurled	
28	jack	Amazon	161-7400-EX	1	1	3.5mm	stereo	
29	plug	Amazon	17PP004-EX	1	1	3.5mm	stereo	
30	SW2	Amazon	200MSP6T1B1M2REH	1	1	toggle		
31	CBL	Mouser		4	4	ft	stereo	shielded
32	WRE	#22 teflon		4	4	ft	#22	wire
33	R		470	1	1	470	axial	LED
34	HST	1/8" shrink tube		1	1	ft		
35	LED	WP710A10SED	power	1	1	1100mcd	T1-Org	1100mcd

The following lists are for individual amp & probe PCB schematics. Check off the BAG box as you go like with old-time HeathKits!

SuperAmp Part List

MC Super Amplifier 1/13/25				
Kit	Bag #	Quantity Needed	Reference	Part
MK1	<input type="checkbox"/> 2	2	C2,C6	22uF
MK1	<input type="checkbox"/> 3	1	C3	0.1uF
MK1	<input type="checkbox"/> 4	2	C4,C5	4.7uF
MK1	<input type="checkbox"/> 6	1	C1	1uF
MK1	<input type="checkbox"/> 8	1	T1	2N3904
MK1	<input type="checkbox"/> 12	1	R3	1K
MK1	<input type="checkbox"/> 15	3	R1,R2,R5	22K
MK1	<input type="checkbox"/> 16	1	R4	68K
MK1	<input type="checkbox"/> 17	1	R6	100
MK1	<input type="checkbox"/> 19	1	R7 POT	2K
MK1	<input type="checkbox"/> 20	1	R8 POT	4.7K
MK1	<input type="checkbox"/> 22	1	U2	LM4871
MK1	<input type="checkbox"/> 26	1	DS1	6V-40mA
MK2	<input type="checkbox"/> 27	2	KB	6mm Knurl Nobs
MK2	<input type="checkbox"/> 28	1	J1	3.5mm jack
MK2	<input type="checkbox"/> 30	1	SW1	Pwr SW
MK2	<input type="checkbox"/> 32	24"	#22	Hook up wire
MK2	<input type="checkbox"/> 33	1	R9	430-470
MK2	<input type="checkbox"/> 34	12"	1/8"	Shrink tube
MK2	<input type="checkbox"/> 35	1	D1	Org LED

SuperProbe Part List

MC Super Probe Revised:1/13/25				
Kit	Bag #	Quantity Needed	Reference	Part
MK1	<input type="checkbox"/> 1	3	C1,C3,C10	0.01uF
MK1	<input type="checkbox"/> 2	3	C2,C5,C7	22uF
MK1	<input type="checkbox"/> 3	2	C4,C6	0.1uF
MK1	<input type="checkbox"/> 4	2	C8,C11	4.7uF
MK1	<input type="checkbox"/> 5	1	C9	360pF
MK1	<input type="checkbox"/> 7	1	D2	1N5711
MK1	<input type="checkbox"/> 8	6	T1,T2,T3,T4,T5,T6	2N3904
MK1	<input type="checkbox"/> 9	5	R1,R4,R7,R9,R15	3.3MEG
MK1	<input type="checkbox"/> 10	3	R3,R6,R11	15K
MK1	<input type="checkbox"/> 11	1	R8	2.7K
MK1	<input type="checkbox"/> 12	4	R2,R5,R10,R14	1K
MK1	<input type="checkbox"/> 13	1	R12	330K
MK1	<input type="checkbox"/> 14	1	R16	10K
MK1	<input type="checkbox"/> 18	1	R13 (Trim POT)	100K
MK1	<input type="checkbox"/> 21	1	SW1	SPDT
MK1	<input type="checkbox"/> 25	1	D1	POP-LED
MK2	<input type="checkbox"/> 29	1	JP1	3.5mm plug
MK2	<input type="checkbox"/> 31	36"	3w+sh cable	cable

Stainless Steel Probe Part List

The following components are used in the SS probe body.

1. Machined stainless steel telescoping probe body
2. Machined acetyl PCB carrier
3. Copper adhesive grounding tape
4. 3 #0-80 x 1/8" PCB mounting screws
5. 1 #4-40 x 1/4" carrier screw
6. 3" x 50 ohm coaxial probe wire
7. Heat shrink tube to optionally insulate the metal probe

Feedback

It takes quite a bit of effort to put kits like this together, and it is easy to make a mistake or omission. If you find errors, omissions, or if you have suggestions on the instructions, kit, packaging or anything else, I would be happy to receive feedback.

- Is the cable long enough?
- Are there enough extra SMD parts?
- Are the instructions adequate?
- Do you have tweaking feedback for us?

I would encourage you to add your implementation to the Instructables "I Made This" section!

The easiest way to provide feedback would be by email to:

Kevin
hcsales@hwcz.com or ppsales@hwcz.com

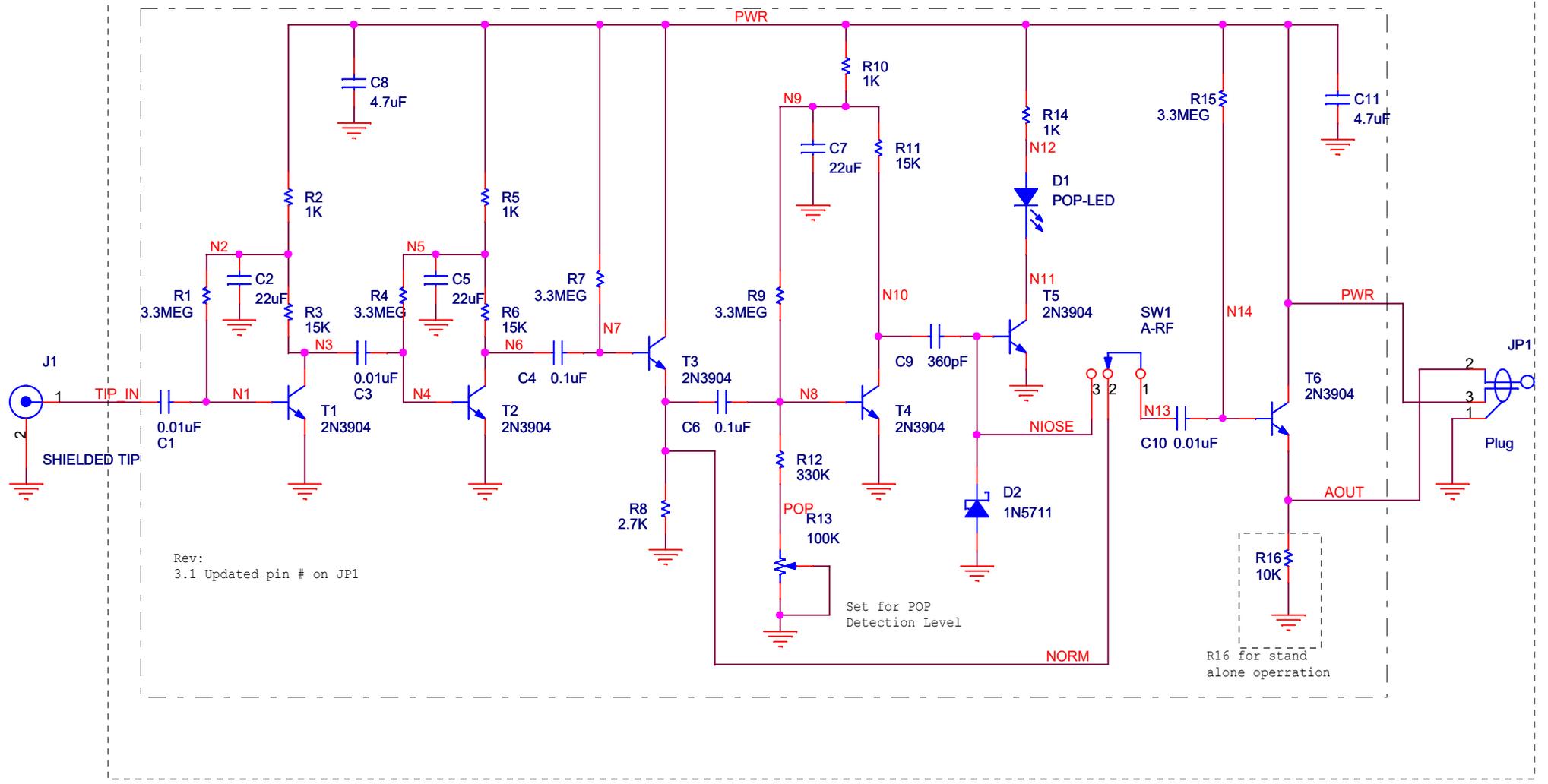
References

<https://www.youtube.com/watch?v=uVkJqqZroN0&t=2583s>
<https://www.instructables.com/Carlsons-Super-Probe/>
<https://www.hollywoodcontrols.com/phpSP/MCSP.php>
https://www.hollywoodcontrols.com/phpSP/MCSP_MK3.php

Here is a great UT video of Carlson using the SuperProbe to locate a noisy component inside a complex transceiver. He makes it seem so easy, and with the SuperProbe it is!
<https://www.youtube.com/watch?v=uiK1BD7HILo>

Super Probe MK2 PCB Kit Parts

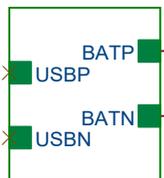
Super Probe MK1 PCB Kit Parts



Title		
Mr Carlson's Super Probe		
Size	Document Number	Rev
A	<Doc>	v3.1
Date:	Wednesday, February 12, 2025	Sheet 1 of 1

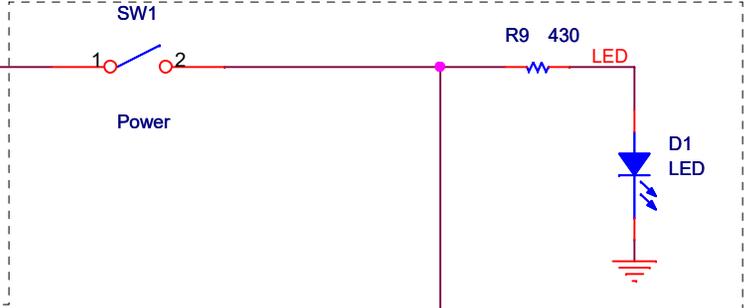
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 A3 0.23
 A4 2.18
 A6 2.25
 A7 2.25
 A8 2.24
 A9 2.24

USBC1



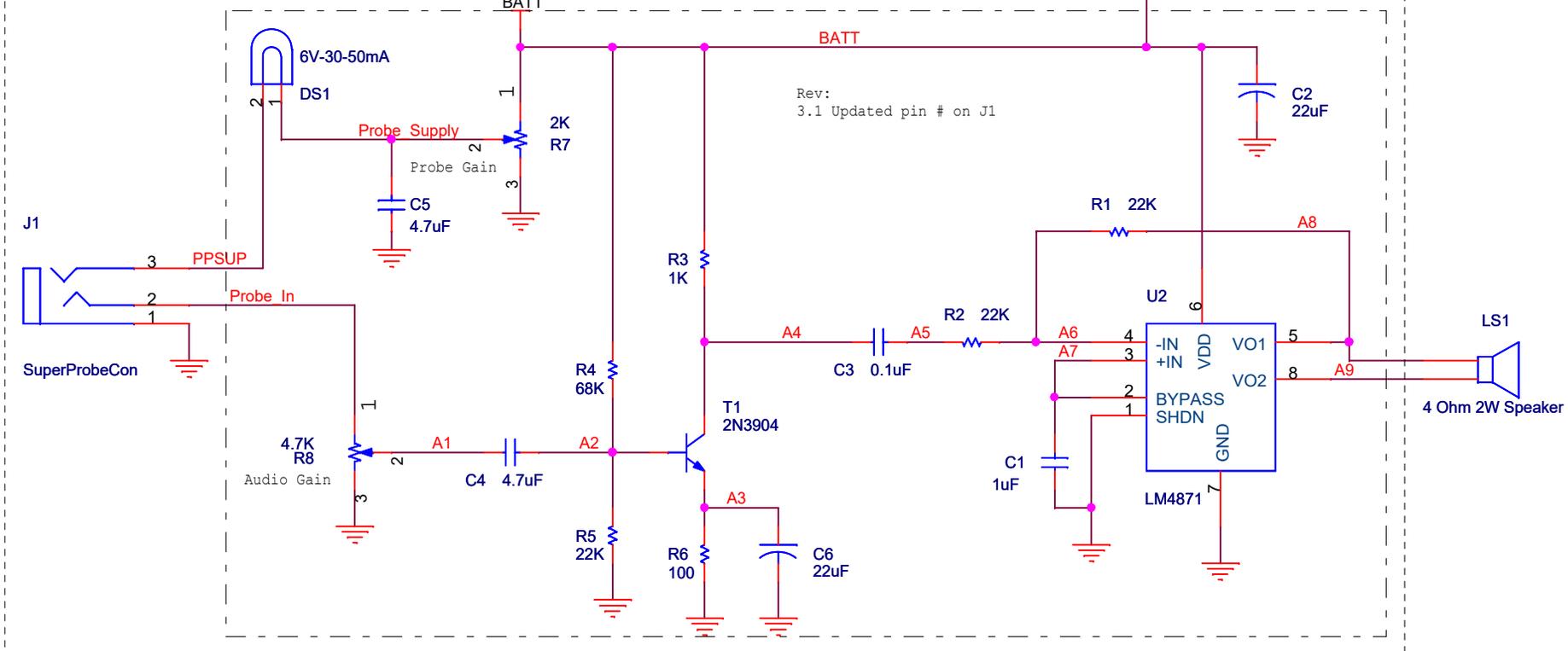
TP4056

Super Amp MK2 PCB Kit Parts



Optional Overload Lamp

Super Amp MK1 PCB Kit Parts



Rev:
3.1 Updated pin # on J1

Title		
Mr Carlson's Super Amp & Li-Ion Power		
Size	Document Number	Rev
A	<Doc>	3.1
Date:	Wednesday, February 12, 2025	Sheet 1 of 1

Drawing V2

