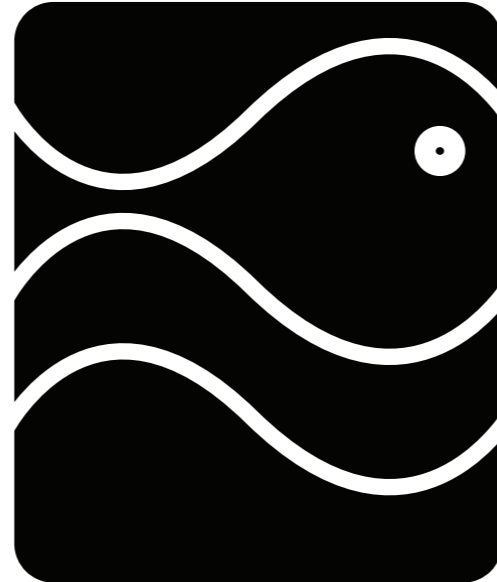
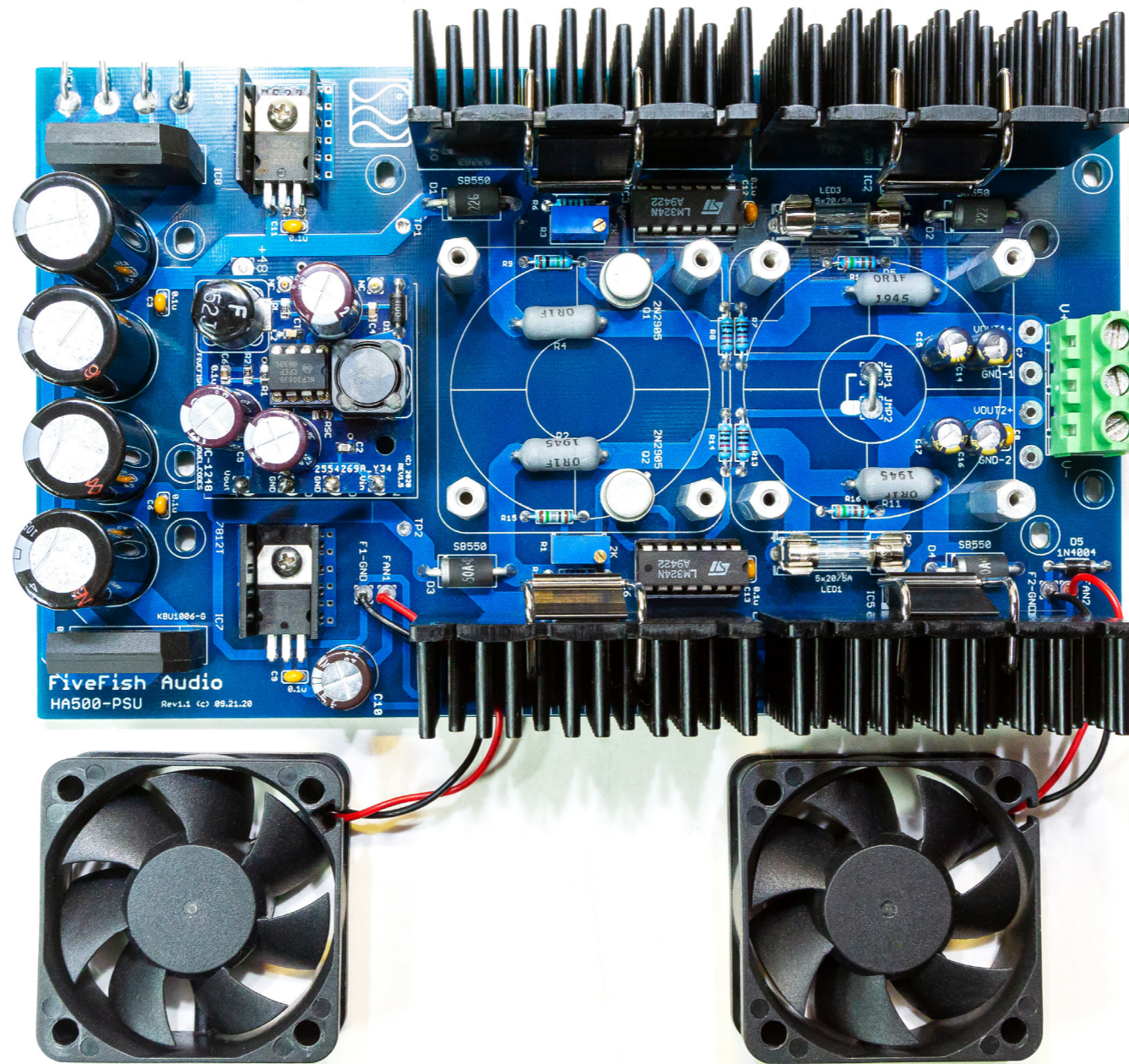


FiveFish



Studios

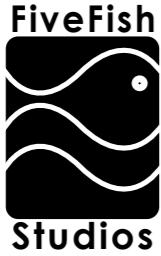
HA500-PSU Power Supply Kit Assembly Guide



Revision 1.00 - 20201009

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Dear Customer,

Thank you for purchasing our HA500-PSU Power Supply PCB.

Great care has been taken to make this assembly guide complete and as accurate as possible. Our goal is to make your assembly work easy and trouble-free, and deliver to you a working, reliable, and high-performance power supply.

This assembly guide is a work in progress and we're continually working to improve it. As always, we welcome the input of the DIY community if you have any comments, suggestions, or additional information that you think will be helpful for inclusion in this assembly guide.

If you have any questions that are not covered by this assembly guide, please feel free to contact us at www.fivefishaudio.com, or via our facebook page.

Sincerely,

FiveFish Team

SAFETY CONSIDERATIONS

GENERAL

This assembly guide must be reviewed for familiarization with safety markings and instructions before assembly of the HA500-PSU Power Supply.

BEFORE APPLYING POWER

Verify that all components and parts are inserted in the right location and correct orientation. Visually inspect that there are no cold solder joints, or short-circuits.

If you're planning to connect heavy loads to the HA500-PSU, you must have cooling fans installed, and also mount a heatsink for each Bridge Rectifier device. Use the appropriate fuse rating for your load.

WARNING

The WARNING sign denotes a hazard. Pay attention to the procedure, instructions, or the like, which if not correctly performed could result in damage to your equipment, electronic component or personal injury.

WARNING

Any interruption or disconnection, or lack of connection of the protective earth terminal/safety ground may cause a potential electric shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).

The heatsinks will get HOT if operated without a cooling fan when running the power supply at heavy loads. Do not operate without cooling fans. The cooling fans cool both the voltage regulators and bridge rectifier devices.

It goes without saying -- do not stick your finger into the fan blade while the fan is spinning.

If operated at 3Amps or more of load, the bridge rectifiers will require some form of heatsinking. A folded flat-piece of aluminum bolted to the bridge rectifier body will help.

Use the appropriate sized fuse for your load.

Do not short-circuit the power supply output.

For complete protection, it's advisable that you house this power supply in a suitable enclosure before use.

GENERAL INFORMATION

1. DESCRIPTION

This is a high-current, low-ripple, linear, adjustable and regulated Power Supply designed especially for use with audio equipment, like an API 500 Series Rack or compatible rack system.

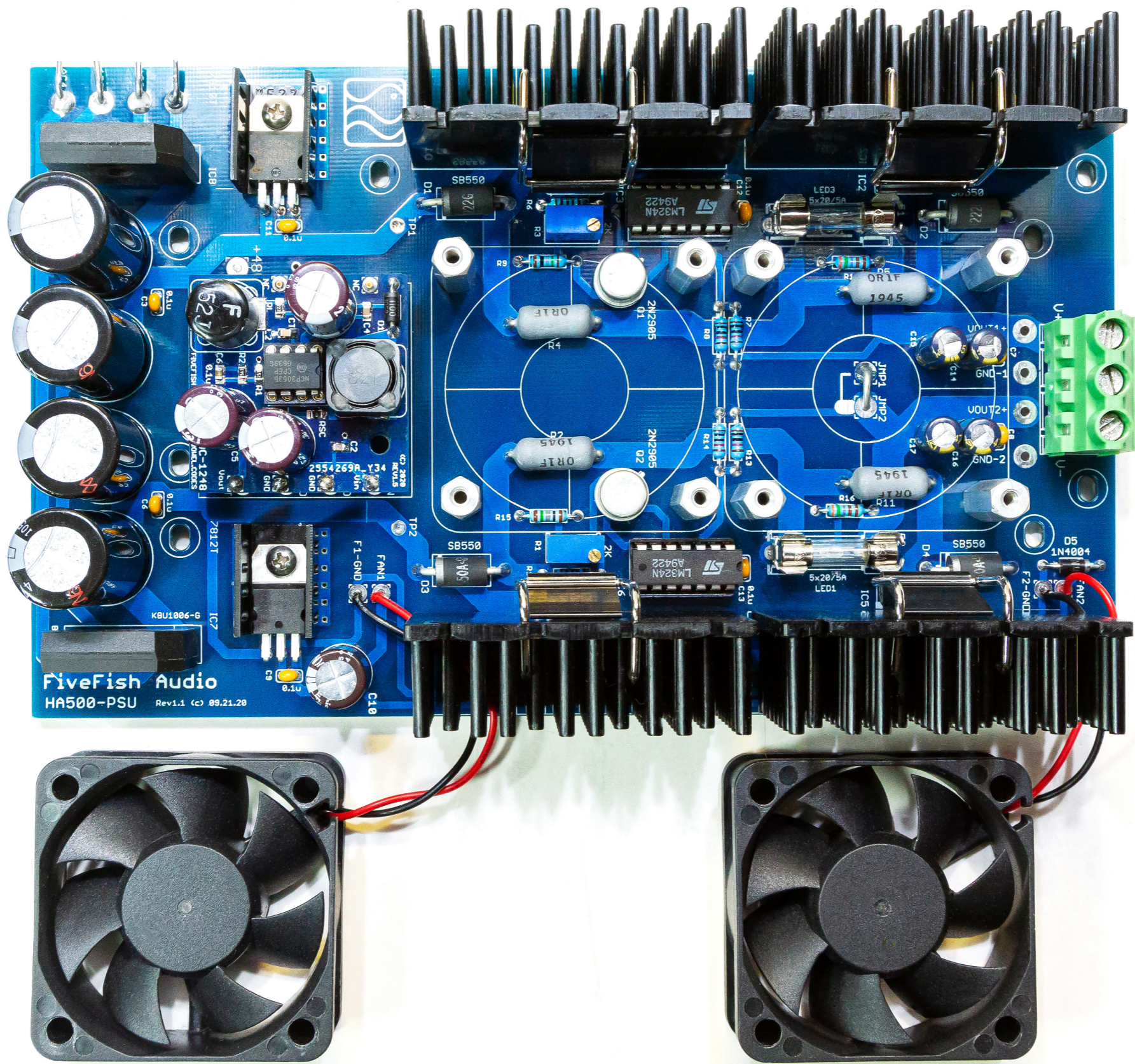
The HA500-PSU provides an adjustable and regulated V+, V- voltage rails, a +48VDC output for phantom powering microphones, a +12VDC output, and a +18VDC output. The +12VDC is used to power the on-board cooling fans, and the +18VDC fixed output is used to power the +48V DC-DC Boost Converter.

The V+ and V- power supply section are identically the same, but connected in series internally to provide the V+ and V- main outputs. The series junction of these 2 power supply modules form the GND reference point.

You can use the auxilliary +18VDC for other purposes on your project if you need to. The +12VDC auxilliary voltage can also be used to power additional cooling fans (for example: an enclosure exhaust fan). I do not recommend using the +12VDC output for other purposes but fan motors as electrical pulse noise from the motors/fans are present on this line.

Two (2) voltage regulator devices for each main output (V+ and V-) are operated in parallel provide redundancy and load sharing, thus lowering operating temperature for each device, resulting in longer life, better reliability and performance. Each device is mounted on it's own high-performance heatsink via quick-mount clips. Two (2) on-board fans provide direct forced-air cooling for the four (4) voltage regulator devices, and also incidental cooling for the two (2) bridge rectifiers.

The printed circuit board is professionally manufactured, with double-sided copper layers, plated-through holes, solder mask, and silkscreen labels.



2. TOOLS & EQUIPMENT REQUIRED

A few basic tools and equipment are required to assemble this kit. These basic tools are not supplied with the PCB/kit.

- 2.1. Soldering Iron and Lead - We recommend a temperature adjustable soldering iron. **DO NOT USE A 100 WATT SOLDERING GUN.** A small to medium-sized soldering tip is required to solder the small parts. You may use lead-free or 60/40 lead-based solder.
- 2.2 Cutter - You will need a cutter to cut component leads and wires.
- 2.3. Solder Sucker Pump - If you need to desolder a component, you'll need one.
- 2.4. Multitester - Used for measuring resistance, continuity, and voltages.
- 2.5. Magnifier & Lamp - I recommend a clean and well-lighted space for your assembly area.
- 2.6. Other Tools (not required, but nice to have) - Component lead bender, vise, tweezers, wire stripper.

3. BILL OF MATERIALS / PARTS LIST

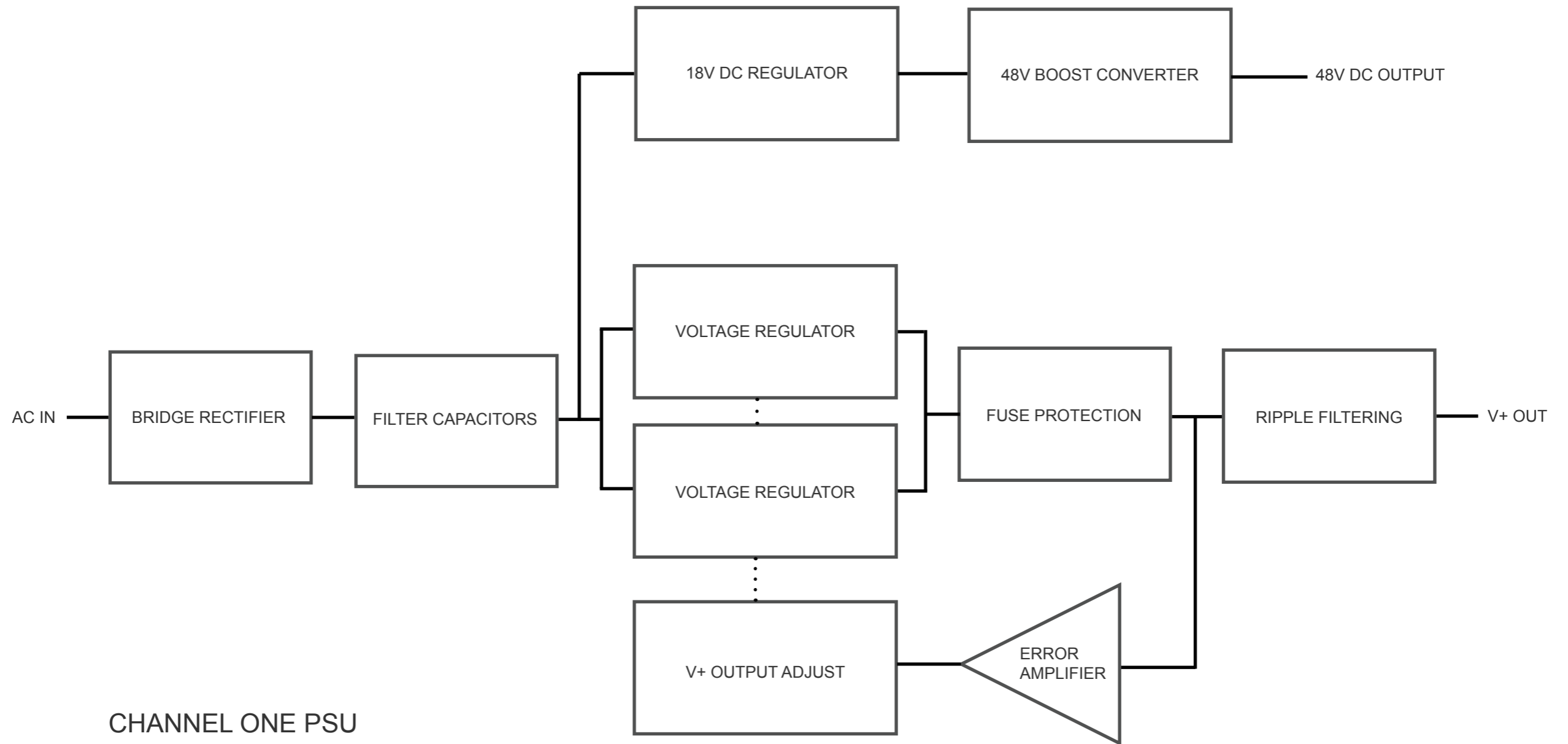
Most of the parts can be purchased from Mouser or Digikey or any reputable electronics component distributor.

Bill of Materials HA500-PSU

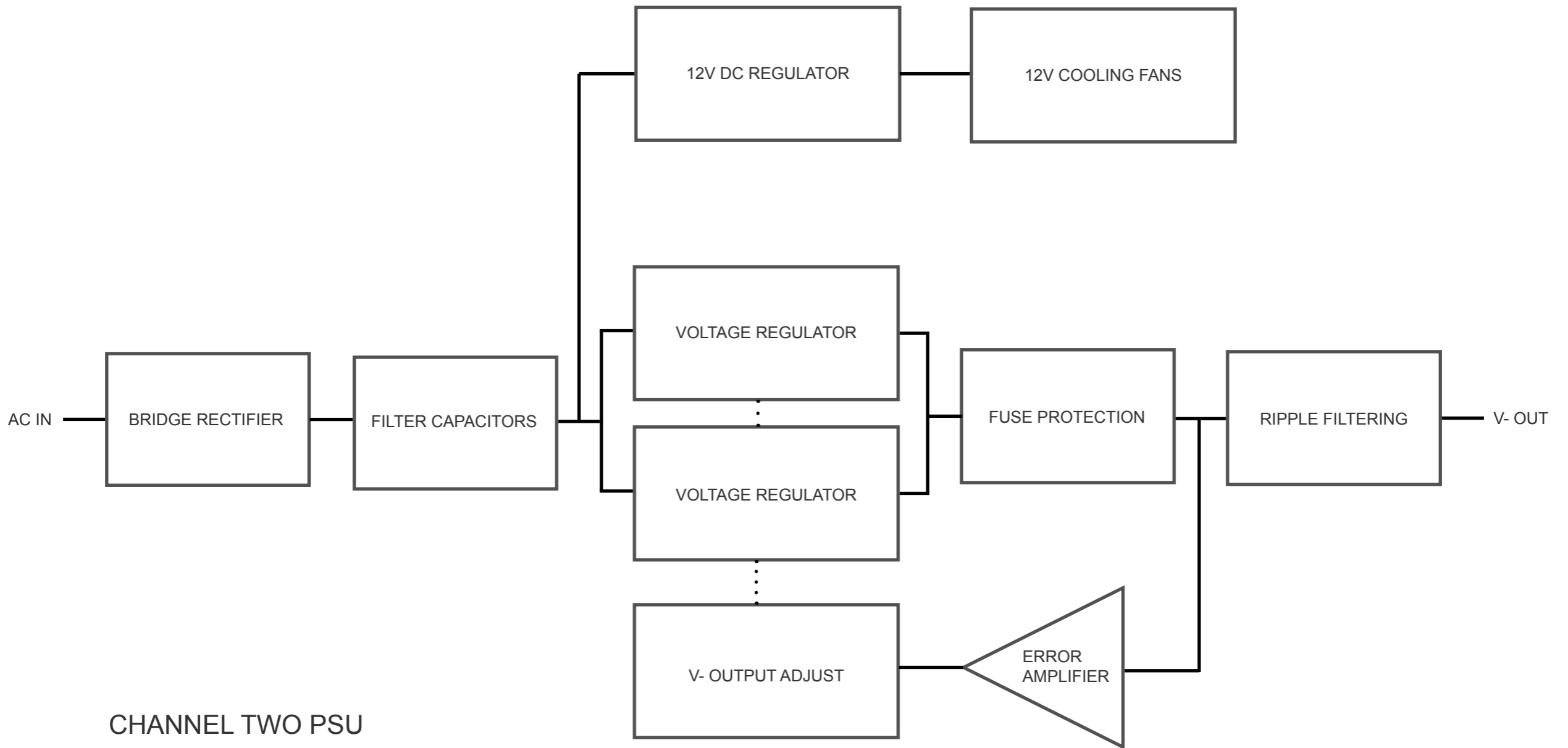
QTY	PART REFERENCE	VALUE	DESCRIPTION	SOURCE	SOURCE PART#
1	PCB	PCB	PCB	FiveFish Audio	HA500-PSU PCB
1	48V-MODULE	DC-1248	48V DC Generator	FiveFish Audio	DC-1248
2	R1, R3	2K TRIMMER	Trimmer Resistor, 25-turn Top Adjust	Mouser	594-64Y202
4	R2, R4, R5, R11	0R1	0.1-ohm Resistor, 0.1Ohms 5W 1%	Mouser	605-RWHSE09TQ000R1FS
2	R10, R16	3K57	1/4 watt Metal Film Resistor	Mouser	
4	R7, R8, R13, R14,	10K	1/4 watt Metal Film Resistor	Mouser	
2	R6, R12	100R	1/4 watt Metal Film Resistor	Mouser	
2	R9, R15	158R	1/4 watt Metal Film Resistor	Mouser	
1	RLOAD	6K8	1/4 watt Metal Film Resistor	Mouser	
4	C1, C2, C4, C5	4700uf / 35V	Electrolytic Capacitor, 16mm dia., 7.5mm LS	Mouser	667-EEU-HD1V472
8	C3, C6, C7, C8, C9, C11, C12, C13	0.1uF / 100V	Ceramic Capacitor	Mouser	80-C320C104K1R
1	C10	220uf / 50V	Electrolytic Capacitor	Mouser	647-UPW1H221MPD6
4	C14, C15, C16, C17	47uf / 50V	Electrolytic Capacitor	Mouser	667-EEU-FC1H470
2	Q1, Q2	2N2905	PNP Transistor BJT PNP 60Vcbo 0.8Watt	Mouser	610-2N2905
2	BR1, BR2	KBU1006-G	Bridge Rectifier, VR=600V IAV=10A	Mouser	750-KBU1006-G
4	D1, D2, D3, D4	SB550	Schottky Diodes & Rectifiers 5.0Amp 50Volt	Mouser	625-SB550A-E3
1	D5	1N4004	Diode, 400V 1A	Mouser	750-1N4004T-G
4	IC1, IC2, IC4, IC5	LM338T	Adjustable Voltage Regulator, LM338	Mouser	926-LM338T/NOPB
2	IC3, IC6	LM324	Quad OpAmp	Mouser	595-LM324N
1	IC7	7812CTG	12 Volt Regulator, TO-220	Mouser	863-MC7812CTG
1	IC8	7818CTG	18 Volt Regulator, TO-220	Mouser	863-MC7818CTG
2	LED1, LED3	Color LED	3mm LED	Mouser	

2	F1, F2	6 Amps	Fuse, use appropriate value for your application	Mouser	576-0235006.HXP
4	FUSE CLIPS	Fuse Clip	5x20mm Fuse Clips	Mouser	504-BK/1A5018-10-R
2	FAN1, FAN2	12V FAN	50mm x 50mm x 20mm, 12V PC COOLING FAN	Amazon	B0837YKXXF
2	14P IC SOCKET	14P SOCKET	14-PIN PDIP SOCKET	Mouser	474-PRT-07939
4	HS1, HS2, HS3, HS4	Heatsink	Ohmite Heat Sinks Dual Pin Fin	Mouser	588-PA-T21-38E
1	CONN1	1704936	Phoenix Connector 1704936	Mouser	651-1704936
8	SPACERS	0.75" Spacer	0.75" M/F Aluminum Spacer, Keystone	Mouser	534-8403
8	MACHINE SCREWS	4-40 x 3/4"	4-40 Machine Screws and Nuts	eBay, Amazon	

4. BLOCK DIAGRAM



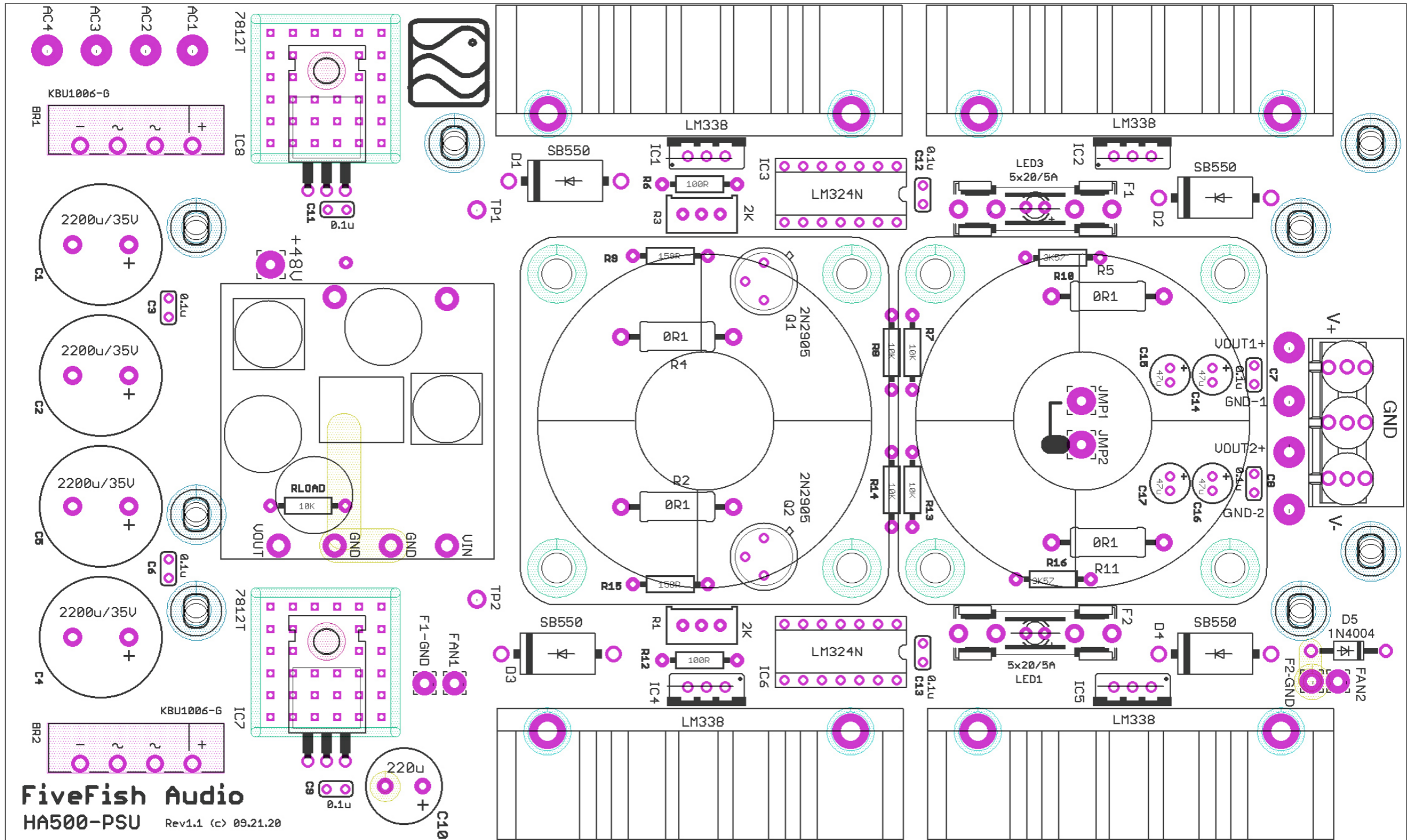
CHANNEL ONE PSU

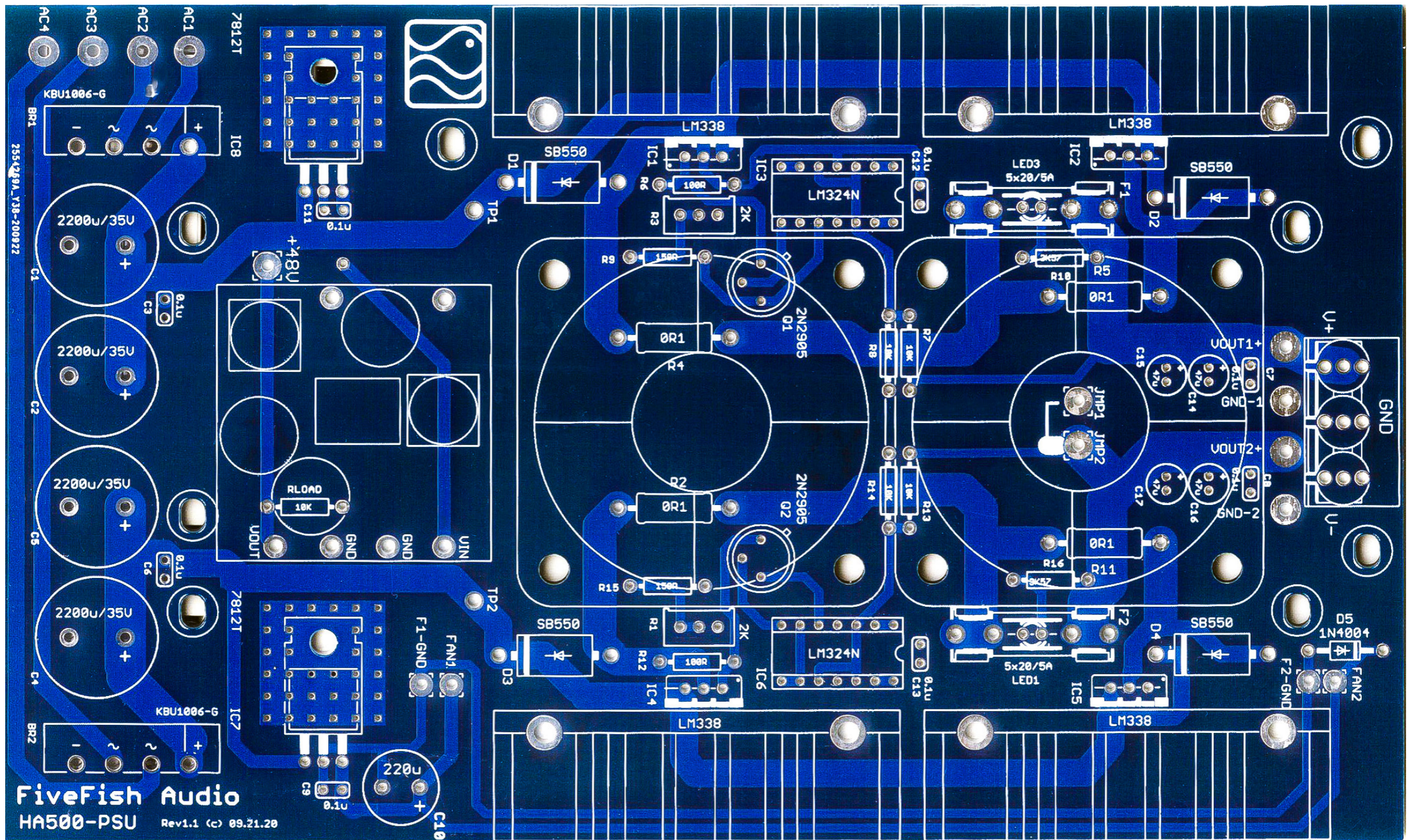


CHANNEL TWO PSU

Note: Channel Two is connected in series with Channel One PSU. Therefore, the V- Out becomes the Reference GND of the whole HA500 Power Supply and the GND of Channel Two is actually -Vout.

5. COMPONENT GUIDE





6. BUILD GUIDE

IMPORTANT:

PLEASE REVIEW SECTION 7.0 FOR ERRATA AND LAST MINUTE CHANGES BEFORE PROCEEDING WITH THE BUILD STEPS.

GENERAL BUILD TIPS & NOTES:

Solder the smallest/shortest component first before the larger/taller components.

The two Bridge Rectifiers require heatsinks if you plan on operating the HA500-PSU with current loads greater than 3 Amps. You can use a simple folded aluminum plate as your heatsink. You can bend a strip of aluminum in an L-shape fashion and mount it with a nut and bolt to the Bridge Rectifier.

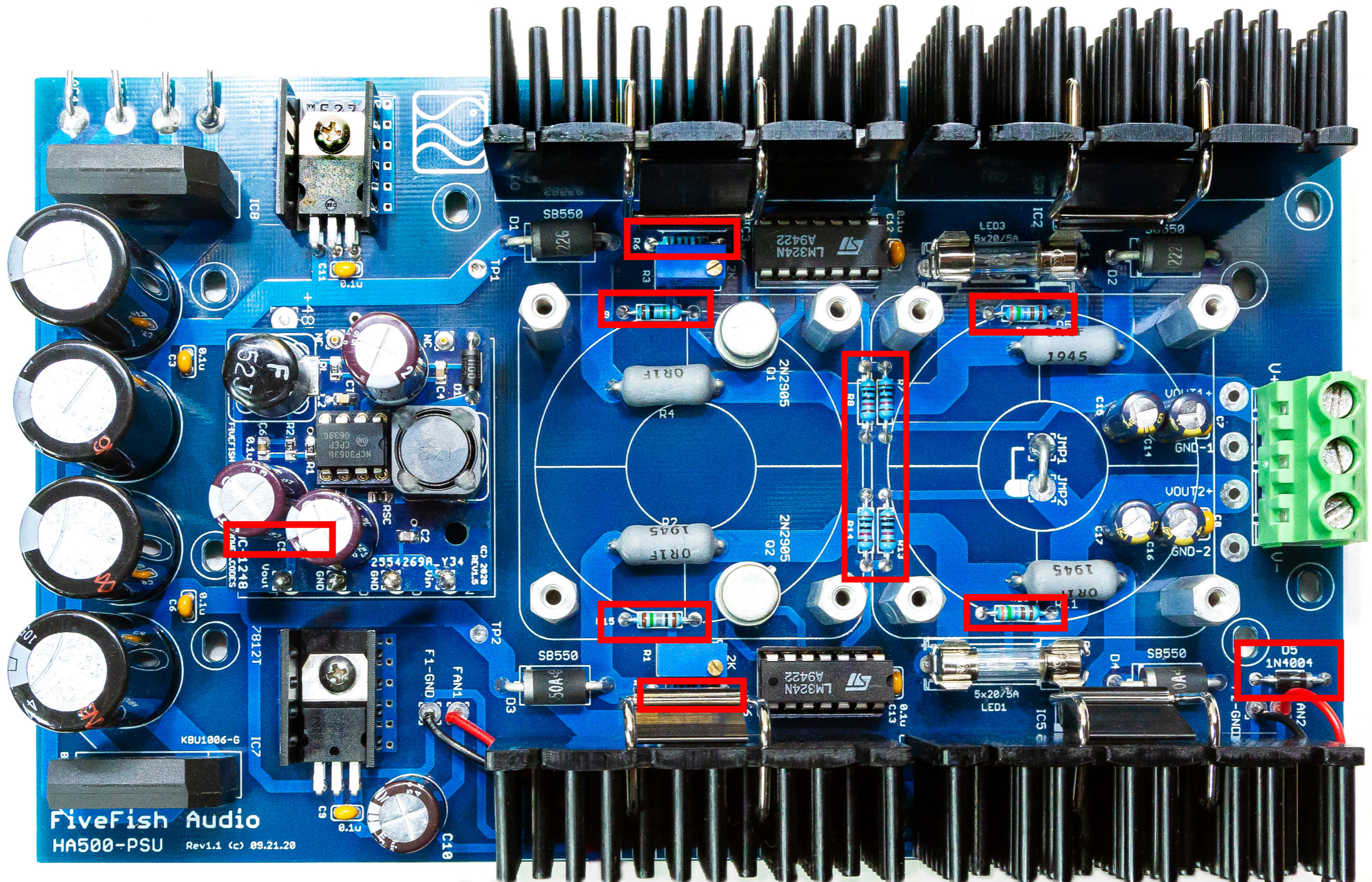
The DC-1248 Boost Converter module is optional. If you don't need 48V Phantom Power, then you don't need to install this module. This module can supply 80-100mA of 48Volts, suitable for powering several channels of condenser microphones. Typically, modern condenser microphones consume 3-5mA each, but a very few vintage mics can consume the full 10mA.

The 7812 and 7818 voltage regulators need to be mounted on a TO-220 heatsink. To avoid undue stress on these devices, mount them first to the heatsink, secure with nut and bolt before soldering their lead terminals to the main board.

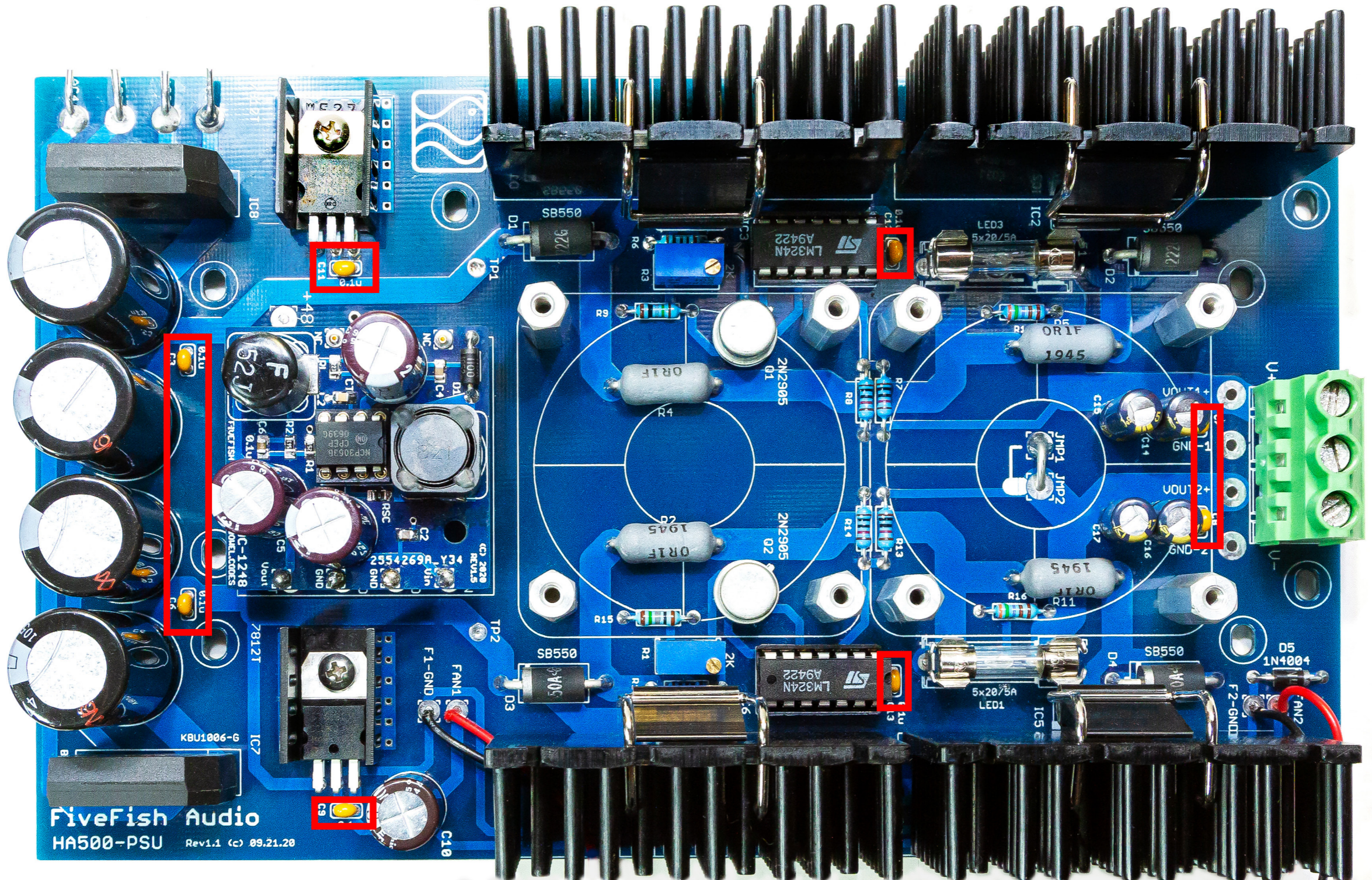
The main voltage regulators are attached to the main heatsinks via quick snap-on clips. Solder the heatsinks to the board first. Make sure the heatsinks are installed vertically straight. Insert the voltage regulator to the PCB but DO NOT SOLDER yet. Clip the voltage regulators to the heatsinks FIRST -- make sure the regulators are vertical straight and secured with the clip, before soldering the regulator's lead terminals to the main board.

The HA500-PSU requires (2x) 50mm x 50mm x 20mm height, 12-Volt Cooling Fans if you plan on operating this power supply at high current. I highly recommend use of the cooling fans. Mount each cooling fan on (4x) 0.75" aluminum spacers using 4-40 machine screws.

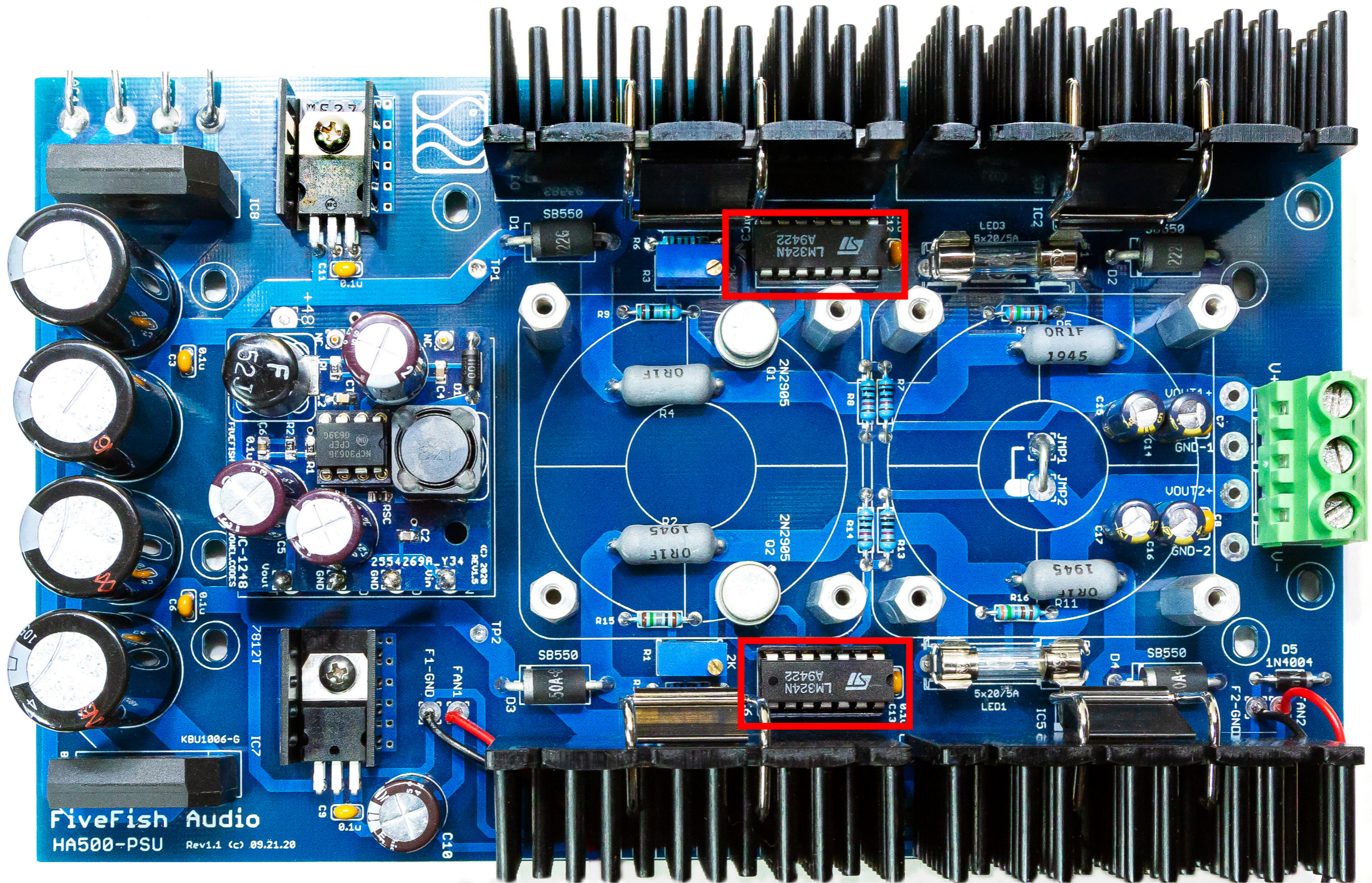
6.1. Solder all 1/4 Watt Resistors and D5 Diode (1N4004). Take note of D5 polarity orientation. The diode band should be on the outside edge of the PCB. See also Section 7.2 for ERRATA information for RLOAD value.



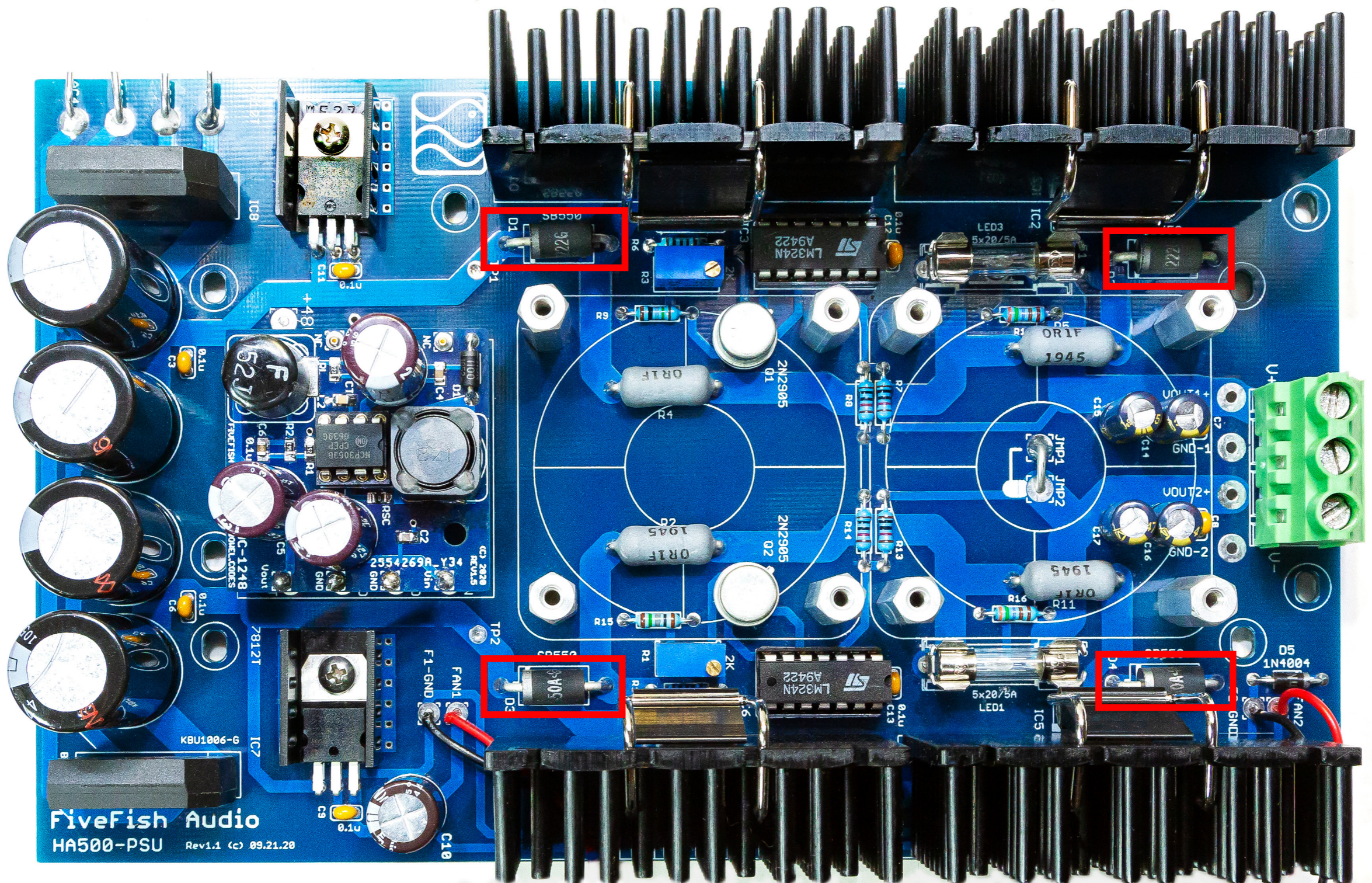
6.2. Solder all ceramic capacitors.



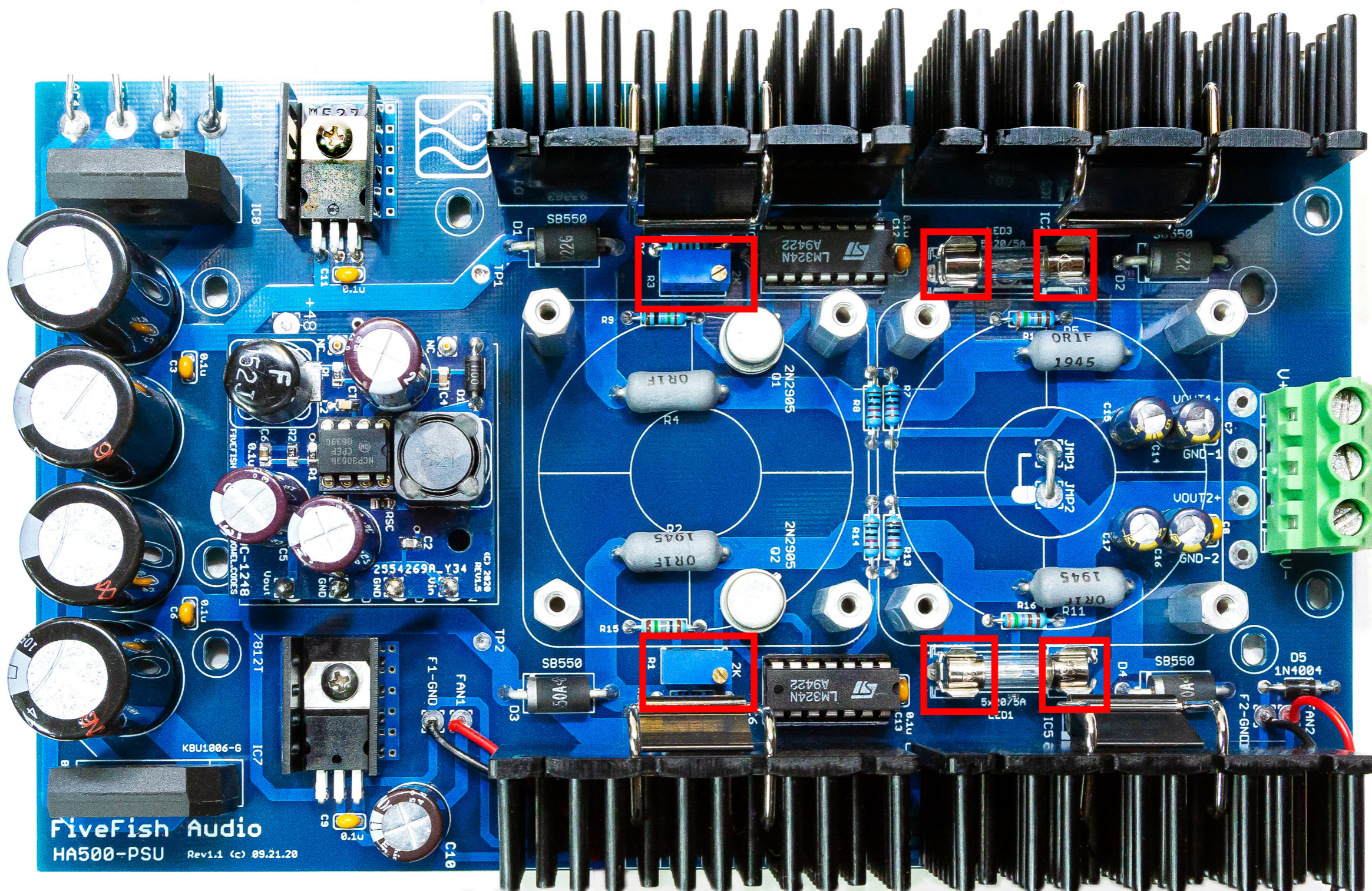
6.3. Solder the IC SOCKET. (Not the IC chip itself, but just the 14-pin IC socket.)



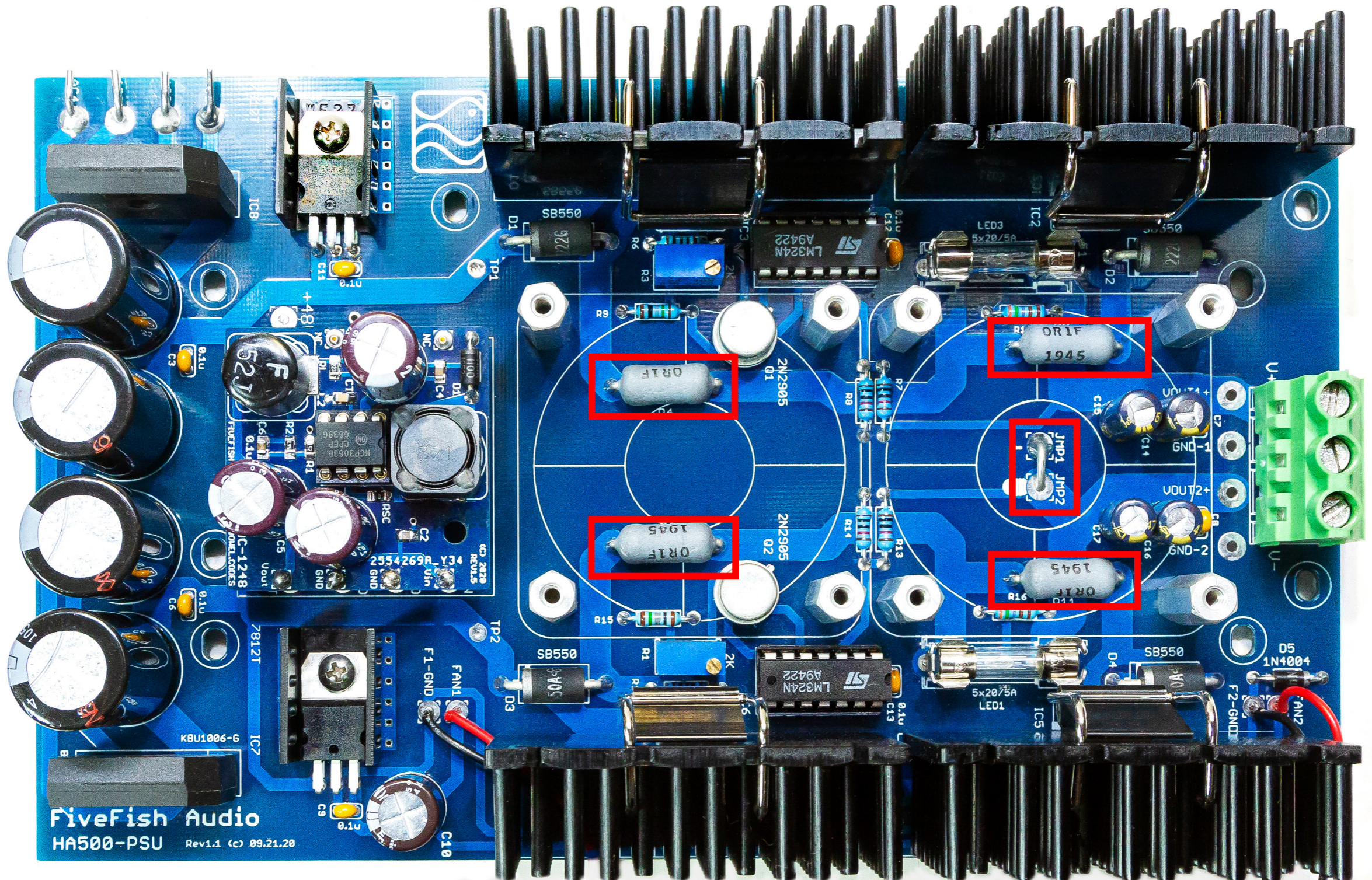
6.4. Solder the large Diodes D1, D2, D3, and D4. Take note of the proper orientation. Consult the photo for reference or follow the silkscreen on the PCB.



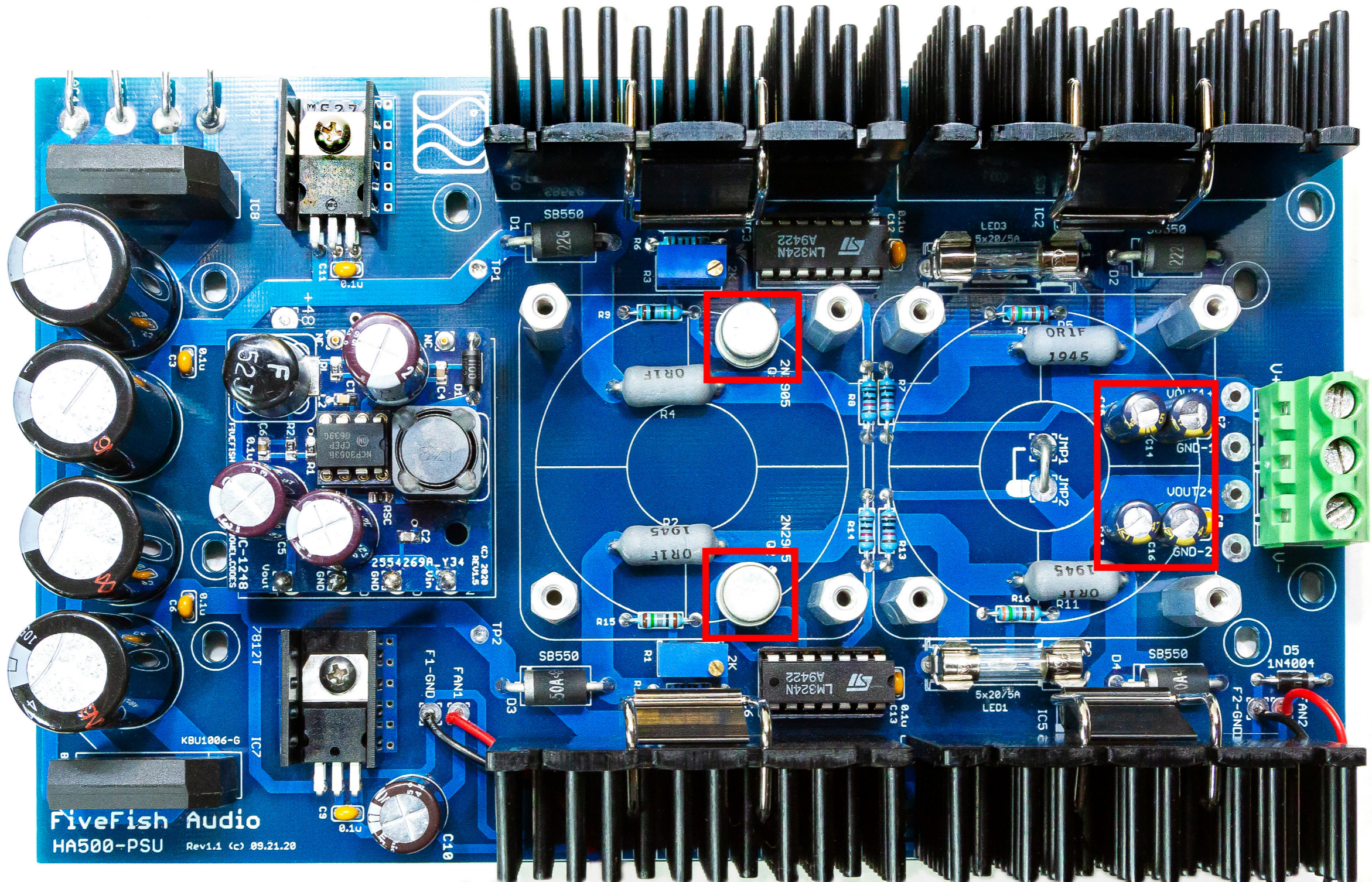
6.5. Solder the two (2) Trimmer Resistors, and the (4) Fuse Clips. NOTE: One end of the fuse clip has a stopper. Make sure to position the stop end of each fuse clip on the outside edge.



6.6. Solder the four (4) 5-watt Power Resistors and Jumper JP1. Bend the resistor leads as close as possible to the resistor body. TIP: Give these resistors at least a 1mm clearance above the PCB when soldering them, that way the resistors aren't touching the PCB. Save one of the cut resistor leads and use this as the jumper for JP1 location. Solder on both top and bottom pads of PCB.

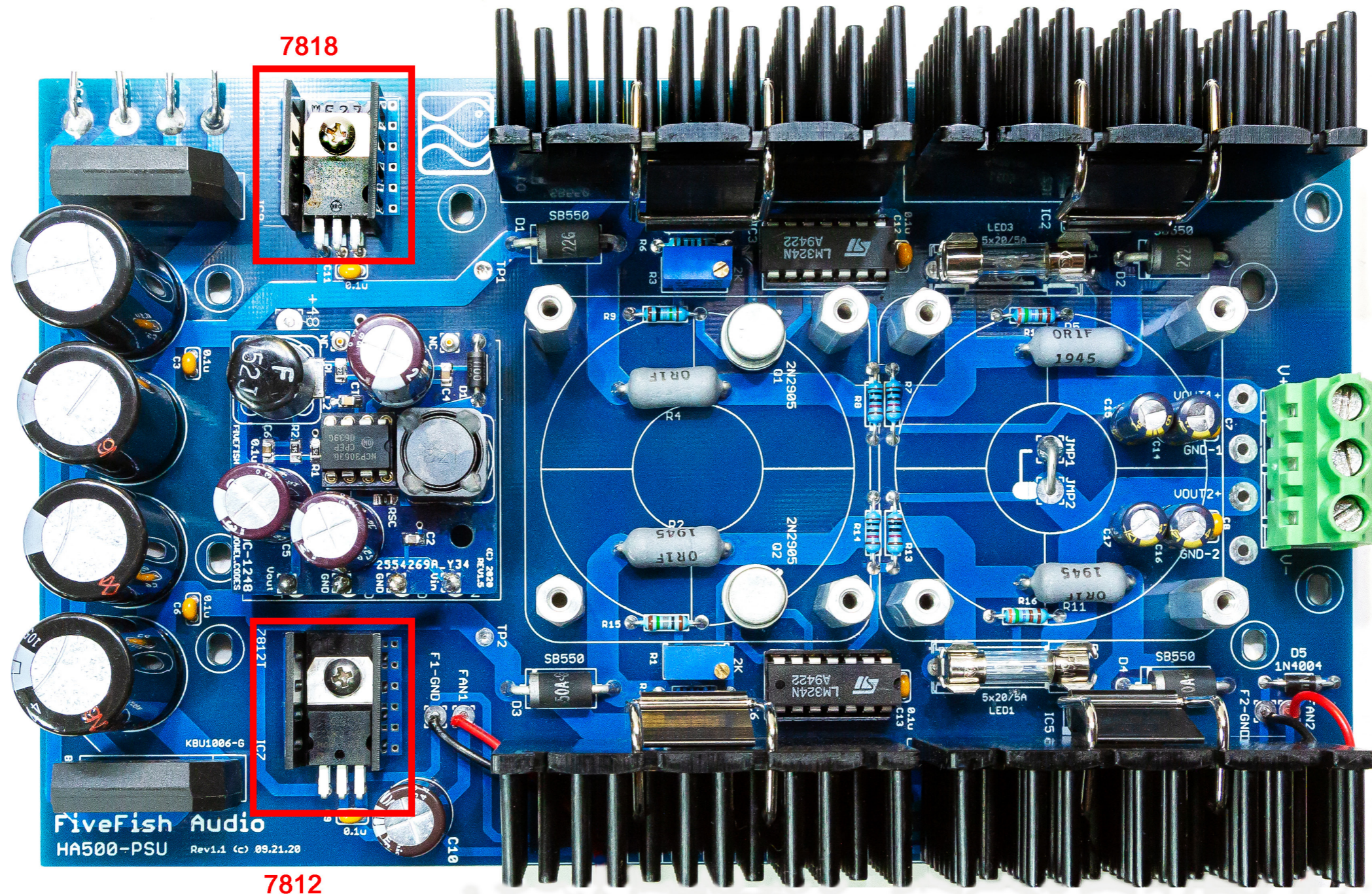


6.7. Solder the four (4) small 47uf capacitors and two (2) Transistors. Take note of proper polarity orientation. Follow proper orientation of the transistor when soldering. There is a tab on the transistor body case. Match this tab with the silkscreen on the PCB.

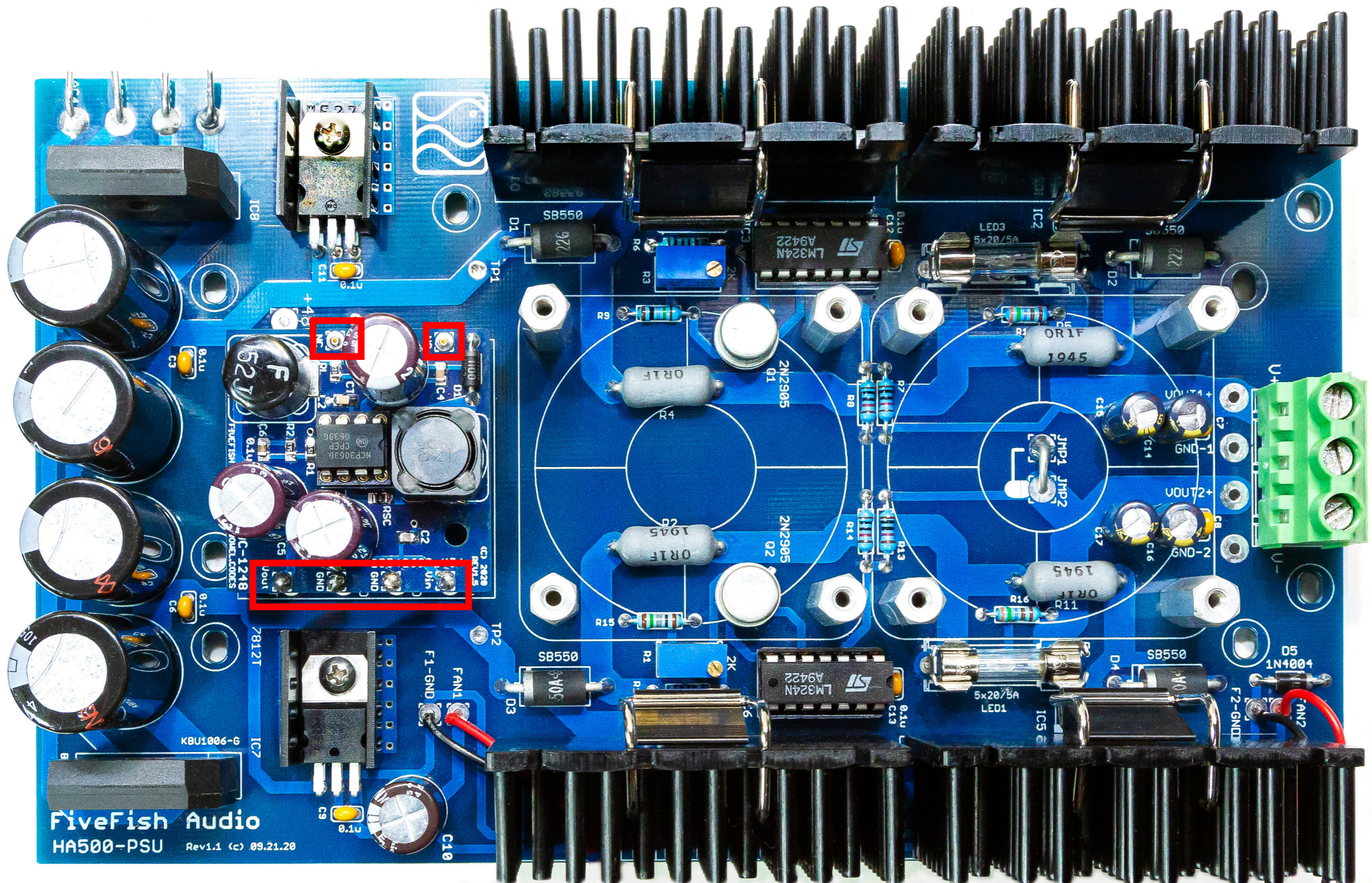


6.8. Voltage Regulator IC7 is a 7812 (12-Volt) for powering the cooling fans. IC8 is a 7818 (18-Volt) for powering the DC-1248 Converter Module. See Section 7.3 ERRATA information. Follow the steps below for proper mounting of these devices.

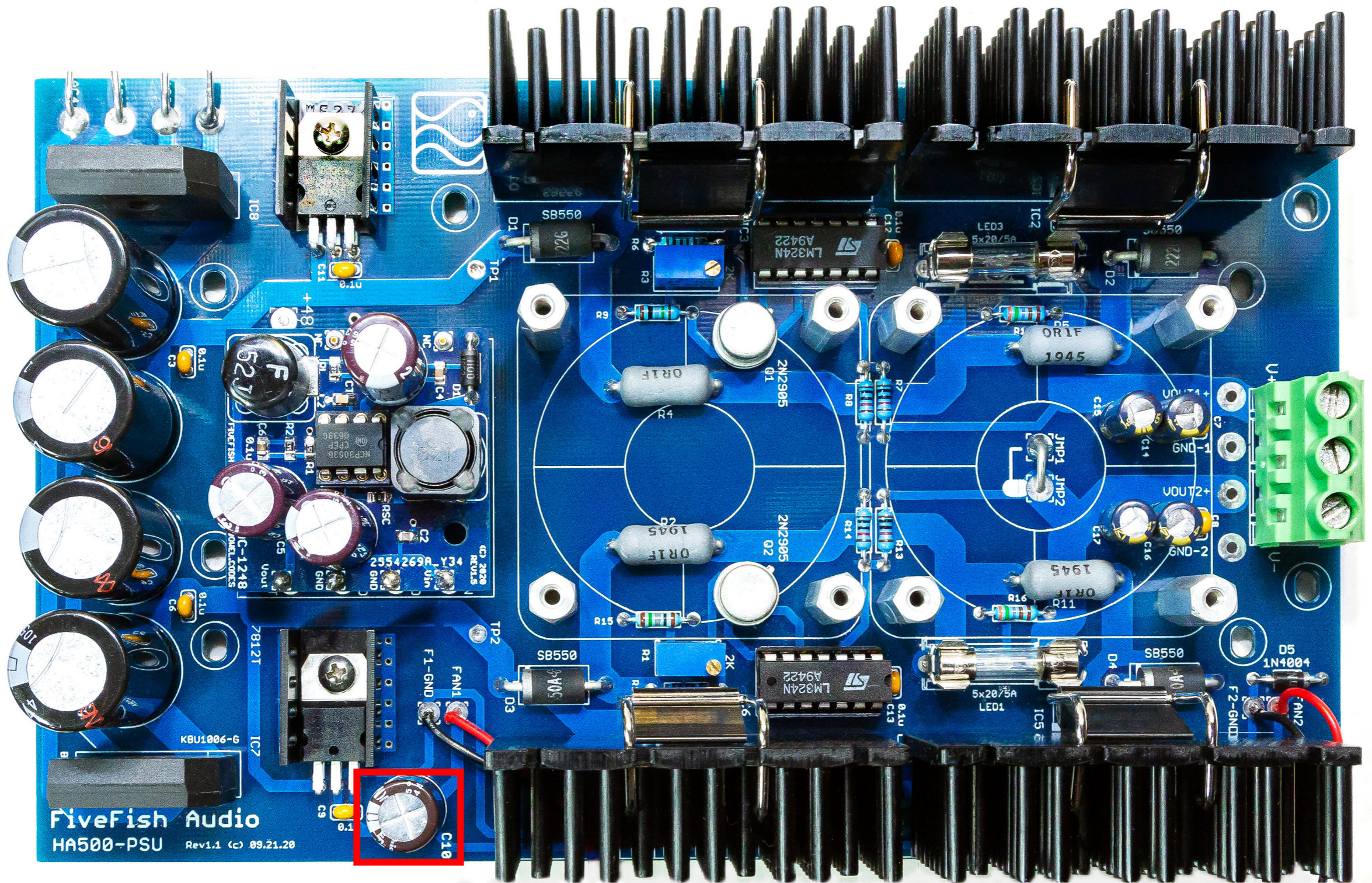
Bend the Voltage Regulator legs as shown in the photo. **DO NOT SOLDER** yet! Then mount the TO-220 Heatsink and Voltage Regulator to the PCB using a 1/4" machine screw and 4-40 nut while keeping the Voltage Regulator leads inserted into the PCB. **DO NOT SOLDER** yet! Tighten the nut and bolt against the PCB. After securing the heatsink and device to the PCB, now you can solder the (3) legs of the Voltage Regulator. Repeat steps for the other Voltage Regulator.



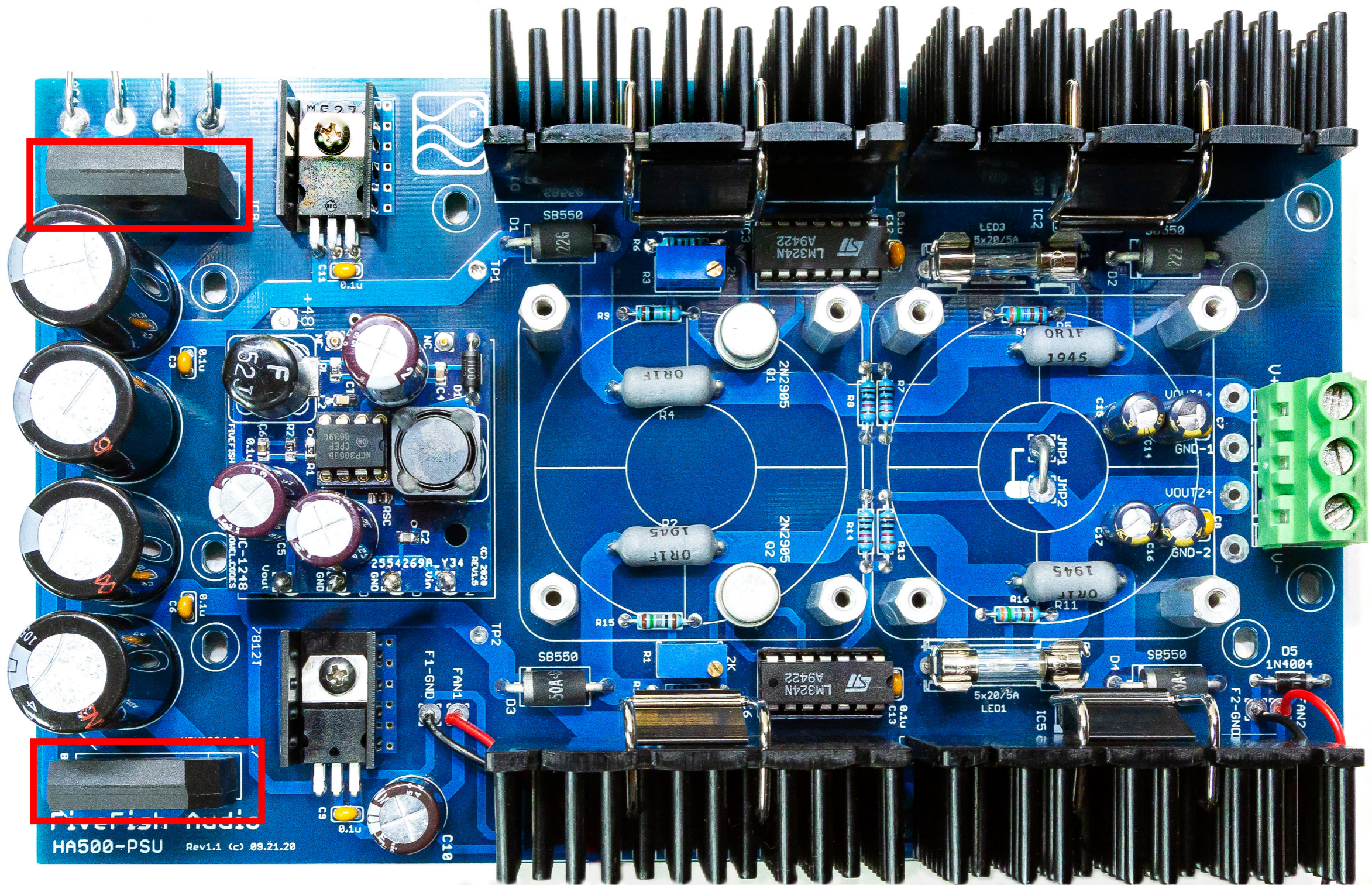
6.9. Solder the six (6) Mill-Max sockets for the 48V Phantom Power Generator PC Board Module. Keep these sockets vertically straight and perpendicular to the PCB. OPTIONAL: If you're not planning on using the 48Volt Phantom Power Generator Module, you can skip this step.



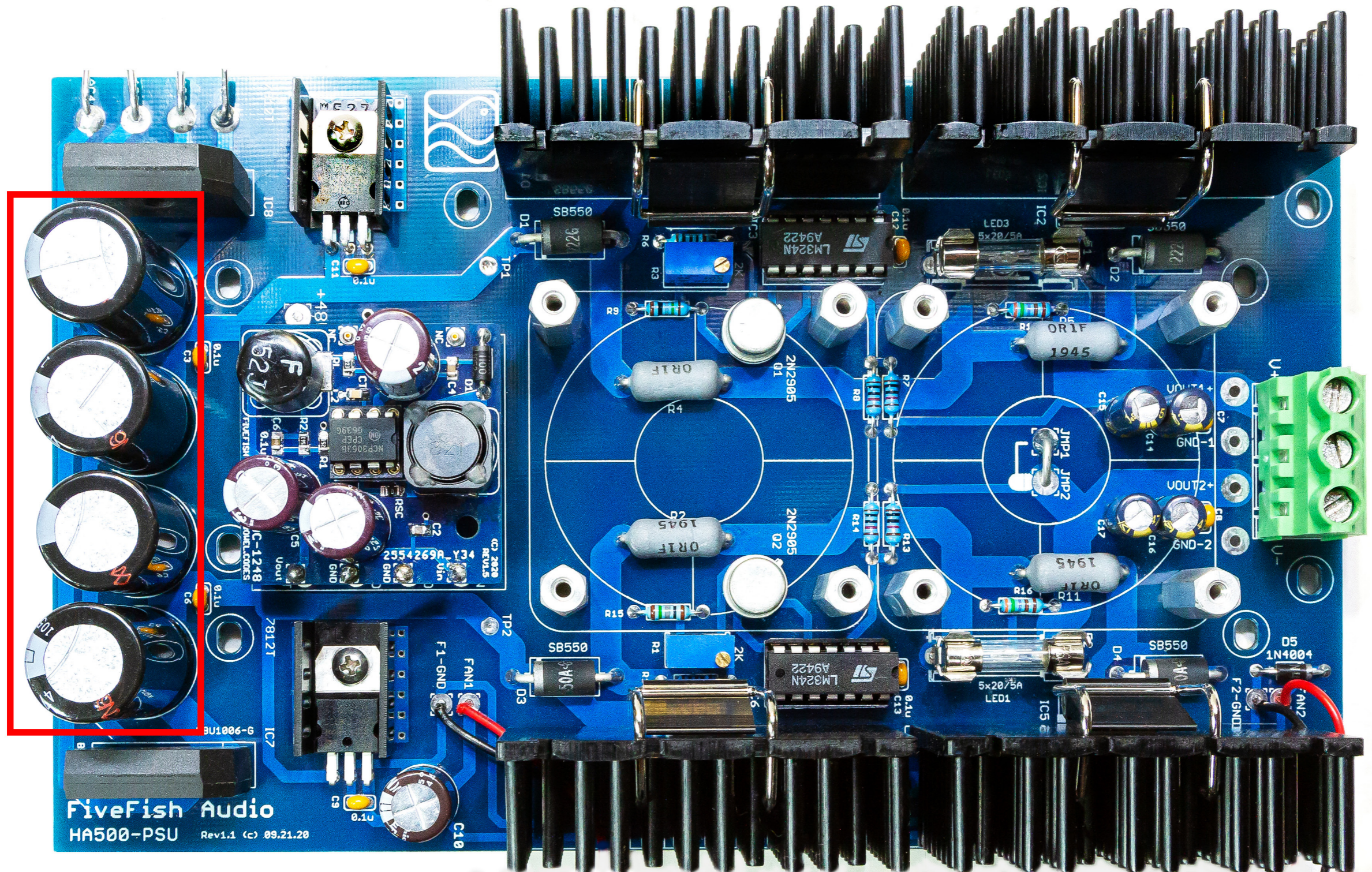
6.10. Solder C18 capacitor, located near IC7 (the 7812 Regulator). Take note of proper polarity orientation.



6.11. Solder the two (2) Bridge Rectifiers, BR1 and BR2. Take note of proper polarity orientation. Follow the silkscreen on the PCB.

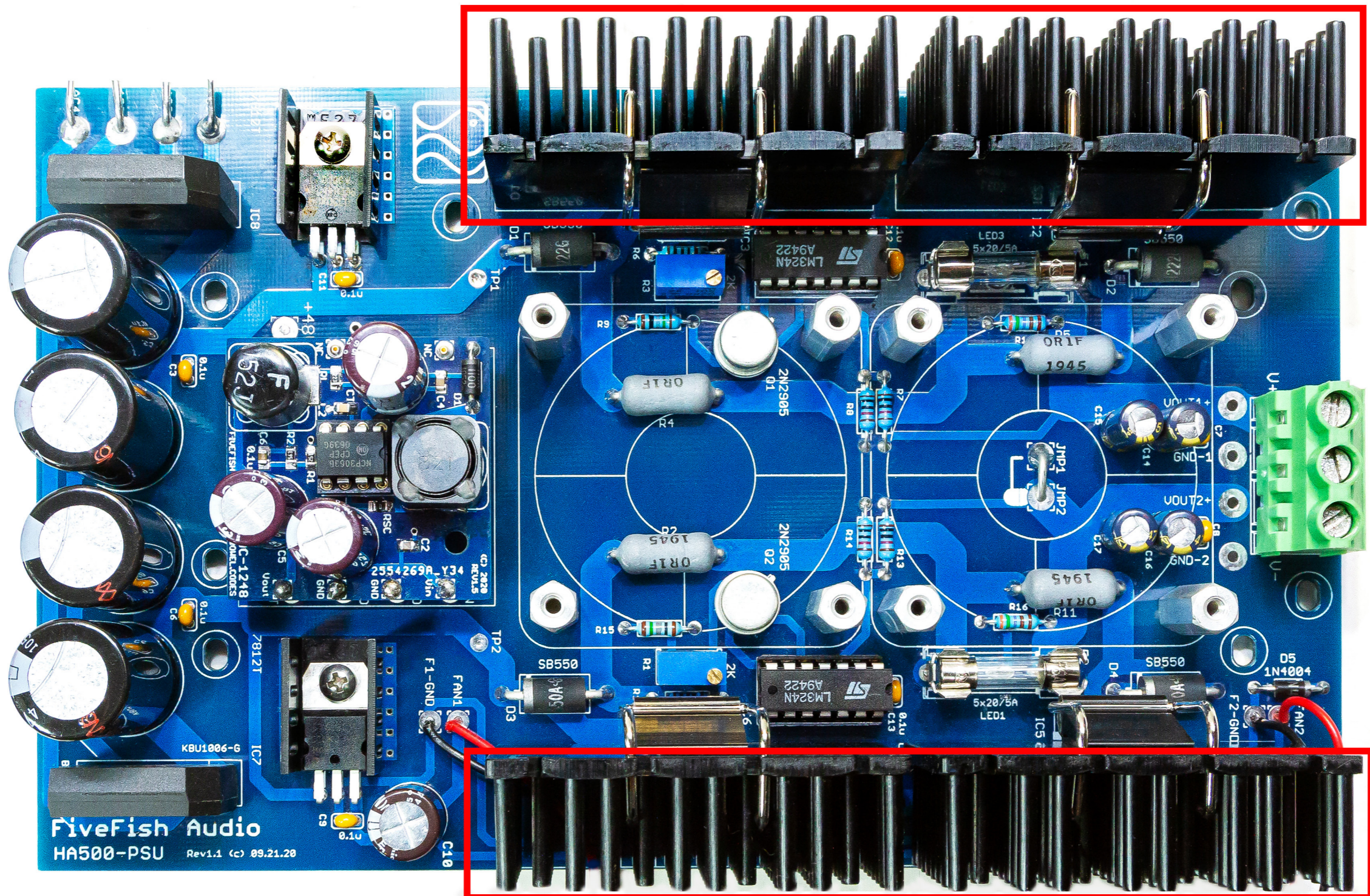


6.12. See Section 7.1 for ERRATA information. Solder the four (4) large Electrolytic Capacitors. Take note of proper polarity orientation.



6.13. Solder the four (4) large main heatsinks. Solder one tab terminal of the heatsink first, then check to make sure heatsink is orientated vertically straight and perpendicular to the PCB. Make adjustments if the heatsink is not vertically straight. If heatsink is perpendicular straight, then solder the second heatsink tab. Repeat procedure for all the remaining heatsinks.

NOTE: You may want to familiarize yourself first with how the locking clip works to make the next step easier.



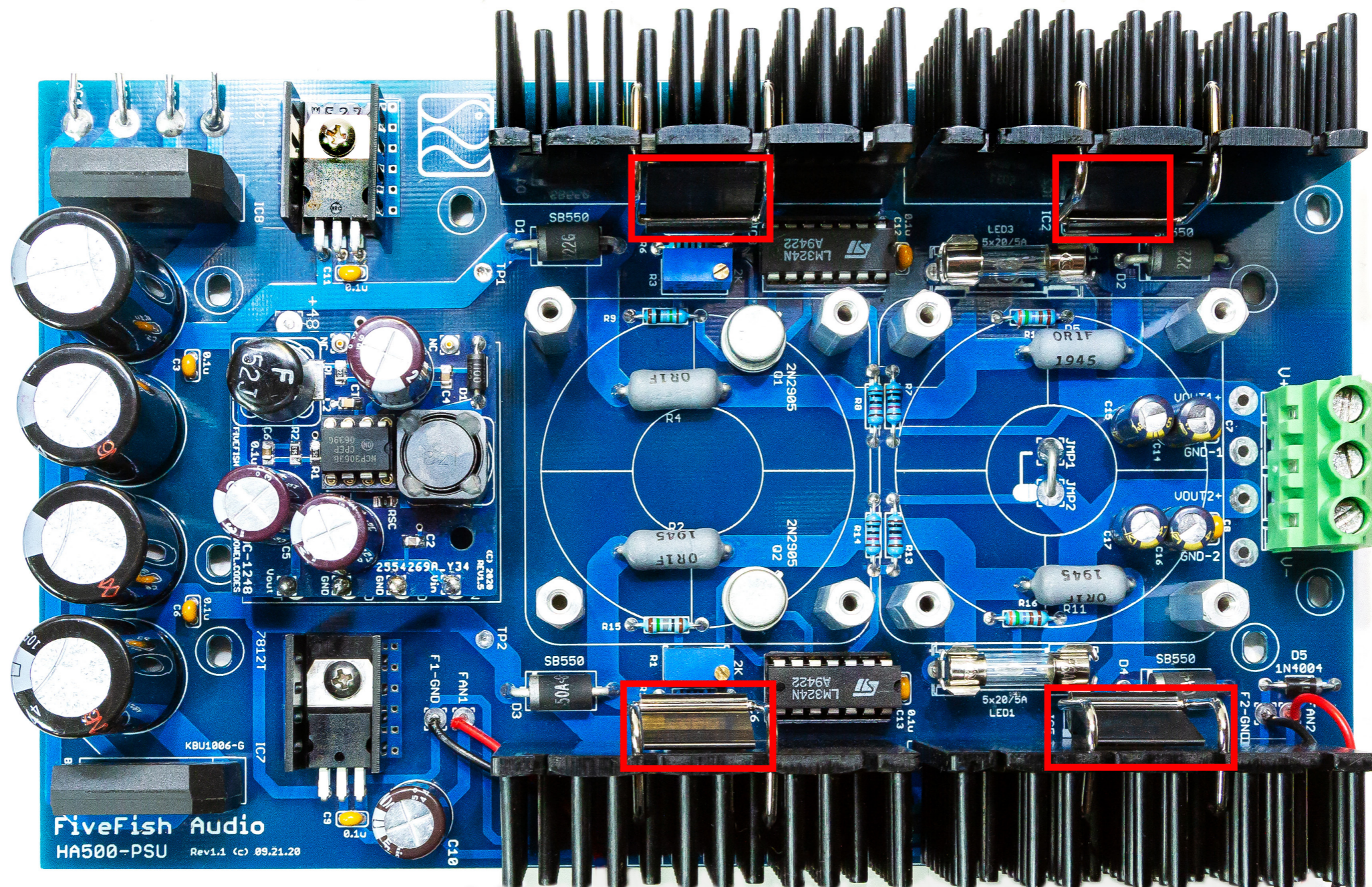
6.14. There's another four (4) identical Voltage Regulators on the board. Repeat the following steps for each Voltage Regulator:

Position and Insert the Voltage Regulator into it's PCB location but **DO NOT SOLDER** yet!

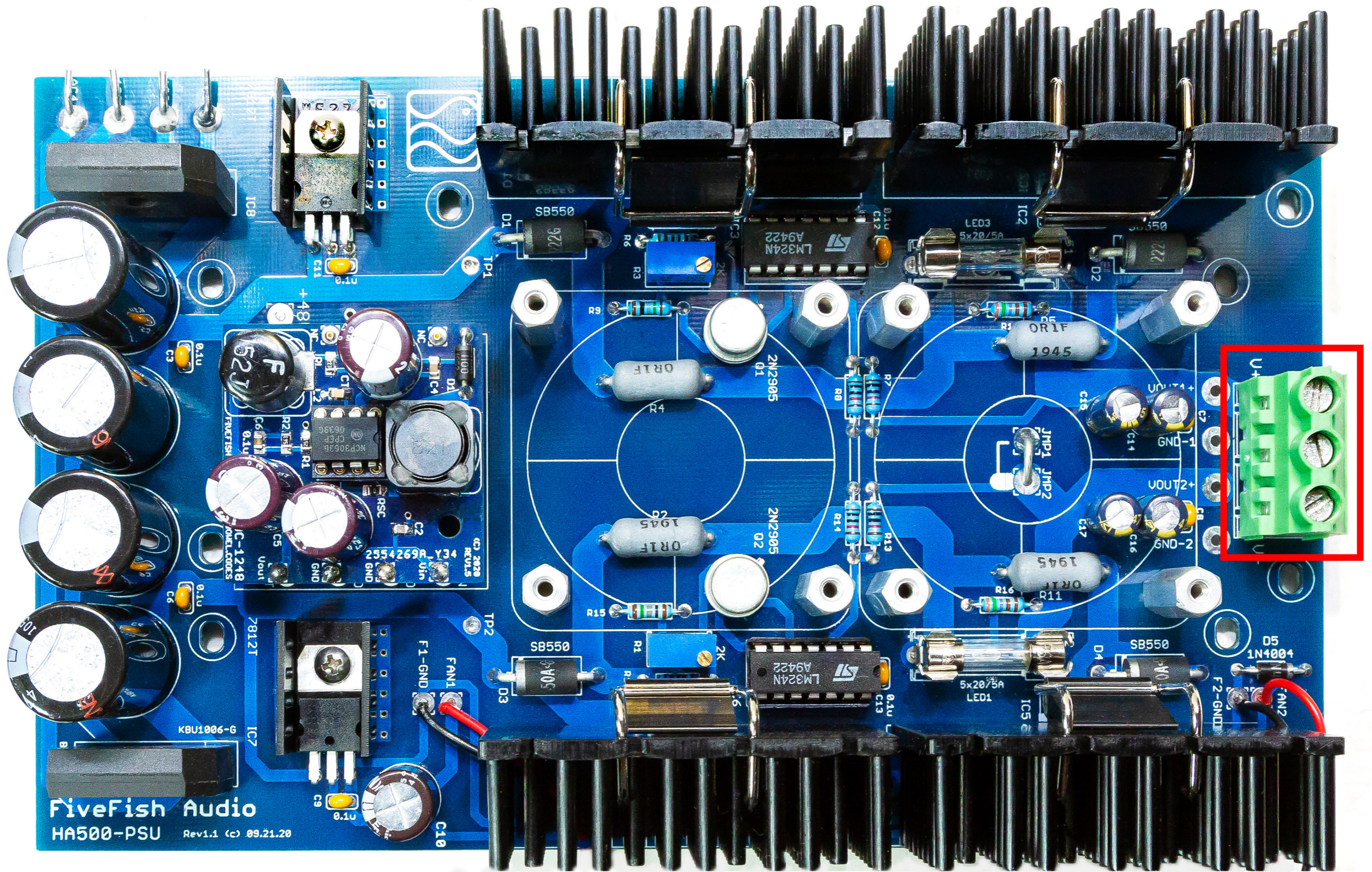
Adjust the height/position of the Voltage Regulator so you can properly clip it against the heatsink. Adjust and lock the clip to secure the Voltage Regulator against the heatsink.

With the Voltage Regulator securely mounted and clipped against the heatsink, turn the PCB over and solder the (3) terminals of the Voltage Regulator.

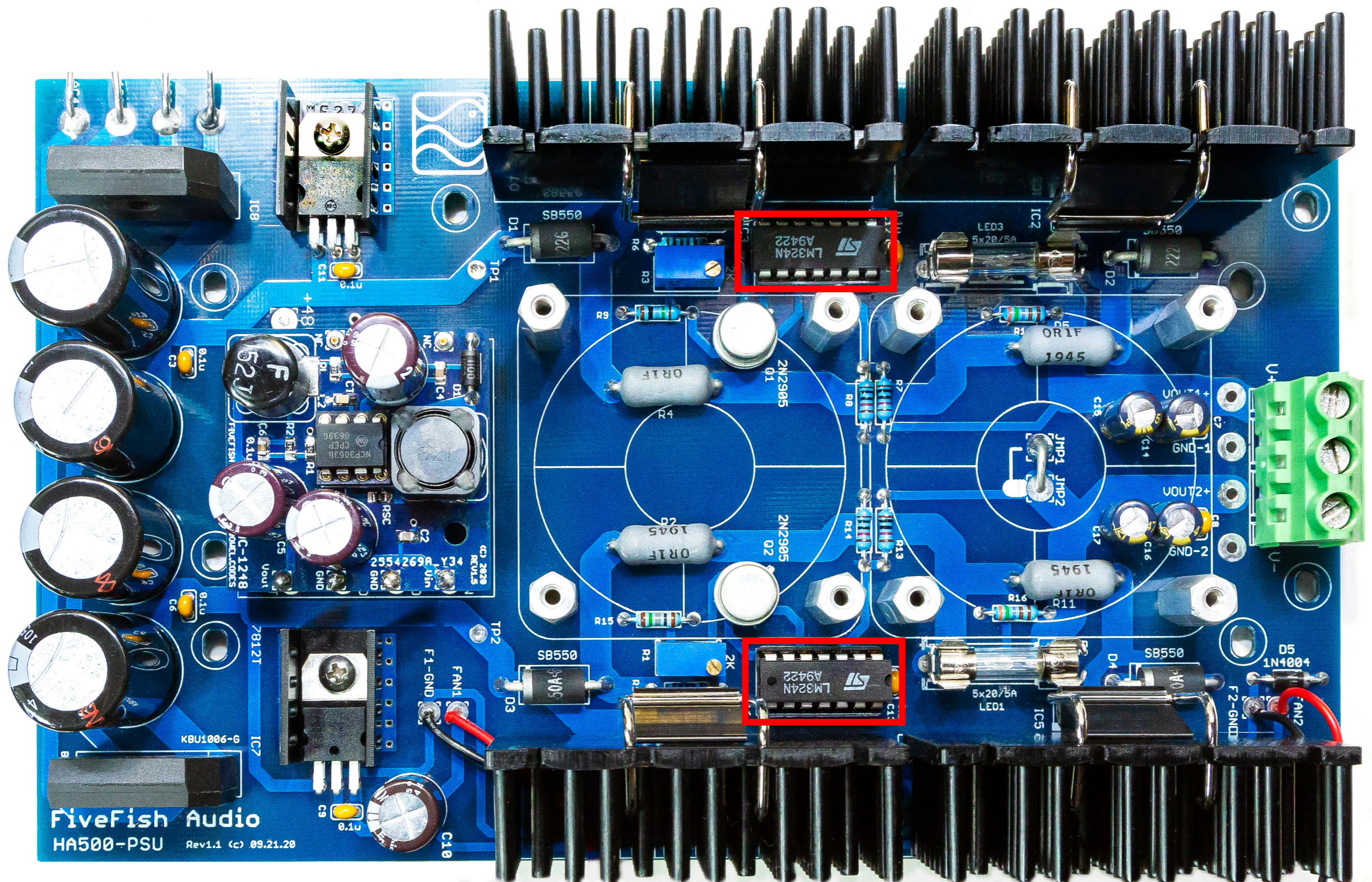
Repeat the above steps for the remaining Voltage Regulators.



6.15. OPTIONAL: Solder the 3-terminal Phoenix screw-on connector.



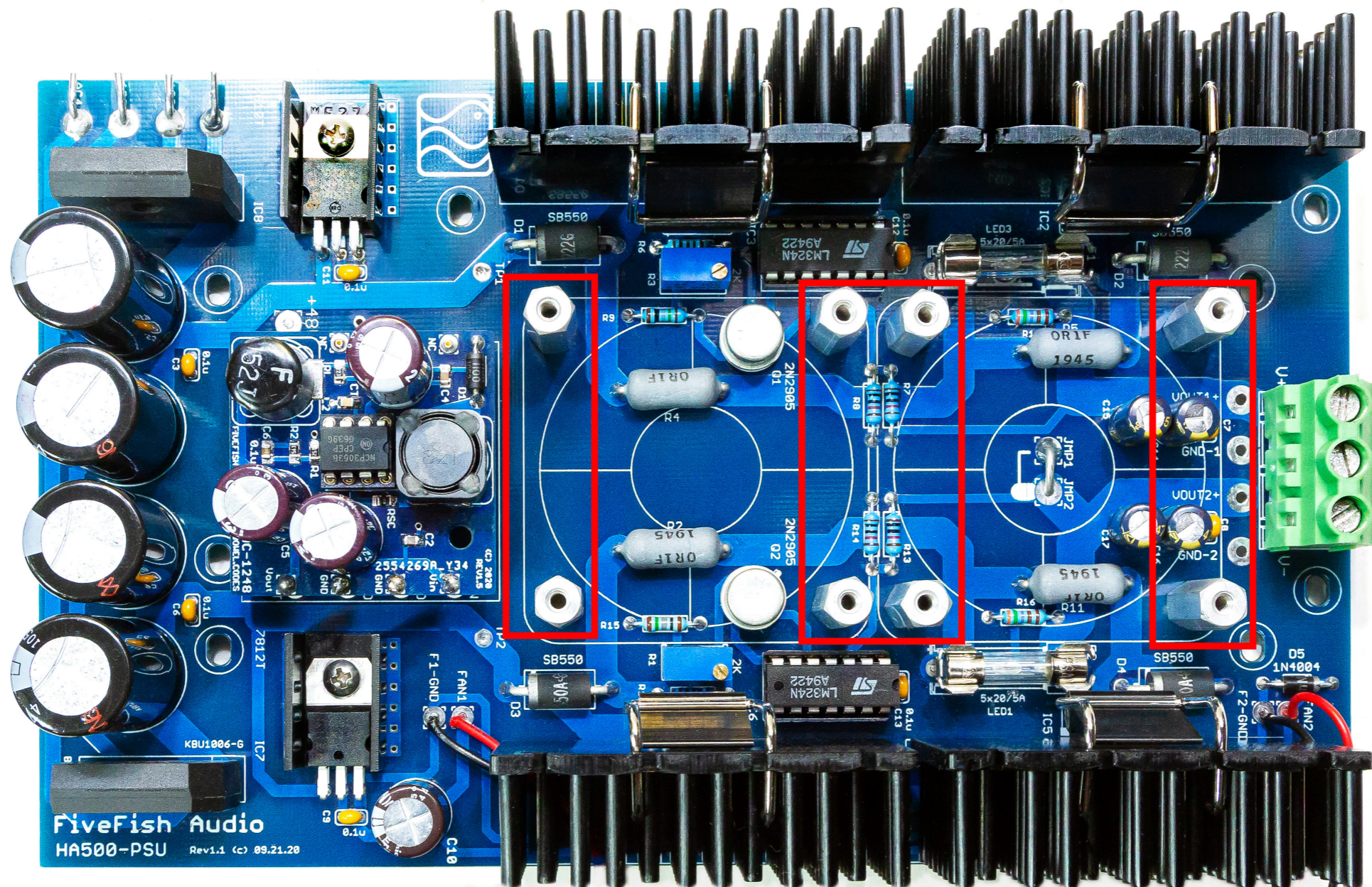
6.16. Insert the two (2) LM324 IC Chips into their IC Sockets. Follow proper orientation. Refer to the photo below, or follow the silkscreen on the PCB. Insert also the two (2) 5Amp or 6Amp fuse to the fuse holders. Push down until you hear it snap and lock.



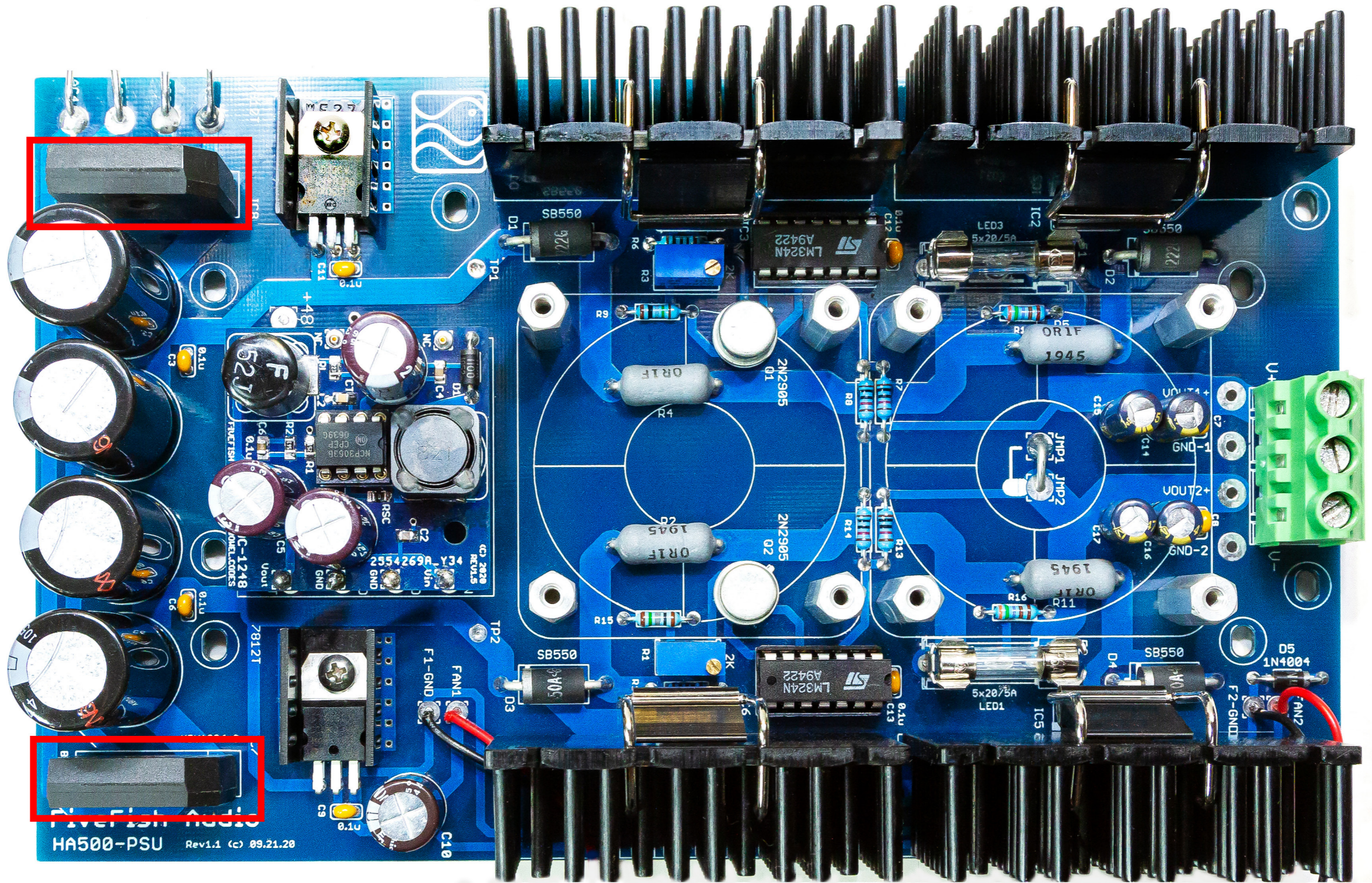
6.17. Mount the eight (8) Aluminum Standoffs to the PCB. Use a 4-40 nut and small washer to secure it to the PCB. After mounting the standoffs, attach the two (2) Cooling Fans (50mm x 50mm x 20mm) to the standoffs using (8) machine screws that is at least more than 20mm long (if using a 20mm thick fan). Solder the fan motor Red wire to their corresponding F1 and F2 pad location on the PCB. Take note of proper orientation, F1-GND and F2-GND are for the Black wires of the fans.

TIP: Do not tighten screw until all (8) screws are inserted. After all screws are inserted and secured, then tighten each screw one by one. Do not overtighten.

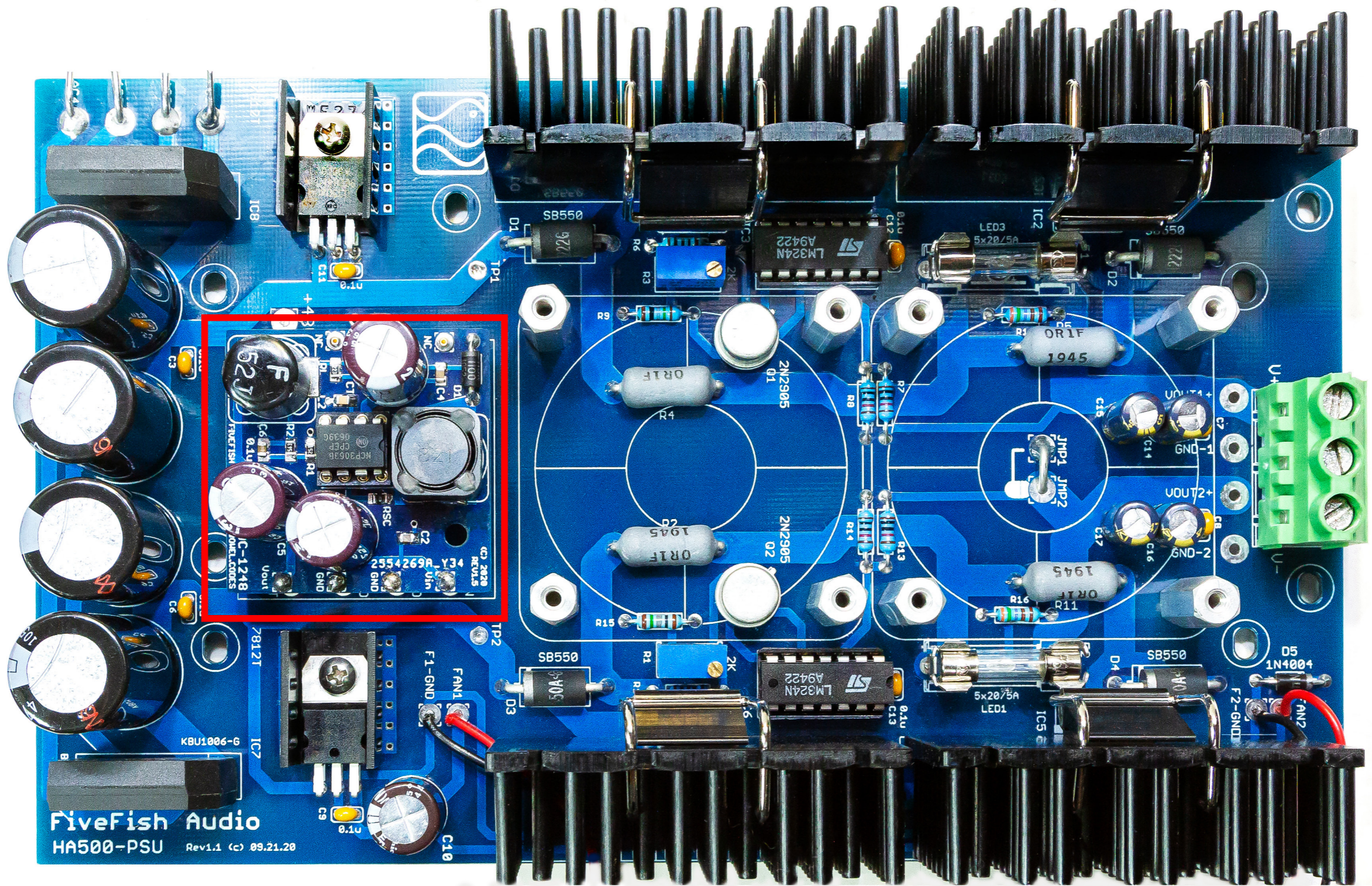
OPTIONAL: You can also place small rubber washer or felt paper on each standoff to reduce fan vibration and noise.



6.18. If you plan on using the PSU with more than 3 Amps load, you must attach some form of plate heatsink to the two (2) Bridge Rectifiers. You can use a simple, small aluminum sheet bent into an L-shape for your Bridge Rectifier heatsink, or visit your hardware store for something suitable you can use.



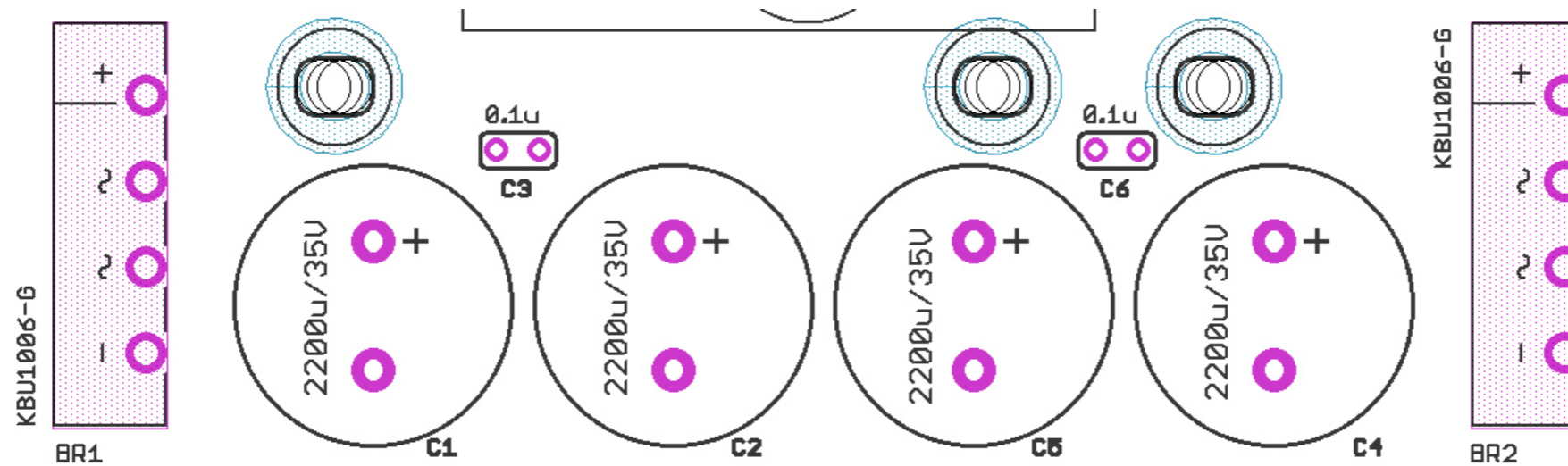
6.19. OPTIONAL: If you don't need 48-Volts Phantom Power, you can skip this step. Mount the DC-1248 module to the Mill-Max sockets.



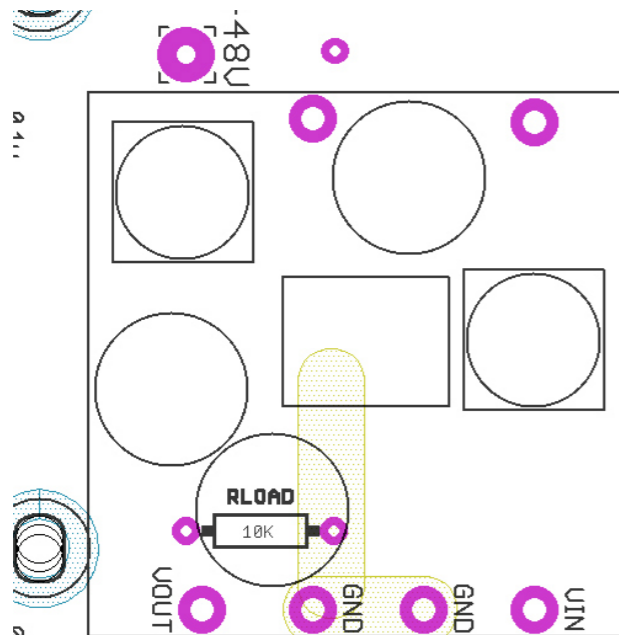
7. ERRATA / MANUAL CHANGE INFORMATION

NOTE: Some component changes have been made to improve performance of the HA500-PSU.

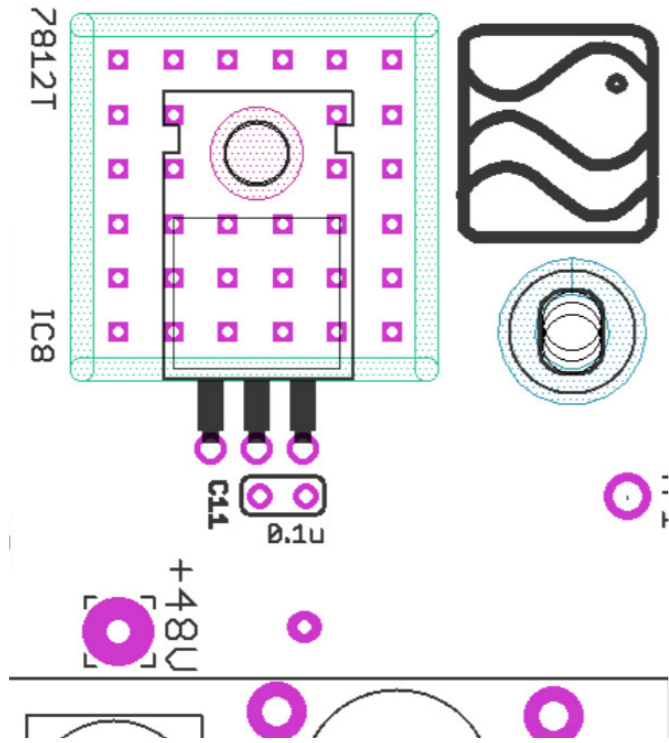
7.1. C1, C2, C3, C4 are now 4,700uf/35V capacitors instead of 2,200uf/35V.



7.2. RLOAD marked 10K on silkscreen is now a 6K8 resistor.



7.3. IC8 marked 7812T on silkscreen is now a 7818 voltage regulator (18VDC output).



8. SCHEMATIC DIAGRAM

