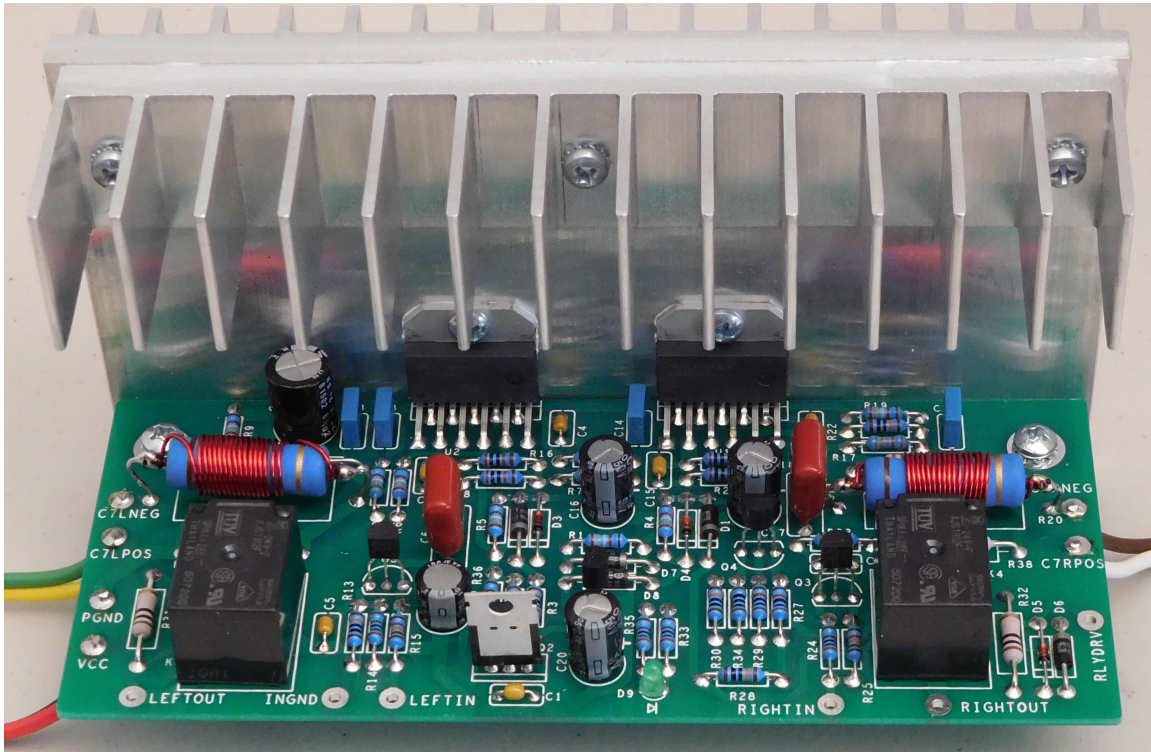


Updatemydynaco



Dynaco SCA80(Q) Amplifier and Power Supply Upgrade (PWRAMP80) ASSEMBLY MANUAL

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Section 1: About This Manual

This manual gives the information needed to build and install the upgraded power supply and amplifier modules for either Dynaco's SCA-80(Q) Integrated Amp. There is another manual that covers installation of this kit into a Stereo 80 Power Amp.

This kit upgrades the power amplifier and power supply sections. It's also an easy alternative to the rather difficult repair of the amplifier section of these units. The resulting amp offers lower distortion and noise, a speaker relay for pop-free startup, It's also a cooler running, more efficient amplifier. The original amp modules dissipate 13 Watts at idle, all of it running through the 4 big power resistors. The new amp module dissipates 8.6 Watts, but all of that power biases the output stage, greatly increasing its linearity.

Who Should Attempt this Project?

You can build this kit if you can:

1. Solder (using normal rosin core solder and a soldering iron).
2. Use simple hand tools like screwdrivers, wire cutters, and pliers.
3. Read and follow directions.

It helps if you:

1. know a bit about electronics, or
2. have a friend who knows a bit about electronics
3. can get to YouTube to watch a few helpful videos about the assembly process (none are posted as of this version of the manual).

Tools you'll need

You'll need the following tools:

1. Phillips screwdriver (#1 and #2), regular screw-drivers.
2. Pliers or nut drivers suitable for #4 and #6 hardware
3. needle nose pliers (helpful, but not strictly necessary)
4. pencil type soldering iron of 25 to 50 Watts (no huge honking soldering guns or blowtorches)
5. wire cutters and strippers
6. multi-meter to measure power supply voltages and confirm resistor values (strongly recommended)!

Helpful Tools

These tools aren't strictly necessary, but make building the kit easier.

1. Magnifying glass, if you're over 42!
2. Lead bending jig to form axial component leads to the correct span for insertion in the PCB.

Project Overview

The project consists of the following steps:

1. Building the circuit boards.

2. Removing the old power supply
3. Installing and testing the new power supply
4. Installing and testing the new power amplifier
5. Completing re-assembly of the amplifier.

Important Safety Notes

By purchasing, using, or assembling this kit, you have agreed to hold Akitika LLC harmless for any injuries you may receive in its assembly and/or use. To prevent injuries:

- Wear safety glasses when soldering or clipping wires to prevent eye injuries.
- Always unplug the power before working on the amplifier.
- Large capacitors hold lots of energy for a long time. Before you put your hands into the amplifier:
 - Pull the AC plug!
 - Wait 2 full minutes for the capacitors to discharge!
- Remove jewelry and rings from your hands and wrists, or anything that might dangle into the amplifier.
- If working on the equipment with the power on, keep one hand in your pocket, especially if you're near the power supply or power supply wires. This can prevent serious shocks.
- Build with a buddy nearby. If you've ignored all the previous advice, they can dial 911 or get you to the hospital.
- Read and understand the safety manuals of all the tools you use.

About Components

We reserve the right to make design/or component changes at any time without prior notification.

Recommended Solder

The kit must be assembled with 60/40 Rosin Core solder. The recommended diameter is 0.032 inches. Among many such sources of solder, I have used Radio Shack part number 64-009. It contains 8 oz. of solder, which is *much more* than you'll need to assemble this kit.

Warranty

With the exception of fuses, Akitika LLC will replace for free any parts of a correctly assembled product that fails within one year of the date of purchase when the equipment has been used in home stereo applications. It is the responsibility of the kit builder to install the replacement part(s). This warranty applies to the original purchaser only. It does not apply to units that have been physically or electrically abused, modified without prior factory authorization, or assembled with other than 60/40 Rosin Core solder. Akitika LLC's liability shall in no event exceed the cost paid to Akitika LLC for the kit.

Section 2: Kit Building Hints

Yes, I know you want to ignore this section, and jump right into building the kit. However, please **take a minute and read the advice.** I've condensed it into bullets so that even you guys who are in a hurry can benefit.

- Stop any time you're feeling confused, tired, or anxious. Taking breaks at those strategic times will keep the build enjoyable and greatly enhance your chances of first-time success.
- A soup bowl is your friend. Before you build a board, carefully empty the parts for just that board into a broad, flat, light colored soup bowl. That makes it easy to find the parts, and keeps them from getting lost.
- A digital ohm-meter is an easy way to make sure that you've picked the right resistor. It's a great cross-check on the resistor color code. Measure twice and solder once!
- A lead-bending jig can make for quicker, neater assembly. It's certainly not necessary.
- Is something in this manual confusing? Does something look wrong? Send your questions by email to dan@akitika.com or dan@updatemydynaco.com. You'll help yourself and everyone who builds the kit.

Section 3: Building the Power Supply

This section details the process of building the power supply circuit board. Begin by carefully emptying the contents of the Power Supply parts envelope into a broad soup bowl, as shown below. In general, you'll start with the components that lay closest to the board, working your way towards the taller components.



Figure 1-Empty the power supply components into a soup bowl

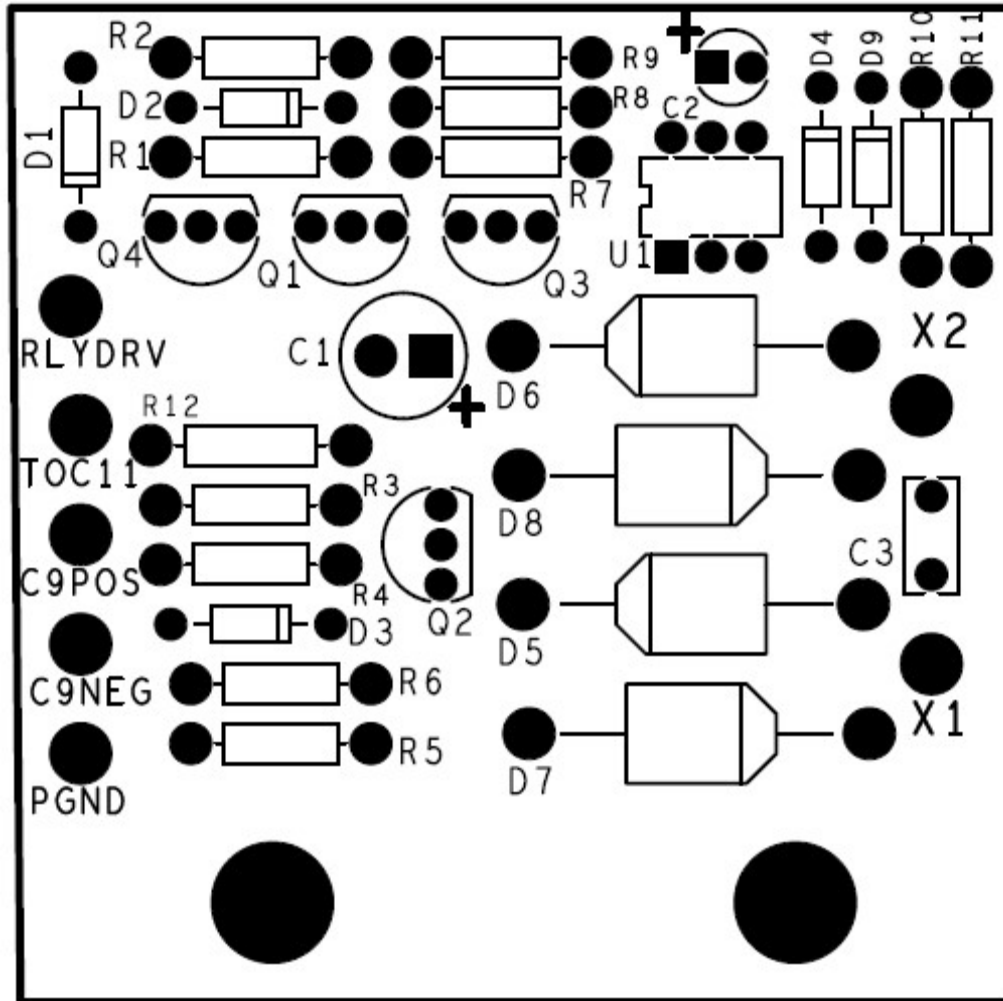


Figure 2-Silk screen shows power supply component locations

Component Order

You'll notice that the component designations in the directions don't go exactly in order. We have grouped them so that all components with the same value appear together. This makes assembly easier. You'll find in the parts kit that similar parts, e.g. 3 1K resistors, are typically (though not always) taped together.

Install the Resistors

In general, you install axial leaded components (like the resistors) by placing the body on the silk screen side of the board, and the leads through the indicated holes. Bend the leads over on the back of the board to keep the resistors from falling out until your solder them in place. Try to bend the leads in a direction that won't lead to solder bridges between traces that should remain disconnected.

We recommend the following procedure:

1. Insert all components of the same value or type

2. Bend the leads as described above.
3. Solder the leads on the back of the board.
4. Clip the leads.

Track your progress by placing a check-mark in the done column as you install each component.

Bend resistor leads to 0.45" width			
Designation	Value	Color Code	Done (✓)
R1	1 Meg	Brown, Black, Black, Yellow, Brown	
R3	1 Meg	Brown, Black, Black, Yellow, Brown	
R4	100K	Brown, Black, Black, Orange, Brown	
R6	10K	Brown, Black, Black, Red, Brown	
R10	20K	Red, Black, Black, Red, Brown	
R5	40K2	Yellow, Black, Red, Red, Brown	
R2	49K9	Yellow, White, White, Red, Brown	
R11	49K9	Yellow, White, White, Red, Brown	
R7	511K	Green, Brown, Brown, Orange, Brown	
R8	511K	Green, Brown, Brown, Orange, Brown	
R9	511K	Green, Brown, Brown, Orange, Brown	
R12	68, 1 Watt, r%	Blue, Gray, Black, Gold	
All resistors are ¼ W 1% metal film unless otherwise indicated			

Install the diodes

Diodes are polarized, having an anode and a cathode. When you insert the diode, match the banded end of the diode to the banded end of its representation on the silk screen.

<i>Diodes – watch the polarity!</i>			
Designation	Type, Package	Rating, Marking, Description	Done? (✓)
D1	1N4148, DO-35	100 PIV switching diode	
D9	1N4148, DO-35	100 PIV switching diode	
D2	BZX79-B10, DO-35	10V zener diode, marked B10	
D3	BZX79-B10, DO-35	10V zener diode, marked B10	
D4	BZX79-B10, DO-35	10V zener diode, marked B10	
D5	1N5404, DO-201AD	400 PIV, 3 Amp, rectifier diode	
D6	1N5404, DO-201AD	400 PIV, 3 Amp, rectifier diode	
D7	1N5404, DO-201AD	400 PIV, 3 Amp, rectifier diode	
D8	1N5404, DO-201AD	400 PIV, 3 Amp, rectifier diode	

Install the optoisolator

The opto isolator comes in a 6-pin DIP (Dual Inline Package). Pin 1 on the PCB is indicated by the square pad. Pin 1 on the opto-isolator package can be identified by the dot on the package, refer to Figure 3. Make sure to install the opto with the correct orientation.



Figure 3-Pin 1 of the opto-isolator is indicated by the dot and the ridge in the package

<i>Opto isolator installation – watch the orientation!</i>			
Designation	Type, Package	Rating, Marking, Description	Done? (✓)
U1	4N35, 6 pin DIP	4N35 opto-isolator	

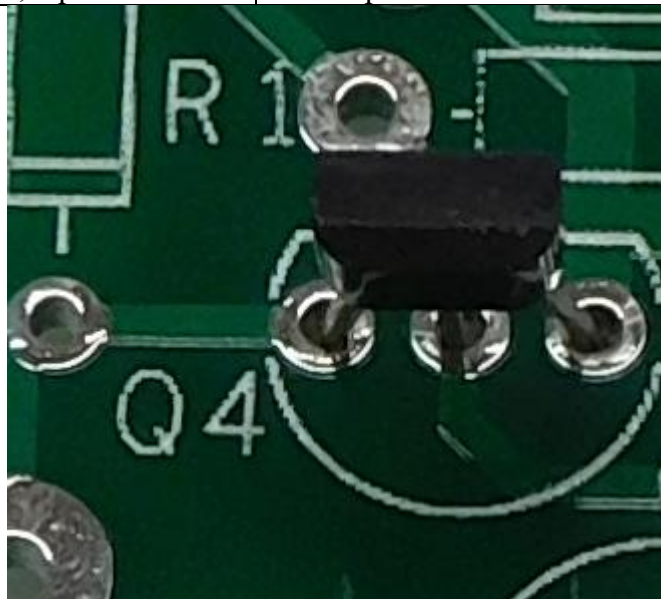


Figure 4-Although more subtle, notice that the Q4 has a square side and a round side

Install the Transistors

Orient the transistor so its body shape matches the silk-screen outline. Leave the top of the transistor about ½" off the board! The lead length reduces stress on the body and keeps the transistor safe from too much heat during the soldering operation.

Designation	Type	Description	Done? (✓)
Q1	2N3904, TO-92	40 V NPN bipolar transistor	
Q2	2N3904, TO-92	40 V NPN bipolar transistor	
Q3	2N3904, TO-92	40 V NPN bipolar transistor	
Q4	ZVN2110A, TO-92	100V N-channel MOSFET	

Install the Small Non-polar Capacitors

Orientation of these caps does not matter.

Designation	Description	Done? (✓)
C3	0.01 uF, 400 Volt film capacitor, box capacitor	

Install the Electrolytic (polarized) Capacitors

Polarized Capacitors (*watch polarity and voltage rating*). The negative side of the capacitor is marked with a minus (-) sign. That side of the capacitor installs away from the + sign on the silk screen.

Designation	Value	Rating, Marking	Done? (✓)
C1	22 uF	Electrolytic capacitor, 22 uF 50 V, radial leads	
C2	1 uF	Electrolytic capacitor, 1 uF 100 V, radial leads	

Fasten the Mounting Brackets to the PCB

Using Figure 5 as a guide, fasten the mounting brackets to the PCB using 2 6-32x1/4" sems screws (they have a built-in lockwasher) into the threaded hole of the mounting bracket.

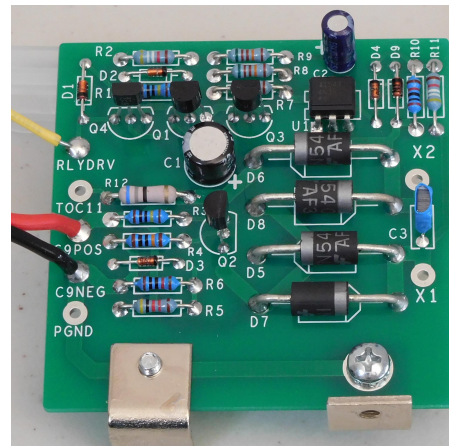
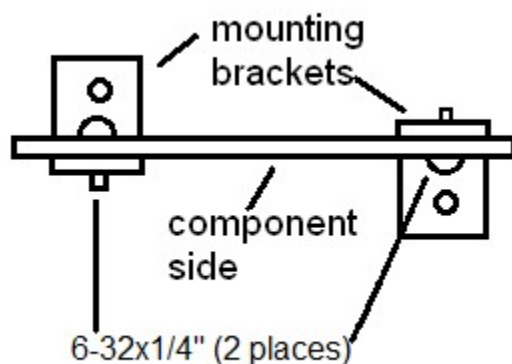


Figure 5-Installing the mounting brackets on the power supply PCB

Install the C9 Connection wires

1. Cut a 5" length of the supplied 18 AWG red/black zip cord.
2. Strip ¼" inch of insulation from each of the four ends.

3. Twist and tin the 4 ends.
4. Insert one end of the red wire into the C9POS terminal from the component side of the board and solder it on the solder side.
5. Insert the accompanying black wire into the C9NEG terminal from the component side of the board and solder it on the solder side.

Install the RLYDRV wire

Connect an 8.5" length of yellow wire into the RLYDRV eyelet. Insert it from the component side, and solder it on the solder side. Note that the hole for this wire is kind of large, so you'll have the best results if you keep the wire and PCB quite still until the solder sets.

Check your work

Look over the board to verify that:

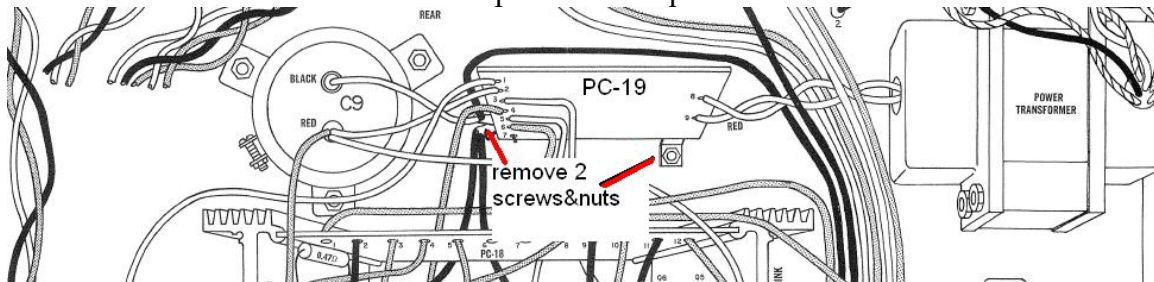
1. All components are soldered.
2. No solder bridges are apparent.
3. Polarity of the electrolytic capacitors is correct.
4. Diode polarity is correct.

If everything looks good, you're ready to install the power supply into your SCA-80 or Stereo 80.

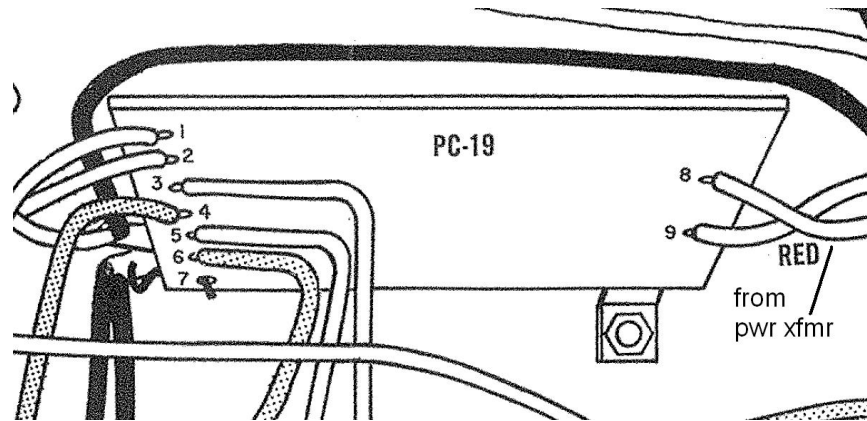
Disconnect the Old Power Supply and Power Amplifier

Unplug the power cord before proceeding. Wait 1 minute for capacitors to discharge.

1. Remove the cover – unscrew and save a total of 5 screws:
 - a. 2 on the left side
 - b. 2 on the right side
 - c. 1 in the center of the top of the back panel.



2. Remove the two sets of screws and nuts that hold the PC-19 brackets to the bottom of the chassis. That will make it easier to remove the wires as needed in the next steps.

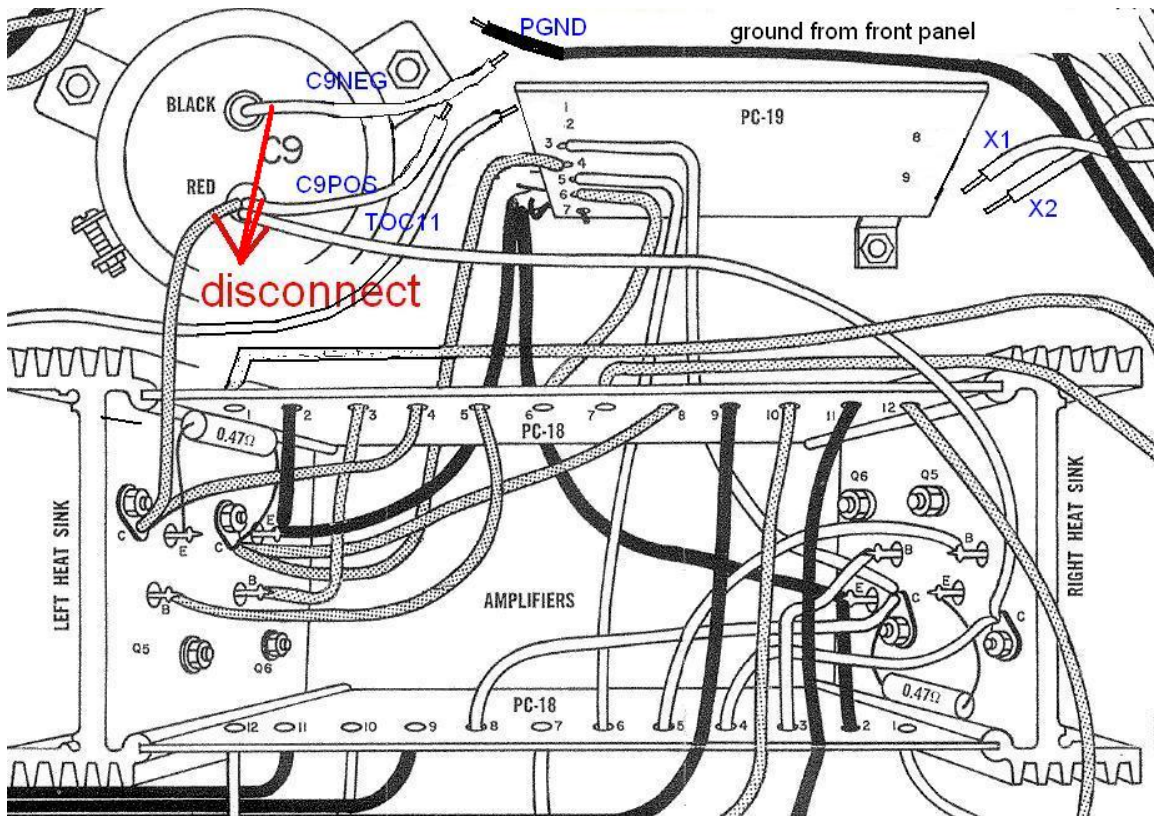


3. De-solder and label these wires from PC19:
 - a. Red transformer wire connected to pin 8. Label it with the “X1” label.
 - b. Red transformer wire connected to pin 9. Label it with the “X2” label.
 - c. Wire connected to pin 1. Label it with the “TOC11” label.
4. Cut the following wires close to the PC-19 circuit board. They won’t be used in the upgraded amp.
 - a. Wire connecting to eyelet 2
 - b. Wire connecting to eyelet 4
 - c. Wire connecting to eyelet 5
 - d. Wire connecting to eyelet 6
5. Cut the short (bare) wire that connects eyelet 7 to the ground lug. Cut it near the ground lug.
6. The PC-19 PCB is now free. Remove it from the chassis and set it aside. It won’t be re-used.

SCA80Q

If you have an SCA80Q then follow these directions. The SCA-80Q front panel says “4-DIMENSIONAL AMPLIFIER”. If you have a plain SCA80, without the Q, for Quadaptor, then skip this section and go on to the SCA80 section.

7. Cut and label these wires *where they meet the ground lug* that was fastened to the mounting screw closest to C9.
 - a. The ground wire that goes to the front panel of the chassis. Label it “PGND”.
 - b. The ground wire that goes to the negative terminal of C9.



SCA80 Directions

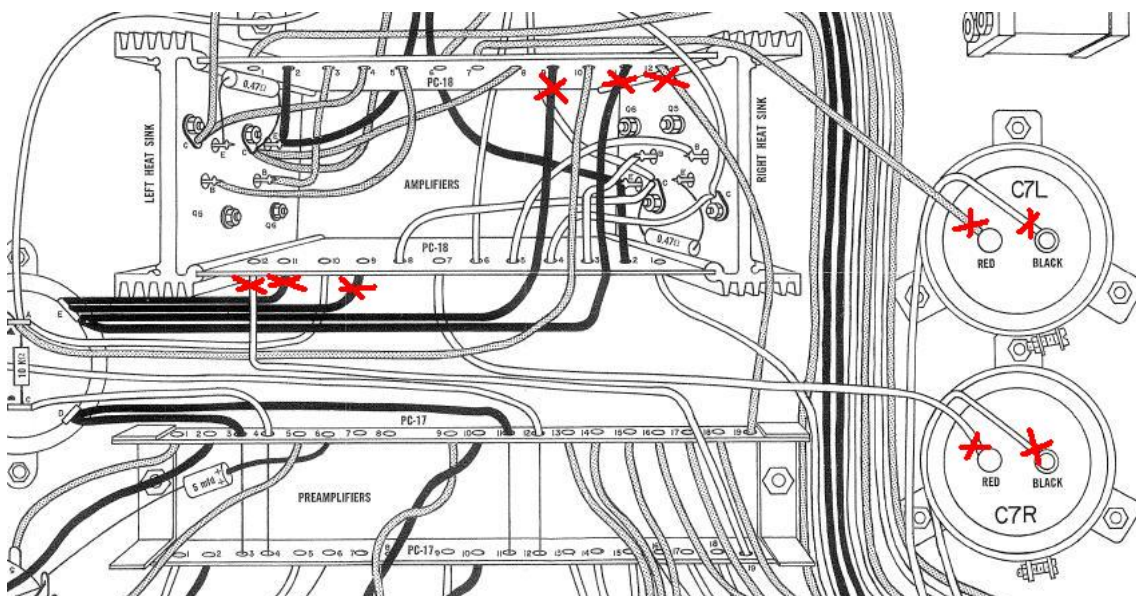
If you have an SCA80, then follow these directions.

8. There are two ground lugs that were fastened to the chassis by the mounting screw on the C9 side of PC-19.
 - a. Find the lug that has two black wires that go to the amplifier modules and one white wire that goes to the negative terminal of C9. Cut the white wire that goes to the negative terminal of C9 near the solder lug.
 - b. The other ground lug has a bare wire and two white wires that connect to the COMMON terminals of the speaker connectors on the back panel. Cut off the bare wire, but leave the other two white wires that connect the lug to the COMMON terminals. This ground lug will be re-attached in a future step.

Removing the Amplifier Modules, All Versions

1. Desolder and remove:
 - a. All wires connected to C9 RED terminal.
 - b. All wires connected to C9 BLACK terminal.

If you've installed a C9 replacement kit consisting of a dynamite configuration of 3 capacitors, then leave the wires that connect these capacitors in parallel in place. Only remove the wires that leave the capacitors for other parts of the amplifier chassis.



2. Desolder the wire connected to the RED terminal of C7L.
3. Desolder the wire connected to the BLACK terminal of C7L. Pull off the big hanging coil of wire. It will not be re-used. Locate the other side of that coil of wire where it connects to the front panel speaker switch. Cut that wire near the speaker switch, but be careful not to cut the green wire on the switch which is also connected to the same switch terminal.
4. Desolder the wire connected to the RED terminal of C7R.
5. Desolder the wire connected to the BLACK terminal of C7R. Pull off the big hanging coil of wire. It will not be re-used. Locate the other side of that coil of wire where it connects to the front panel speaker switch. Cut that wire near the speaker switch, but be careful not to cut the red wire on the switch which is also connected to the same switch terminal.
6. Cut and mark the following wires close to the eyelets on the power amp PCBs:
 - c. Eyelet 12 of right channel (front-most) power amp PCB, and label it "RIGHTIN".
 - d. Eyelet 12 of left channel (rear-most) power amp PCB, and label it "LEFTIN".
 - e. Eyelet 11 of left channel (rear-most) power amp PCB, and label it "INGND".
7. Cut and remove the following ground wires at both ends:
 - f. Eyelet 9 of left channel (rear-most) power amp PCB, and its attachment to the ground of C11.
 - g. Eyelet 9 of right channel (front-most) power amp PCB, and its attachment to the ground of C11.
 - h. Eyelet 11 of right channel (front-most) power amp PCB, and its attachment to the ground of C11.
9. Identify the wire that connects to eyelet 10 of the front-most power amplifier channel. Clip that wire where it connects to C11, near C11.
10. Identify the wire that connects to eyelet 10 of the rear-most power amplifier channel. Clip that wire where it connects to C11, near C11.

11. Identify the wire that connects to eyelet 1 of the front-most power amplifier channel. Clip that wire where it connects to eyelet 1, and label it RIGHTOUT.
12. Identify the wire that connects to eyelet 1 of the rear-most power amplifier channel. Clip that wire where it connects to eyelet 1, and label it LEFTOUT.
13. Turn the amplifier over and remove the 8 screws (2 groups of 4 screws) that hold the heatsinks to the chassis.
14. Remove the amplifier assembly and the PC19 board.

Install the New Power Supply

Make sure that the amplifier is unplugged before proceeding

Connect the following wires to the indicated places on the new power supply board:

1. The X1 wire from the transformer to the X1 terminal of the new PCB. Insert it from the component side and solder it on the solder side.
2. The X2 wire from the transformer to the X2 terminal of the new PCB. Insert it from component the side and solder it on the solder side.

Connect the red/back pair on the power supply PCB as follows:

3. From C9POS (RED) wire on the PCB to the positive (RED) terminal of C9.
4. From C9NEG (BLACK) wire on the PCB to the negative (BLACK) terminal of C9.

Connect the TOC11 labeled wire from C11:

5. The TOC11 wire from C11 to the TOC11 terminal of the new PCB. Insert on the component side and solder on the solder side.

Ground Wire

6. For an SCA80Q. The PGND wire that goes to the front panel area to the PGND terminal of the new PCB. Insert this wire into the component side and solder it on the solder side.
7. If you have an SCA80 there will be no connection to the PGND eyelet. Ground connections will be made when you install the power supply PCB into the chassis.

Fasten the power supply into the chassis as follows:

1. Re-use the chassis holes that previously mounted the PC-19.
2. The component side of the new PCB faces forward.
3. Do this step if you have an SCA80. Insert and tighten a 6-32x1/4" sems screw from the bottom of the chassis, through the lug with the two wires that connect to the speaker terminal commons, into the threaded PCB support bracket farthest from the transformer, see Figure 6.
4. Do this step if you have an SCA80Q. Insert and tighten a 6-32x1/4" sems screw from the bottom of the chassis into the threaded PCB support bracket farthest from the transformer.
5. Insert and tighten a 6-32x1/4" sems screws from the bottom of the chassis into the threaded PCB support bracket closest to the transformer.
6. Inspect your work to assure that there are no pinched wires or loose bits of wire floating around inside the amplifier.

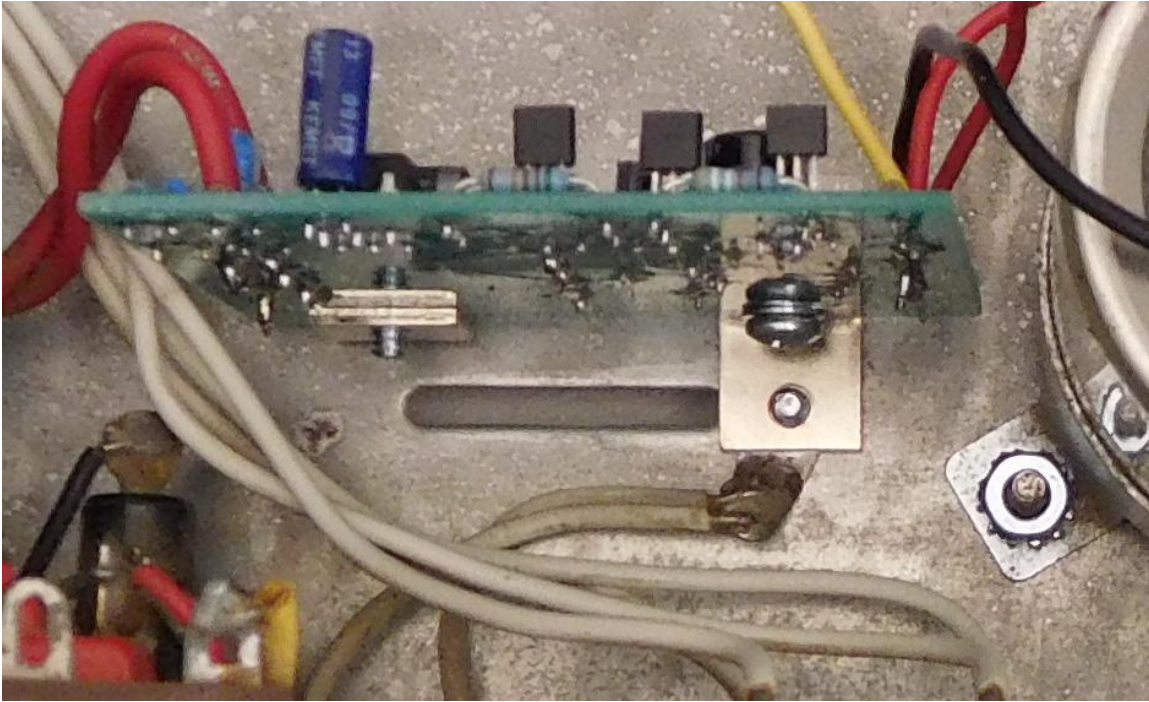


Figure 6-Grounding arrangement for speaker common connections on the SCA-80

Test the New Power Supply

Take a minute to clean up your work area before proceeding. Get a DC voltmeter ready to perform the following test:

1. Tape off the end of the yellow RLYDRV wire.
2. Turn the power switch off.
3. Plug in the amplifier.
4. Stand at arm's length from the amplifier and turn on the power switch. ***This arm's length direction is for your safety.*** If you've connected C9 or the diodes backwards, there could be a pop and a bang, and the insides of a capacitor could come hurtling out of the capacitor. Watch for smoke. If no smoke, then check the voltage across C9. It should be about 75 Volts.
5. Turn off the amplifier.
6. Unplug the amplifier.

Section 4: Building the Stereo Amplifier Module

Building the Stereo Amplifier Module proceeds along the same lines as the power supply you built in the previous section. Carefully pour all the components from the Amplifier Module Envelope into your soup bowl. Track your progress by placing a check-mark in the done column as you install each component. As before, we begin with resistor installation.

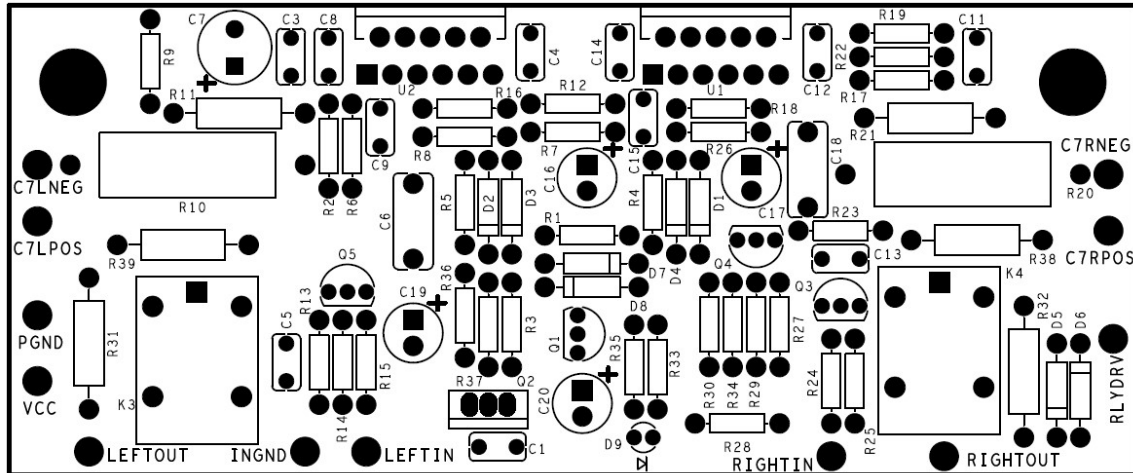


Figure 7-Component locations for the stereo amplifier module

Bend resistor leads to 0.45" width

Designation	Value	Color Code	Done ✓
R34	100	Brown, Black, Black, Black, Brown	
R12	100K	Brown, Black, Black, Orange, Brown	
R13	100K	Brown, Black, Black, Orange, Brown	
R22	100K	Brown, Black, Black, Orange, Brown	
R23	100K	Brown, Black, Black, Orange, Brown	
R28	100K	Brown, Black, Black, Orange, Brown	
R30	100K	Brown, Black, Black, Orange, Brown	
R3	10K	Brown, Black, Black, Red, Brown	
R29	10K	Brown, Black, Black, Red, Brown	
R7	1K37	Brown, Orange, Violet, Brown, Brown	
R17	1K37	Brown, Orange, Violet, Brown, Brown	
R15	11K3	Brown, Brown, Orange, Red, Brown <ul style="list-style-type: none"> • Install it if you're upgrading an SCA-80 or SCA-80Q integrated amplifier. • Don't install it if upgrading a Stereo 80 basic power amplifier. 	
R25	11K3	Brown, Brown, Orange, Red, Brown <ul style="list-style-type: none"> • Install it if you're upgrading an SCA-80 or SCA-80Q <i>integrated</i> amplifier. • Don't install it if upgrading a Stereo 80 <i>basic</i> power amplifier. 	
R8	20K0	Red, Black, Black, Red, Brown	
R16	20K0	Red, Black, Black, Red, Brown	
R18	20K0	Red, Black, Black, Red, Brown	
R26	20K0	Red, Black, Black, Red, Brown	
R27	20K0	Red, Black, Black, Red, Brown	

R1	24K9	Red, Yellow, White, Red, Brown	
R2	24K9	Red, Yellow, White, Red, Brown	
R4	24K9	Red, Yellow, White, Red, Brown	
R5	24K9	Red, Yellow, White, Red, Brown	
R6	24K9	Red, Yellow, White, Red, Brown	
R9	24K9	Red, Yellow, White, Red, Brown	
R19	24K9	Red, Yellow, White, Red, Brown	
R14	2K00	Red, Black, Black, Brown, Brown	
R24	2K00	Red, Black, Black, Brown, Brown	
R33	2K00	Red, Black, Black, Brown, Brown	
R35	2K00	Red, Black, Black, Brown, Brown	
R36	2K00	Red, Black, Black, Brown, Brown	
R37	2K00	Red, Black, Black, Brown, Brown	
R11	2.2, 1W, 5%	Red, Red, Gold, Gold	
R21	2.2, 1W, 5%	Red, Red, Gold, Gold	
R31	10, 1W, 5%	Brown, Black, Black Gold	
R32	10, 1W, 5%	Brown, Black, Black Gold	
R38	1K, 1W, 5%	Brown, Black, Red, Gold	
R39	1K, 1W, 5%	Brown, Black, Red, Gold	
R10		Not installed at this time. We mean it!	
R20		Not installed at this time. We mean it!	
All resistors are ¼ W 1% metal film unless otherwise indicated			

Install the diodes

Diodes are polarized, having an anode and a cathode. When you insert the diode, match the banded end of the diode to the banded end on the silk screen.

Diodes – watch the polarity!			
Designation	Type, Package	Rating, Marking, Description	Done? (✓)
D1	1N4004, DO-41	1A, 400 PIV, rectifier diode	
D2	1N4004, DO-41	1A, 400 PIV, rectifier diode	
D6	1N4004, DO-41	1A, 400 PIV, rectifier diode	
D7	1N4004, DO-41	1A, 400 PIV, rectifier diode	
D8	1N4004, DO-41	1A, 400 PIV, rectifier diode	
D5	BZX79-B10, DO-35	10V zener diode, marked B10	
D3	TZX6V2C, DO-35	6.2V zener diode, marked 6V2	
D4	TZX6V2C, DO-35	6.2V zener diode, marked 6V2	
D9	Green LED	T1 package	

For the LED, you can identify the anode (triangle side) and cathode (line side) in the following ways:

1. Anode is the longer of the two leads (assuming they are at factory length)
2. Cathode is the lead adjacent to the flattened side of the package. (very difficult to see, so use method 1).

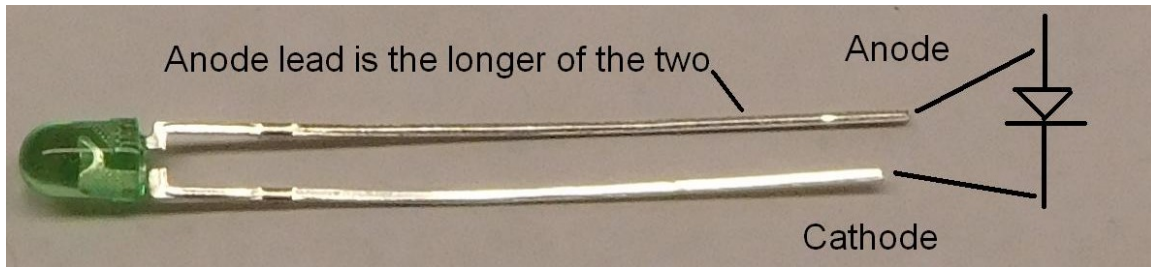


Figure 8-Anode is the longer of the two leads

Install the Small Non-polar Capacitors

Note that the mounting hole space for the small COG caps is a big snug, but they'll fit there nicely.

Orientation of these caps does not matter.		
Designation	Description	Done? (✓)
C9	100 pF, axial, COG, marked 101	
C15	100 pF, axial, COG, marked 101	
C1	220 pF, axial, COG, marked 221	
C4	220 pF, axial, COG, marked 221	
C5	220 pF, axial, COG, marked 221	
C12	220 pF, axial, COG, marked 221	
C13	220 pF, axial, COG, marked 221	
C3	0.1 uF 100 Volt film capacitor, rectangular box	
C8	0.1 uF 100 Volt film capacitor, rectangular box	
C14	0.1 uF 100 Volt film capacitor, rectangular box	
C11	0.1 uF 100 Volt film capacitor, rectangular box	
C6	1 uF, film, pillow shaped, marked 105	
C18	1 uF, film, pillow shaped, marked 105	
C2	Not used	
C10	Not used	

Install the Electrolytic (polarized) Capacitors

Polarized Capacitors (*watch polarity and voltage rating*). The negative side of the capacitor is marked with a minus (-) sign. That side of the capacitor installs away from the + sign on the silk screen.

Designation	Description	Done? (✓)
C16	100 uF, 50 Volt, Electrolytic	
C17	100 uF, 50 Volt, Electrolytic	
C20	100 uF, 50 Volt, Electrolytic	
C19	22uF, 50Volt, Electrolytic	
C7	47 uF, 100 Volt, Electrolytic	

Install the Transistors

Orient the transistor so its body shape matches the silk-screen outline. Leave the top of the transistor about 1/2" off the board! The lead length prevents stress on the body and keeps the transistor safe from too much heat during the soldering operation.

Designation	Type	Description	Done? (✓)
Q1	2N5551, TO-92	150 V NPN bipolar transistor	
Q4	2N3904	40 volt NPN bipolar transistor	
Q3	J175	P-channel JFET	
Q5	J175	P-channel JFET	
Q2	TIP32C	100 V PNP bipolar transistor	

Install the Relays

Install K3 and K4. Note that the designations K1 and K2 are not used on the PCB. It's best to solder two diagonal pins first, then make sure that the relays sit flush on the PCB. If you have to reheat one of the two original pins to get it to sit flush, it's fairly easy to do. After you're sure the relays sit flush, finish soldering the rest of the pins.

Fasten the PCB to the Heatsink

Follow the diagram in Figure 9 to fasten the heatsink to the PCB. Note that this is a side view, so the assembly must be done on both the left and right sides of the PCB.

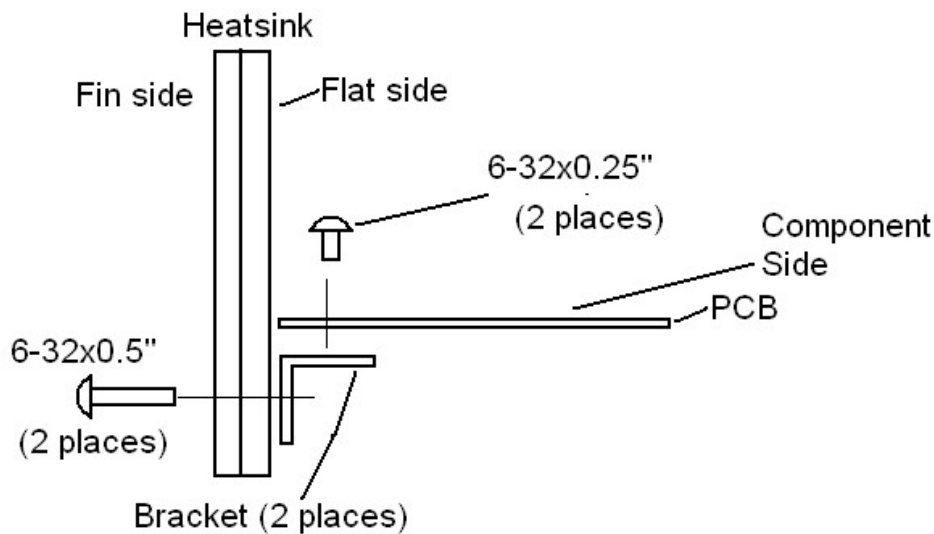


Figure 9-Assembling the PCB to the heatsink

Install the LM3886 Power Amplifier ICs

1. Cut a corner of the thermal compound packet. If you use it appropriately, that's enough to do everything you need. Place a line of thermal compound onto the back of U1, an LM3886. Use your finger to smear the line into a *thin* film covering on the back of the LM3886. Save the rest of the thermal compound for other steps in the assembly.
2. Insert U1 into the indicated space on the board, and fasten it into place using a 6-32x3/8" screws (no built-in lockwasher) through the mounting hole and into the

- heat sink. Make sure that U1 sits level with respect to the PCB, then tighten the mounting screw.
3. Place a line of thermal compound onto the back of U2, an LM3886. Use your finger to smear the line into a thin film covering on the back of the LM3886. Save the rest of the thermal compound for other steps in the assembly.
 4. Insert U2 into the indicated space on the board, and fasten it into place using a 6-32x3/8" screw (no built-in lockwasher) through the mounting hole and into the heat sink. Make sure that U1 sits level with respect to the PCB, then tighten the mounting screw.
 5. Working from the solder side of the board, solder all the pins associated with U1 and U2.

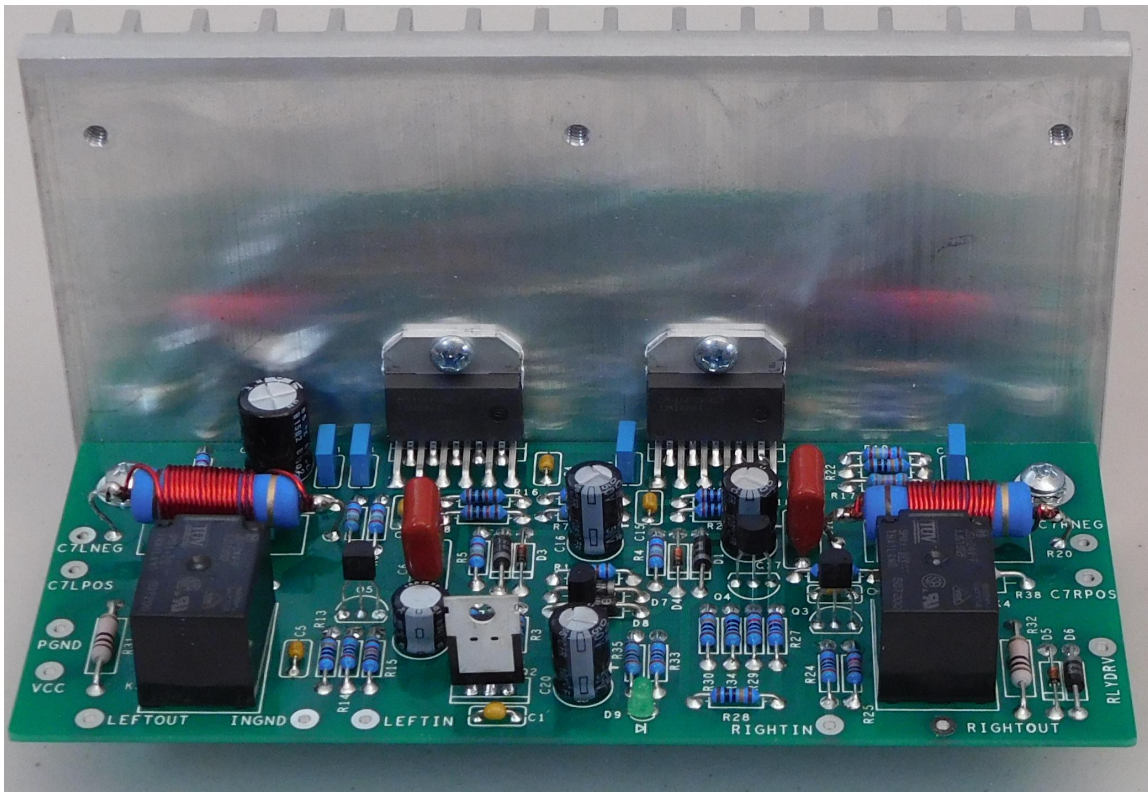


Figure 10-Assembled amplifier on main heatsink

Build and Install the Inductor Resistor Combination

The kit includes special magnet wire whose insulation is removed by the act of soldering. The kit supplies 40" lengths of this wire. Cut the 40" length into two equal 20" lengths. There will be a little left over from each length once you've completed each inductor-resistor combination.

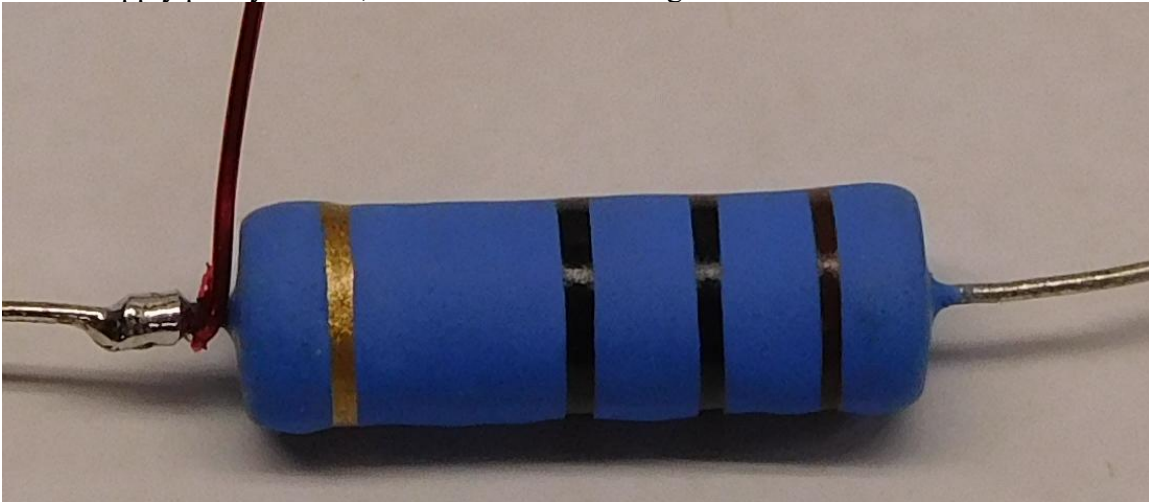
You'll create two such combinations. Here are the steps for each L-R combination:

1. Scrape 1/2" of the insulation off one end of the magnet wire using your diagonal cutters. Be careful not to nick the conductor. You'll see the bright copper revealed beneath the now removed red varnish. It's ok if some of the insulation remains. It has a special formulation that melts in the presence of heat from a soldering iron.

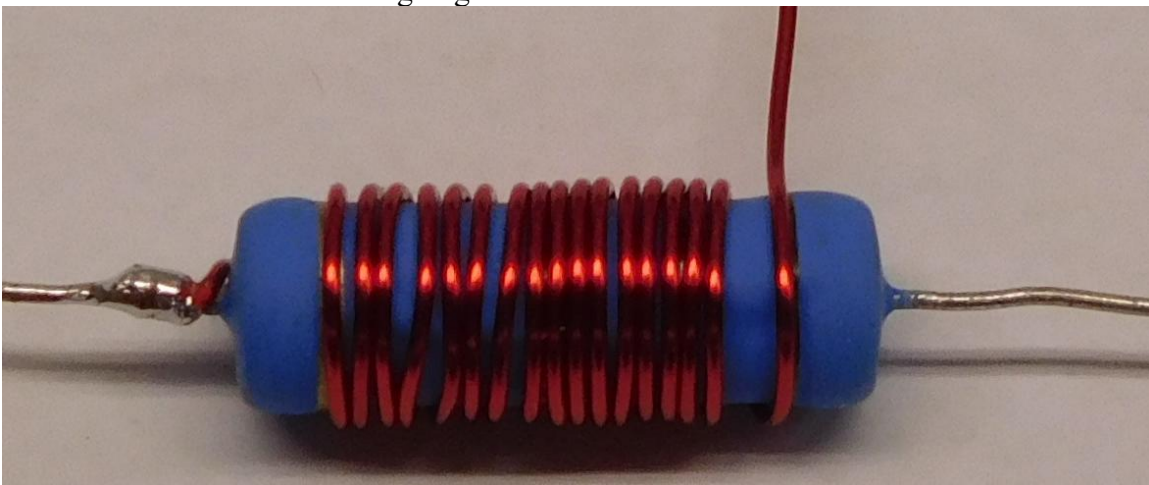
2. Wind the scraped portion of the magnet wire (about three turns) around one lead of the 10 Ohm 5 Watt resistor, near the body of the resistor.



3. Apply plenty of heat, and then solder the magnet wire to the resistor lead.



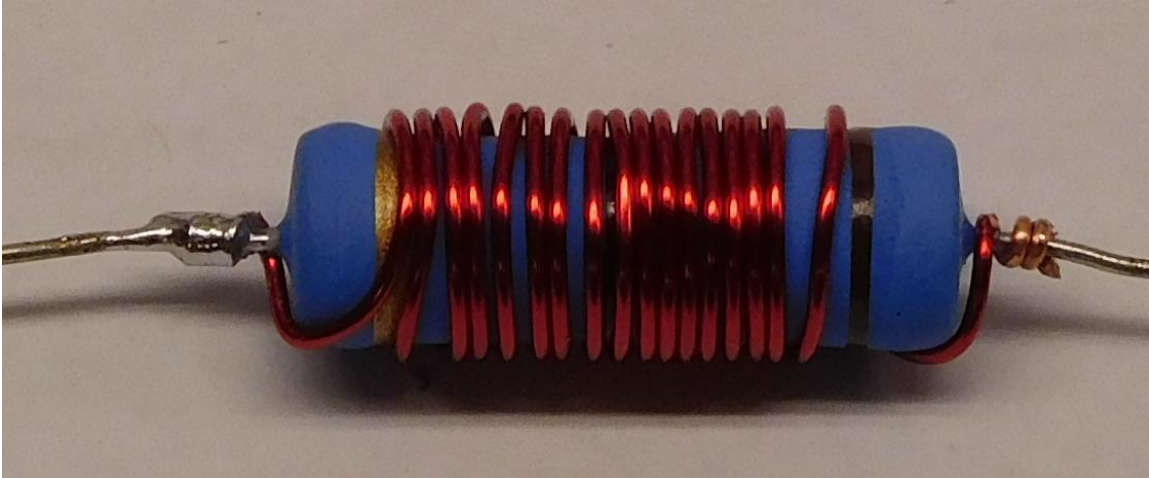
4. Allow it to cool before going on.



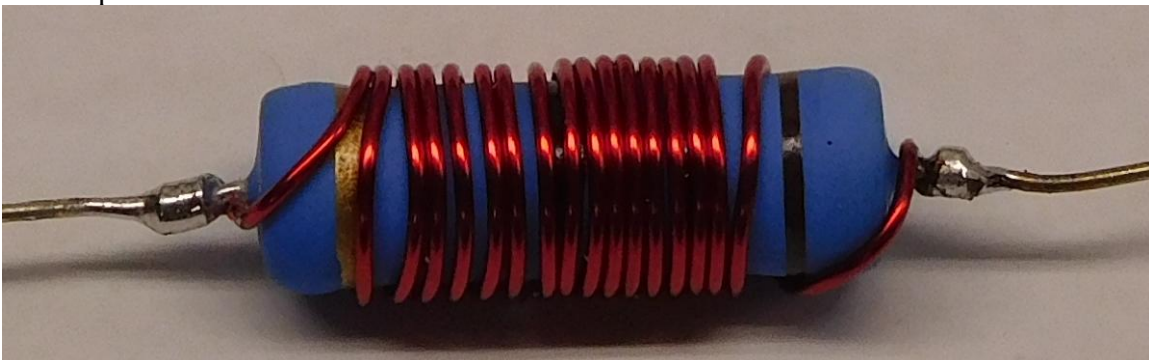
5. Wrap 16 closely spaced turns of magnet wire tightly around the body of the resistor. Keep all the turns going in the same direction, although the direction

chosen is not important. If you are within a turn or two of the ideal 16, you are fine.

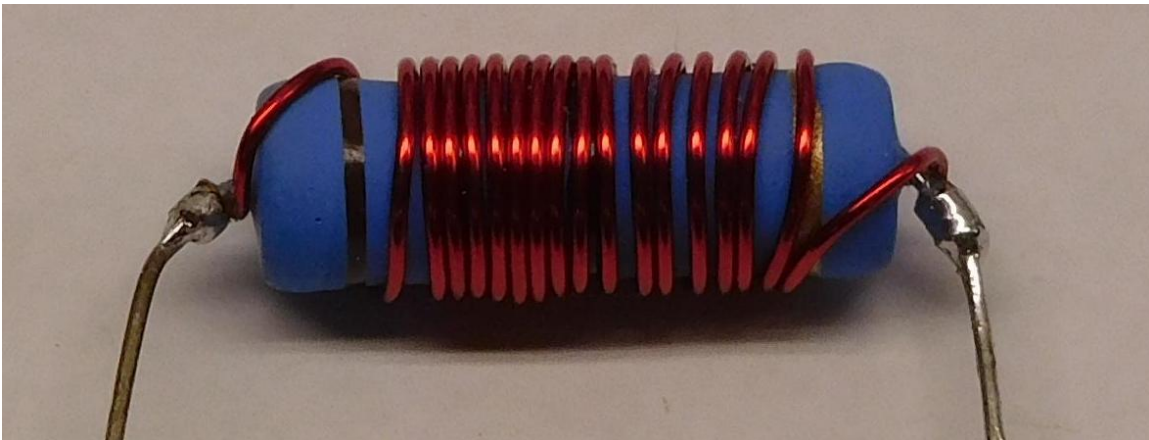
6. If you have extra wire past the amount needed to make 16 turns and terminate the coil on the resistor lead, then cut the wire. You'll probably cut no more than 1" off the wire. Remove ½" of insulation from the end of the wire.



7. Wrap three turns of the free-end of the magnet wire around the as yet unsoldered power resistor lead.



8. Apply plenty of heat, and then solder the magnet wire to this resistor lead.
9. Set the assembly aside to cool, and then build a second such assembly.
10. Test the resistance of both assemblies. Their resistance should be significantly less than 0.5 Ohms.



11. Form the leads and install one of these assemblies into the PCB as R10.

12. Form the leads and install the second of these assemblies into the PCB as R20.

Install the Red/Black Zipcord Power Wires

1. Cut a 9" length of the supplied 18 AWG red/black zip cord.
2. Strip $\frac{1}{4}$ " inch of insulation from each of the four ends.
3. Twist and tin the 4 ends.
4. Insert one end of the red wire into the VCC terminal from the solder side of the board and solder it on the component side.
5. Insert the accompanying black wire into the PGND terminal from the solder side of the board and solder it on the component side.

Install the Bonded Pair Capacitor Wires

The kit is supplied with a 16" length of 4-conductor (Green, Yellow, Brown White) bonded wire.

1. Separate that 4 conductor wire into two pieces:
 - a. A Green-Yellow piece.
 - b. A Brown-White piece.
2. Cut the Green-Yellow piece to a length of 15 inches.
3. Strip $\frac{1}{4}$ " inch of insulation from each of the four ends.
4. Twist and tin the 4 ends.
5. Inserting the wires into the solder side of the board, and soldering on the component side:
 - a. Connect the Green wire to the C7LNEG eyelet on the board.
 - b. Connect the Yellow wire to the C7LPOS eyelet on the board.
6. Cut the Brown-White piece to a length of 9 inches.
7. Strip $\frac{1}{4}$ " inch of insulation from each of the four ends.
8. Twist and tin the 4 ends.
9. Inserting the wires into the solder side of the board, and soldering on the component side:
 - c. Connect the Brown wire to the C7RNEG eyelet on the board.
 - d. Connect the White wire to the C7RPOS eyelet on the board.

Install the auxiliary heatsink

Refer to Figure 11. Locate the 1" tall piece of heatsink material.

1. Smear a thin film of thermal compound on the flat side of the 1" heatsink. ***Be careful to avoid cutting yourself as the edges may be sharp.***
2. Attach it to the main heatsink using 3 6-32x5/8"sems screws.

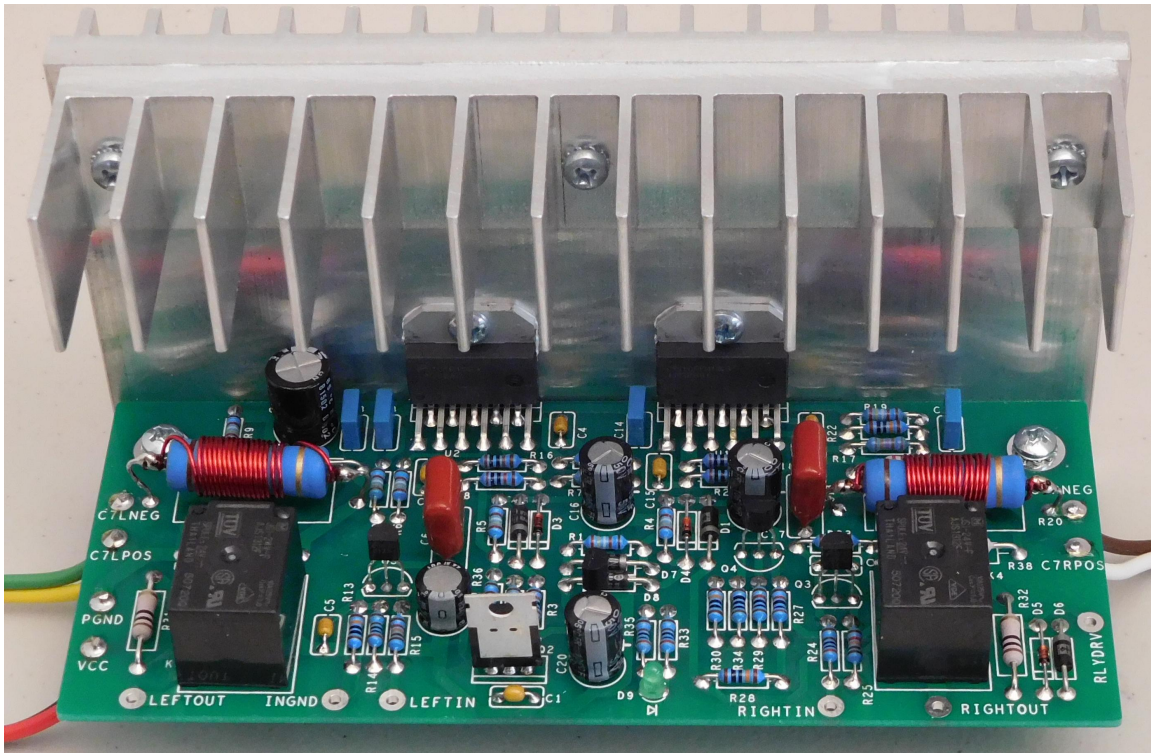


Figure 11-Assembled PCB with both heatsinks attached

Install the power amplifier

Prior to fastening the amplifier into the chassis:

1. Connect the yellow RLYDRV wire from the power supply to the RLYDRV eyelet on the right side of the power amplifier PCB. Insert it from the solder side, and solder it on the component side.
2. Connect the following wires to the amplifier module. Insert from the solder side and solder on the component side. You may shorten the wires before installation, but leave them long enough that you access the bottom of the PCB for later assembly or troubleshooting steps.
 - a. INGND wire from C11 to the INGND terminal.
 - b. RIGHTIN wire to the RIGHTIN terminal.
 - c. LEFTIN wire to the LEFTIN terminal.
3. Connect the LEFTOUT wire to a length that comfortably reaches the LEFTOUT eyelet of the amplifier PCB to allow easy access for service. Insert the wire from the solder side and solder on the component side
4. Connect the RIGHTOUT wire to a length that comfortably reaches the RIGHTOUT eyelet of the amplifier PCB to allow easy access for service. Insert the wire from the solder side and solder on the component side
5. Solder the following wires from the bonded pairs to C7L and C7R:
 - a. Connect the Green wire from the C7LNEG eyelet on the board to the negative terminal of C7L. C7L is near the transformer.
 - b. Connect the Yellow wire from the C7LPOS eyelet on the board to the positive (RED) terminal of C7L. C7L is near the transformer

- c. Connect the Brown wire from the C7RNEG eyelet on the board to the negative terminal of C7R. C7R is near the front panel.
 - d. Connect the White wire from the C7RPOS eyelet on the board to the positive terminal of C7R. C7R is near the front panel.
6. Do a trial fitting into the chassis without the screws. Take this time to push various wires out of the way to clear the way for the amplifier module. Once you see that there's a clear path to installing the amplifier module, proceed to the next step.
7. Use the spare thermal compound reserved previously to "butter" the bottom edge of the heatsink with a thin film of thermal compound. This will help transfer heat to the chassis, and lets the amplifier idle about 2 degrees C cooler.
8. Insert the 6-32x3/8" sems screws (have built-in lockwashers) thru the bottom of the chassis and tighten them up to hold the heatsink in place.
9. Connect the RED/BLACK power wires from the amp PCB to C9:
 - a. RED wire from VCC to the positive terminal of C9.
 - b. BLACK wire from PGND to the negative terminal of C9.
10. Inspect your work:
 - a. Make sure there are no pinched wires.
 - b. Form the wires to satisfy your sense of neatness.
 - c. All of the label eyelets around the border of the PCB should have a wire installed.

Test your work

Caution: Potentially fatal voltages will be present. This is not the time to get sloppy!

Bare amplifier tests

1. Turn the power switch off.
2. Plug the amp in to the AC mains.
3. **Working at arms length from the amplifier**, turn the amp on and watch for smoke. If no smoke, then continue. (Of course, if smoke, then pull the plug and take a break).
4. 5 to 10 seconds after turn-on, the LED on the amplifier board should illuminate, and you'll hear the relays click if the room is quiet.
5. Check the voltage on C9. It should be about 72 volts DC. It isn't a regulated voltage, so it may range from 66 to 78 volts.
6. Turn off the power switch. The LED turns off almost immediately when the power switch turns off.

Amplifier plus speaker tests

1. Hook a pair of speakers to the FRONT speaker outputs.
2. Turn the volume down and set the selector switch to TUNER. Set the speaker switch to FRONT.
3. Turn the amplifier on. There may be a "tick" sound when the relays close, but it should be quite soft. The amplifier should otherwise be quiet.
4. Temporarily set the top cover back in place. Note that on the SCA80(Q), having the top cover in place greatly diminishes hum.

5. Turn off the amplifier.

Amplifier plus speaker plus source tests

1. Connect a high level source like a CD player to the TUNER inputs.
2. Turn the volume down.
3. Turn the amplifier on.
4. After the relays click in, increase the volume to a comfortable listening level.
Enjoy the music, but don't get carried away. We still must complete final assembly.

Final Assembly

1. Turn the amplifier off.
2. Unplug the amplifier power.
3. Reinstall the 5 screws that hold the cover in place.

Your upgraded amplifier is ready for use.

In Case of Trouble

This section contains a list of the most often found assembly errors and their symptoms.

Symptom	Assembly Error
Amp draws too much current, even at idle.	<p>You've swapped some of the 2K0 and the 20K0 resistors. That makes the gain too low, which causes the amp to go unstable, oscillate, and draw too much current.</p> <p>Check all of the 2K and 20K resistors for swaps. If you're either color-blind, or uncertain about the colors, lift one end of any questionable resistor, and measure its resistance using an ohm-meter.</p>

About the Design

Power Supply Theory of Operation

The power supply schematic is shown in Figure 15.

Stepped down AC voltage from the transformer enters on the left side of the schematic through pins X1 and X2. These connect to D5-D8, which form a full-wave bridge that turns the AC input into pulsating DC. C9, located externally to the power supply PCB, filters the pulsating DC, turning it into VCC, a largely constant DC voltage. VCC is nominally 72 Volts when the amplifier modules are connected but idle. VCC contains a little bit of AC ripple, approximately 100 mV peak-to-peak (assumes 120 mA load current and $C9=10,000\ \mu\text{F}$).

C3 contains the high frequency switching currents from the diodes into a small loop that doesn't include the power transformer, limiting interference into adjacent devices like FM tuners.

R12 taps off some of the 72 volts and provides, with C11, filtered low voltages that run the preamp section of the SCA80.

So, what does all the rest of the stuff in the power supply do? It controls the speaker relays, hopefully in a way that eliminates pops and clicks on turn-on and turn-off. These circuits have the following major parts:

1. Regulated Supply for the turn-on circuits
2. DC voltage good detection
3. AC voltage is present detection
4. Time Delay
5. Relay Driver

Regulated Supply

For the moment, consider the sub-set of the circuit shown in Figure 12.

R2 and D2 form a regulated 10V supply that makes turn-on operation timing consistent and independent of the input voltage.

Time Delay and Relay Driver

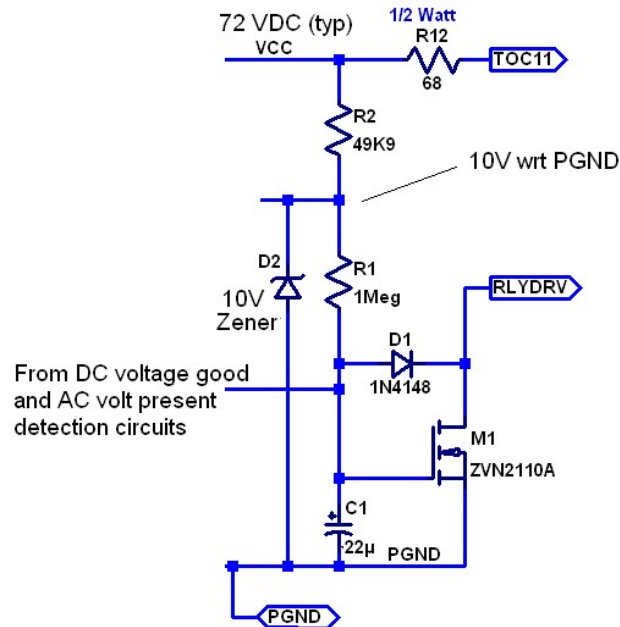


Figure 12-Power supply snippet

M1 is an N-channel MOSFET that turns on to energize the coils of the speaker relays found on the amplifier PCB. M1 turns on when its gate to source voltage, which is also the voltage across C1, gets a bit above M1's threshold voltage, about 2.5 volts. R1 charges C1 rather slowly, over the course of a few seconds, to make this happen. This slow charging provides the time delay that allows the amplifier modules to stabilize before they relay energizes. This is the action that prevents pops and clicks on turn-on and turn-off.

D1 makes the on-off timing of the time delay repeatable and largely independent of quick on/offs of the power supply. Without D1, the voltage on C1 would eventually rise to 10 volts. With D1, the voltage on C1 only rises to about $V_{thres} + 0.6$, no matter how long the amplifier is on. That makes the time to reset the capacitor independent of how long the amplifier was turned on.

The circuits described in the next section only allow the voltage on C1 to rise when both DC voltage is good and AC voltage is present from the transformer.

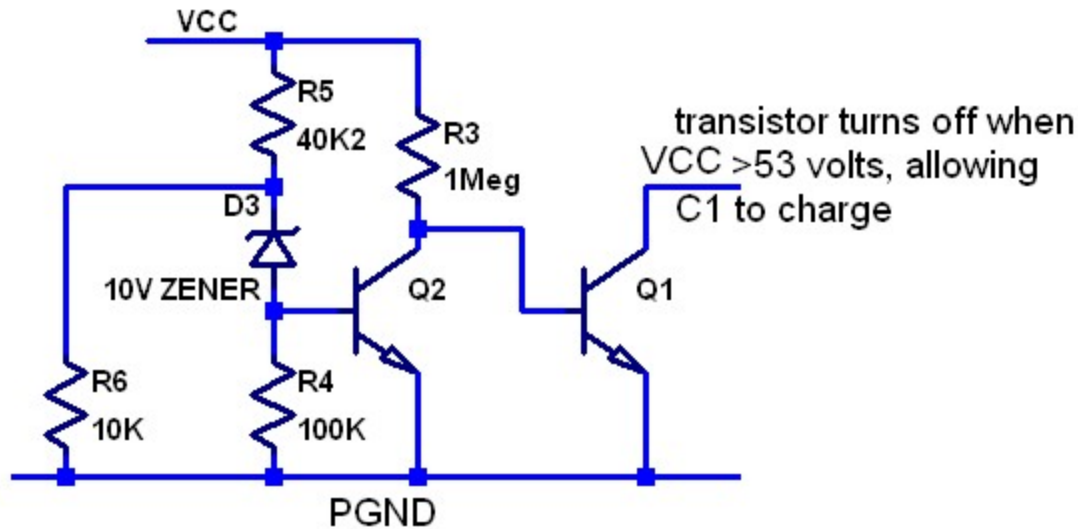


Figure 13-DC Good Detector snippet

DC Voltage Good Detection

The following discussion refers to Figure 13. The DC Voltage good detector allows C1 to charge, and the relay to be energized, whenever VCC is greater than about 53 volts. Here's how it works.

R5 and R6 form a voltage divider that places 1/5 of VCC on the cathode of D3, a 10 Volt zener. When the cathode of D3 is more than 10.6 volts positive (with respect to PGND) Q2 turns on. This turns Q1 off, allowing C1 to charge via R1. That says that the threshold of DC voltage good is approximately $VCC > 5 \times 10.6 = 53$ volts. This calculation ignores the attenuation of R4, but that provides less than a 10% change. R4 is there to assure that Q2's leakage currents cannot turn it on.

AC Voltage Present Detection

The following discussion refers to Figure 14. The AC Voltage Present Detection Circuit allows C1 to charge, and the relay to be energized, whenever the peaks of the X1-X2 transformer voltage are much greater than 40 volts. Here's how it works.

R11 and R10 form a voltage divider that places 2/7 of the voltage from X1 to X2 at the input of D4, a 10 Volt zener. Thus any time that the peaks of the transformer voltage exceed 39.2 volts, opto-isolator U1's LED conducts, which turns on the opto-isolator's transistor, discharging C2. ($7/2 \times 11.2 = 39.2$, where 11.2 is the sum of the 10V zener voltage and the 1.2 volt drop across the input LED of the opto isolator.).

Discharging C2 keeps Q3 turned off, which allows Q3 to charge.

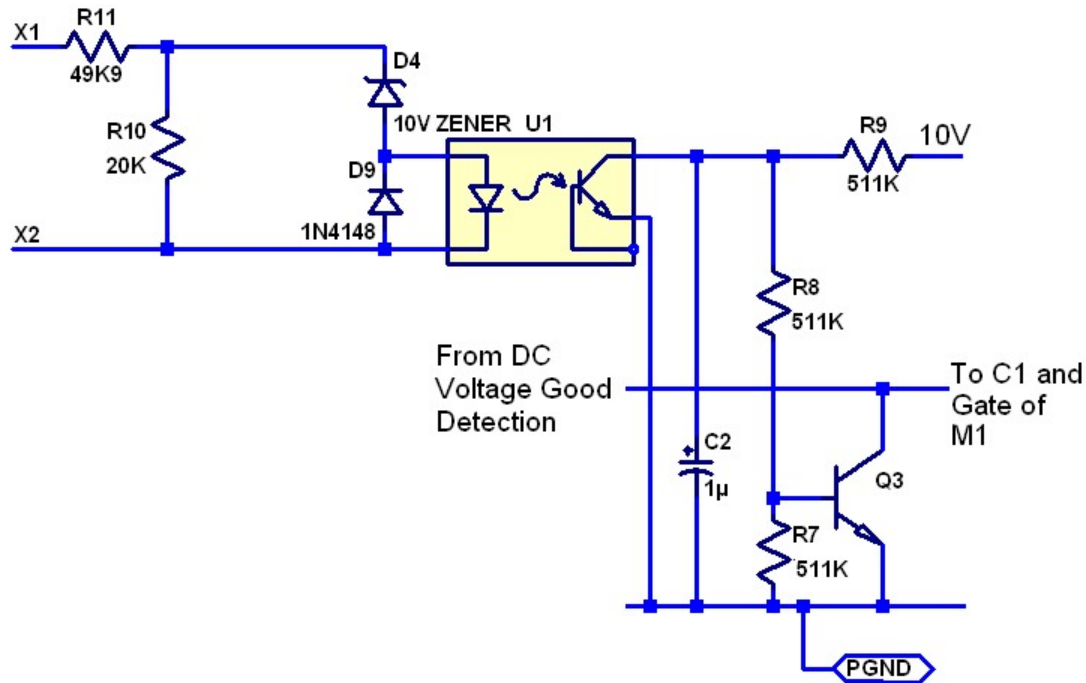


Figure 14-AC Detect snippet

Q3 turns on whenever the voltage Across C2 is greater than 1.2 volts. So we see there is an element of timing involved here. Every time a pulse at X1-X2 exceeds 40 volts, C2 discharges. If the power switch is turned off (or the plug is pulled), then there will be no input pulses, C2 charges, and C3 turns on, resetting C1.

All Together Now

So we see that to allow the time delay that leads to relay turn-on to begin:

1. The DC voltage must be high enough
2. Pulses must be present on the AC input voltage

When either condition is false, the time delay capacitor is reset, and the relay turned off, preventing the speakers from being connected to the load. This keeps turn-on/turn-off pops and clicks out of your speakers.

Amplifier Board Theory of Operation

VMID Generator

The following discussion refers to Figure 16. The no-signal DC output voltage of the power amplifiers is set to half the supply voltage. That voltage appears across the clamp mounted C7s so that there is no DC voltage on the speakers. The VMID generator generates a clean and quiet voltage at half the supply voltage or approximately 36 volts.

Q1 and Q2 form a compound amplifier that generates VMID.

- R1 and R2 set the input voltage to the Q1-Q2 amplifier,
- C2 filters that input voltage to make it quiet,
- D5 manages the charge on C2 during turn-off
- C1 frequency compensates the Q1-Q2 amplifier, keeping it stable
- R7 and R8 take a bit of the dissipation of the Q1-Q2 amplifier and provide a convenient place to monitor the current it delivers.
- D1, D4 and R4 generate VMIDL, the VMID for the left channel.
- D2, D3, and R5 generate VMIDR, the VMID for the right channel.

Sound Node

The SOUND node generates a voltage that mutes the amplifier input by about 20 dB until just after the speaker relays close.

- When RLYDRV is high, the speaker relays are not energized.
- Q4 is turned on, and the SOUND node is low, which mutes the amplifier input.

Once RLYDRV goes low:

- Q4 turns off.
- C19 charges, and the SOUND node rises to about 12 Volts, which stops the muting action.

If RLYDRV then goes high again (e.g. during power amplifier turn-off):

- Q4 discharges C19, grounding the sound node, and restoring the mute function for the next turn-on cycle.

Power Amplifiers

The following discussion refers to Figure 17. The part numbers cited will be for the left channel, the equivalent right channel parts are easily seen by looking at the same place in the lower half of the diagram.

- R15 provides an input loading resistance that in aggregate is similar to what the old SCA80 power amp provided. This keeps the tone control action unchanged.
- R14 and Q5 provide the muting circuit discussed in the previous section. When SOUND is at 12 V, there is no muting. When SOUND is near ground, Q5 shows a low impedance that mutes the input signal.
- C5 provides a little bandwidth limiting to the input signal.
- VMIDL is filtered even more than VMID by the action of C16.
- C6 is the input coupling capacitor.

- R12 provides DC bias current for the positive input.
- R7 and R8 set the power amp's midband gain.
- C4, C9, and R16 civilize the behavior of the protection circuits when the amp is heavily loaded.
- R9 unmutes the power amplifier when adequate voltage is present.
- C7 and C8 provide power supply bypassing that aids the amplifier's stability.
- R11 and C3 form the Zobel network that helps stabilize the output stage.
- The output of the amplifier goes off the board to the clamp mounted C7 via the C7LPOS pin. The output of that capacitor returns to the board via C7LNEG.
- That signal passes through the parallel L1-R10 combination that helps assure the amp's stability in the presence of capacitive loading.
- K3 helps assure the absence of turn-on/turn-off pops and clicks. Assume that the amp has been off for a while. Now, when the amp is turned on, K3 remains de-energized until DC voltage is good, AC input is present, and the time delay expires. During all that time:
 - The speaker outputs are disconnected.
 - C7 charges to its proper value through R31.
 - The amplifier input is muted
- Once RLYDRV goes low (active), the relay coil is driven, and:
 - LED D9 lights up.
 - K3 connects LEFTOUT to the amplifier output
 - The SOUND node rises, removing the muting action on the input.
 - The amplifier is ready to reproduce the selected source.

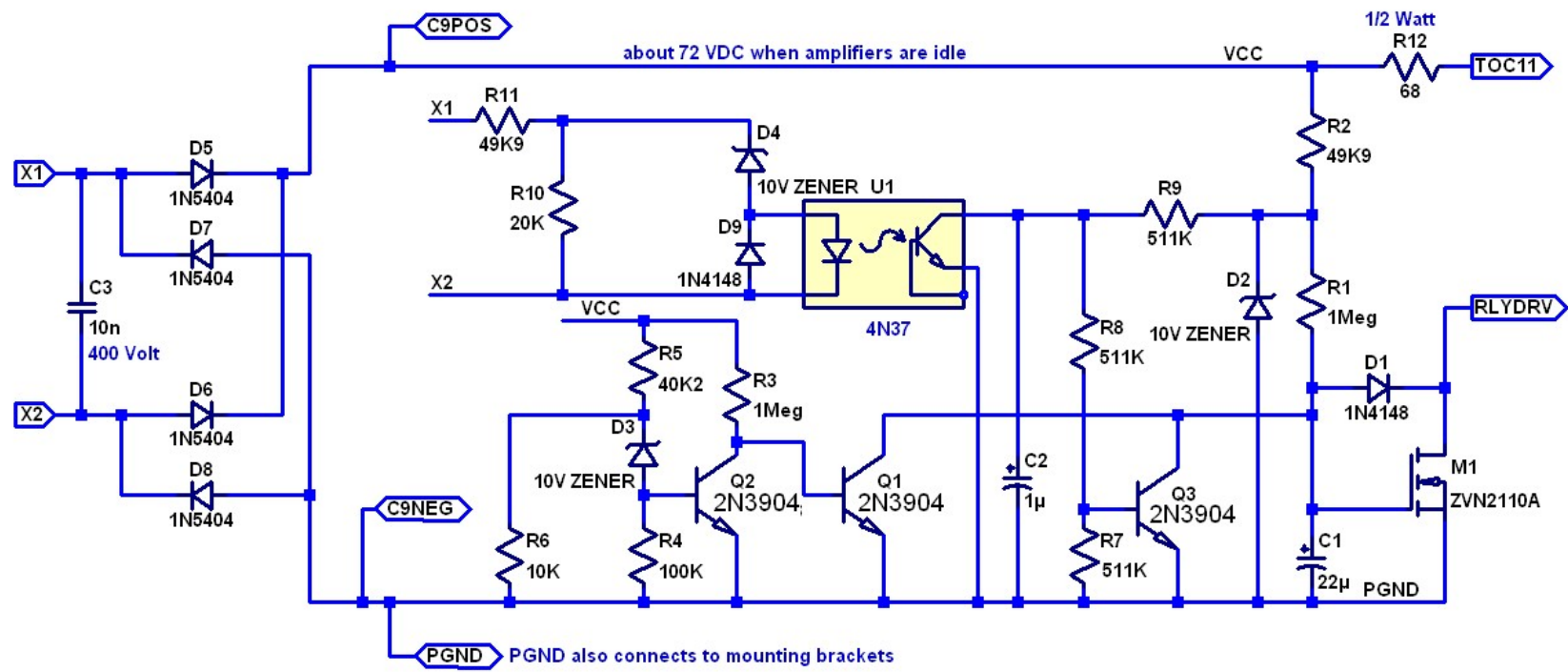


Figure 15-Power Supply Schematic

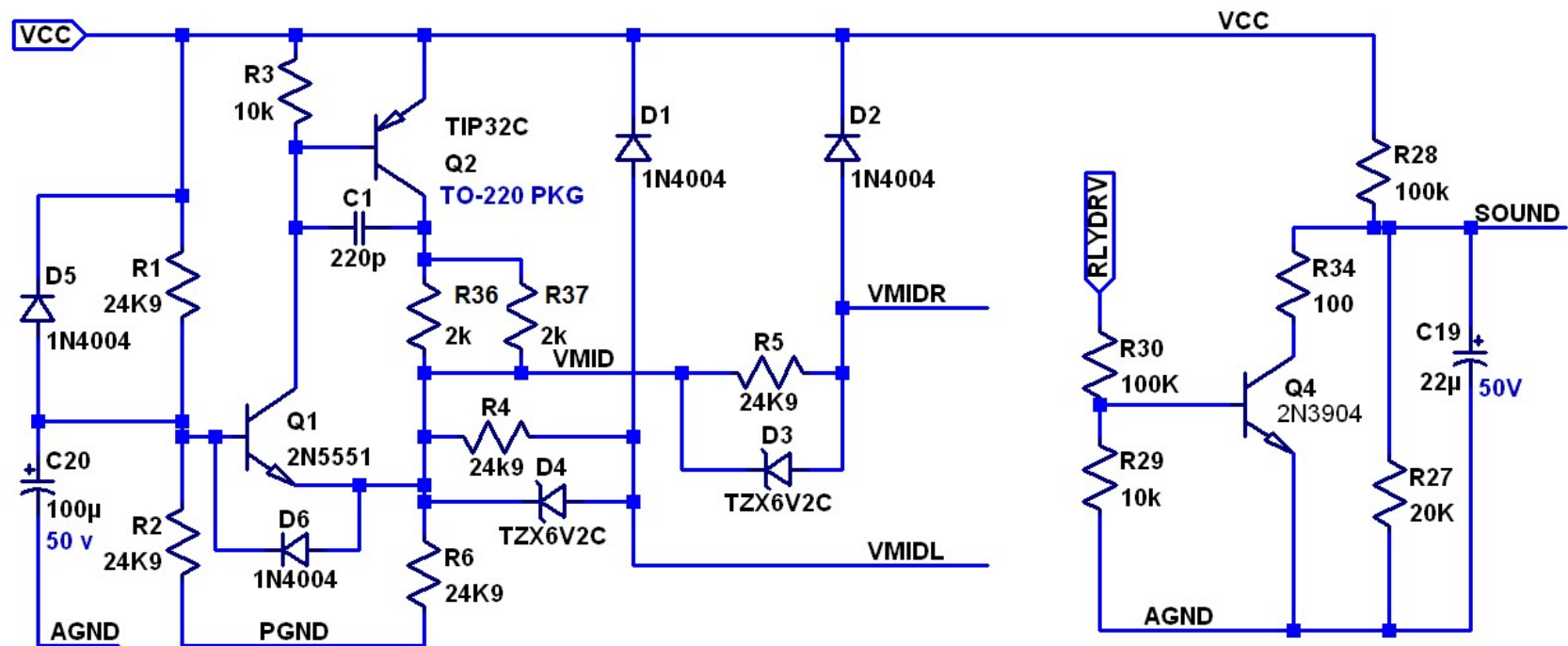


Figure 16-Page 1 of Amplifier Board Schematic

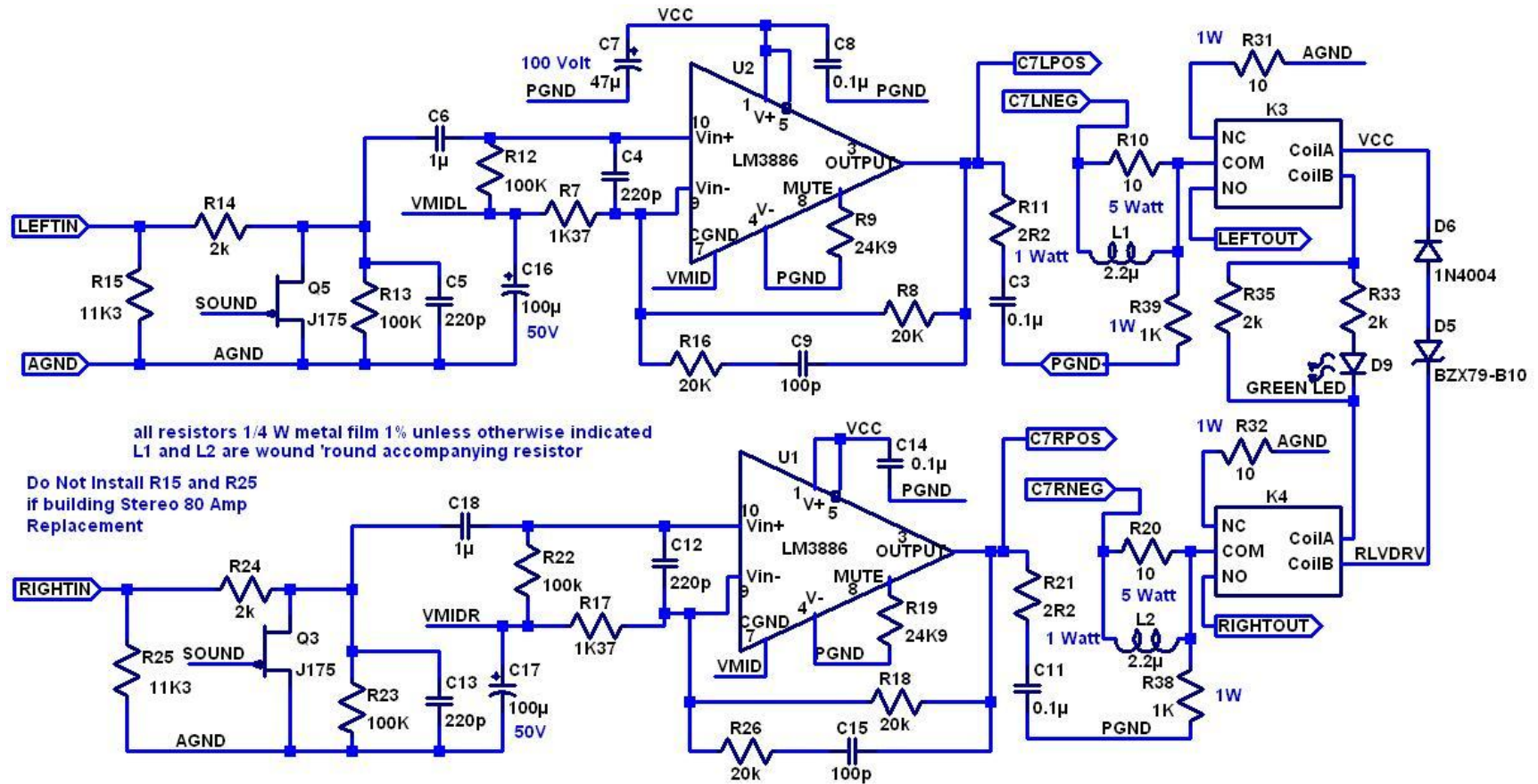


Figure 17-Page 2 of amplifier board schematic