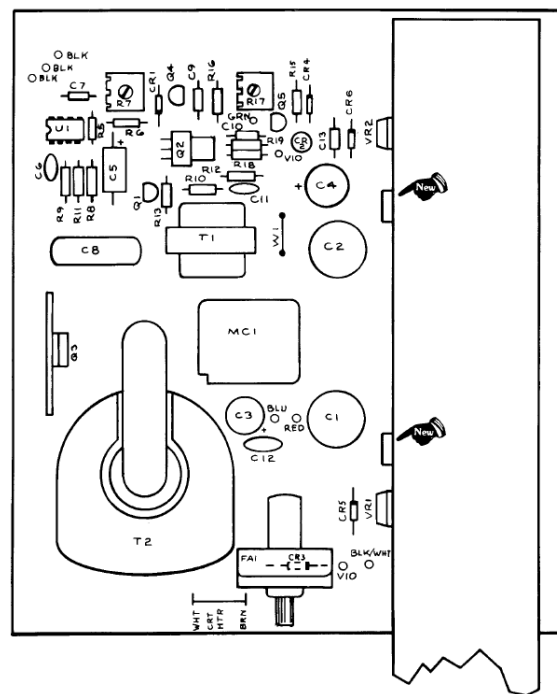


# Amplifone HV PCB

## TO-220 Power Resistor Modification Procedure

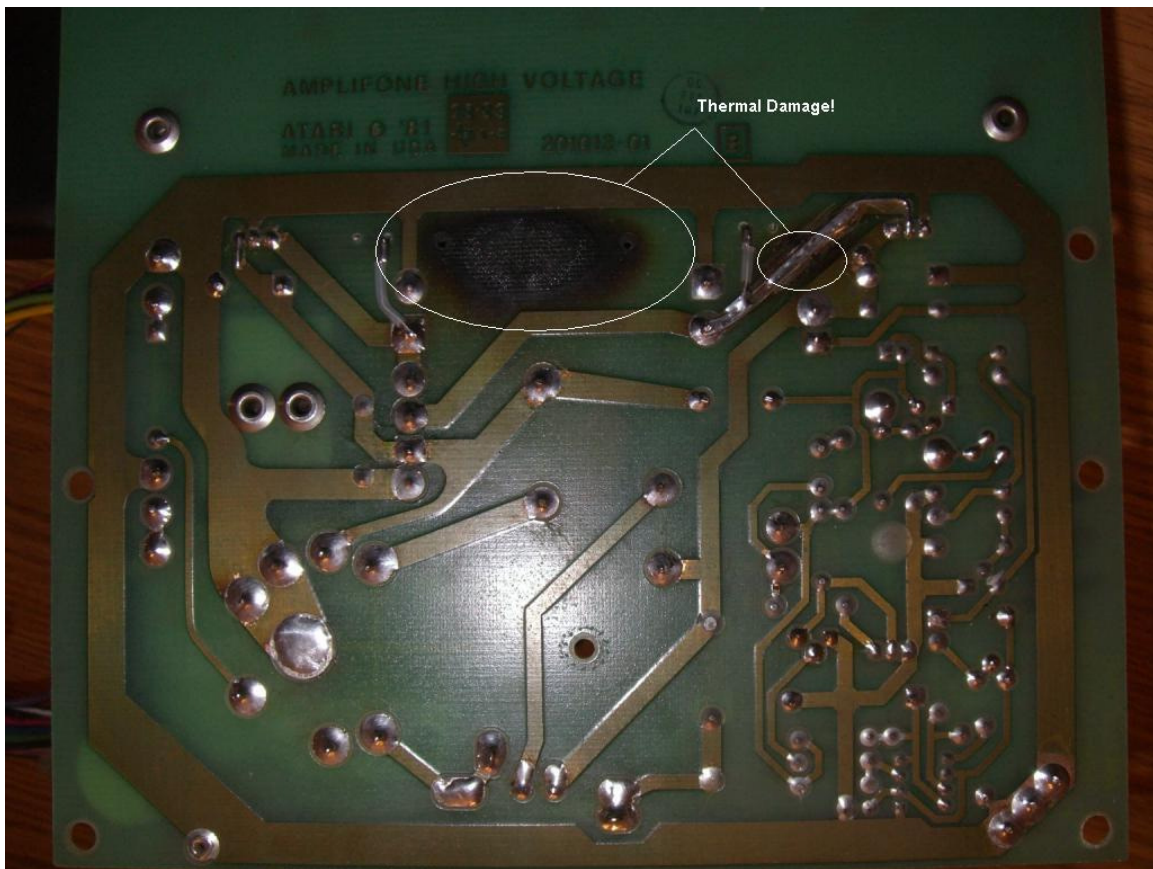
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## **Purpose**

The purpose of this modification is to correct the original 50-ohm power resistor modification such that it will generate very little heat. The original modification used standard 5W 50-ohm power resistors which generate a severe amount of heat that usually cause circuit board or component damage over time. Figure 1 shows the kind of thermal damage that can occur with the original power resistor modification.

With this modification, the TO-220 power resistors are not only rated at 30W but they also benefit from the use of the heat sink, effectively eliminating the high heat caused by the original design.



**Figure 1 Thermal Damage**

## **Materials Needed**

- 2 ea TO-220 50-ohm 30W power resistors. Mouser part number 684-MP930-50 (or equivalent)
- Approximately 4" of 18AWG Solid Bus Wire (stranded ok)
- 2 ea 4-40 x 3/8" Machine Screw
- 2 ea 4-40 Machine Screw with Lock Washer
  - You may use either nut with lock washer attached or a separate spring lock washer.
- Thermal Grease, (non conductive)
- Soldering supplies
- X-ACTO type knife, with a new blade.

## **Preparation**

The ideal time to do this modification is during a complete rebuild as certain capacitors and the HVT make it difficult to work in the locations required for this procedure. At a minimum you should remove your HVT, and capacitors C1, C2 and C4. Put them aside for re-installation later on in this procedure. Don't worry they will thank you for it later ;)

## **Remove the Old Power Resistors**

Before you can proceed you will need to remove the 50-ohm 5W power resistors that may be present on your Amplifone HV PCB. These resistors are usually mounted pretty high off of the PCB surface close to the heat sink. Clip them out and de-solder their leads from the PCB. Throw them away!

## **Drilling Mounting Holes for the TO-220 Power Resistors**

These instructions assume you are drilling the heat sink from the direction of the PCB where the components are located and that you have removed all obstructing components as described in the preparation section of this document. If you wish to drill from the outside of the PCB (looking into the U of the heat sink) then you will have to transpose your hole markings with respect to these instructions.

On the face of the heat sink where the voltage regulators (VR1 and VR2) are mounted, measure about 1.25" to the right of center line of VR2 and mark the heat sink at the same height as the mounting hole for VR2. Measure about 7/8" to the left of the center line of VR1 and mark the heat sink at the same height as the mounting hole for VR1. Before drilling the mounting holes, use your power resistors as a guide and check to be sure the leads will not interfere with any copper on the solder side of the board when they are installed, see Figure 4 for reference.

After you've double checked the position of the leads, drill a 1/8" hole at each of the marked locations on the heat sink. Remove the burrs from the holes before continuing. Be sure to do this by hand using a larger bit ( $\geq 1/4$ "). Clean and remove any filings that may have been left behind.

## **Marking the PCB for the TO-220 Leads**

Using your TO-220 power resistor as a guide place it against the heat sink centered with respect to the new hole you drilled and mark the PCB where legs touch. You can use a bit of paint/ink or something on the legs to transfer the marks to the PCB. Repeat this for both TO-220 power resistors.

## **Making the TO-220 Lead Holes**

You may do this with a drill, but since the PCB is marked on the top it is difficult to get the drill close enough without the chuck hitting the heat sink. Also as the heat sink is riveted on so it limits the ability to work around the situation. What worked for me was a fresh clean X-ACTO blade. Simply twirl it back and forth to work your way (partially) through the PCB but don't go all the way through. Go far enough into the PCB such that you can see it on the solder side of the PCB (it should show like a white dot). Then, finish piercing the board from the solder side of the board, this way you have a clean hole. If you try and drive all the way through with the X-ACTO from the component side, the blade can break or your board could end up a bit mangled.

## **Test Fit**

Test fit your TO-220 resistors to be sure the holes are in proper place and the resistor fits properly with respect to the mounting holes you drilled in the first step.

## **Clean the Heat Sink and Resistors**

Use Isopropyl alcohol and thoroughly wipe down the heat sink where your TO-220s will be mounted and the ceramic side of the TO-220's themselves.

## **Mounting the TO-220 Power Resistors**

For each of the resistors, apply a light film of thermal grease to the ceramic side of the power resistor. Insert the 4-40 machine screw into the (non-greased side) mounting hole of the resistor. With the greased side facing the heat sink, feed the resistor leads into the holes of the PCB until the screw lines up with the mounting hole in the heat sink. As you move the resistor into position try to keep the resistor surface away from the heat sink so you don't smear the grease. Insert the mounting screw into the hole of the heat sink. Fasten the screw with the nut and lock washer. Tighten firmly into place.

## Connecting the Circuit: Component Side

For the power resistor to the right of VR2, connect and solder its left leg to the anode of diode CR6 using a piece of the 18AWG jumper wire (see Figure 2). The anode of CR6 is the side of the diode WITHOUT the banding.

For the power resistor to the left of VR1, connect and solder its right leg to the cathode of diode CR5 using a piece of the 18AWG jumper wire (see Figure 3). The cathode of CR5 is the side of the diode WITH the banding.

For this example as shown in the pictures the jumper wires were insulated with high temp insulation tubing, this is not necessary.



### Figure 2 Power Resistor (Right of VR2)





**Figure 3 Power Resistor (Left of VR1)**

## Re-Install Components You May Have Removed

Now is a good time to re-install any components you may have removed in preparation for this modification.

## Connecting the Circuit: Solder Side

Orient the PCB such that the markings are right side up, the heat sink will be facing away from you. You will be oriented properly if VR1 is to your left and VR2 is to your right. See Figure 4 for component reference.

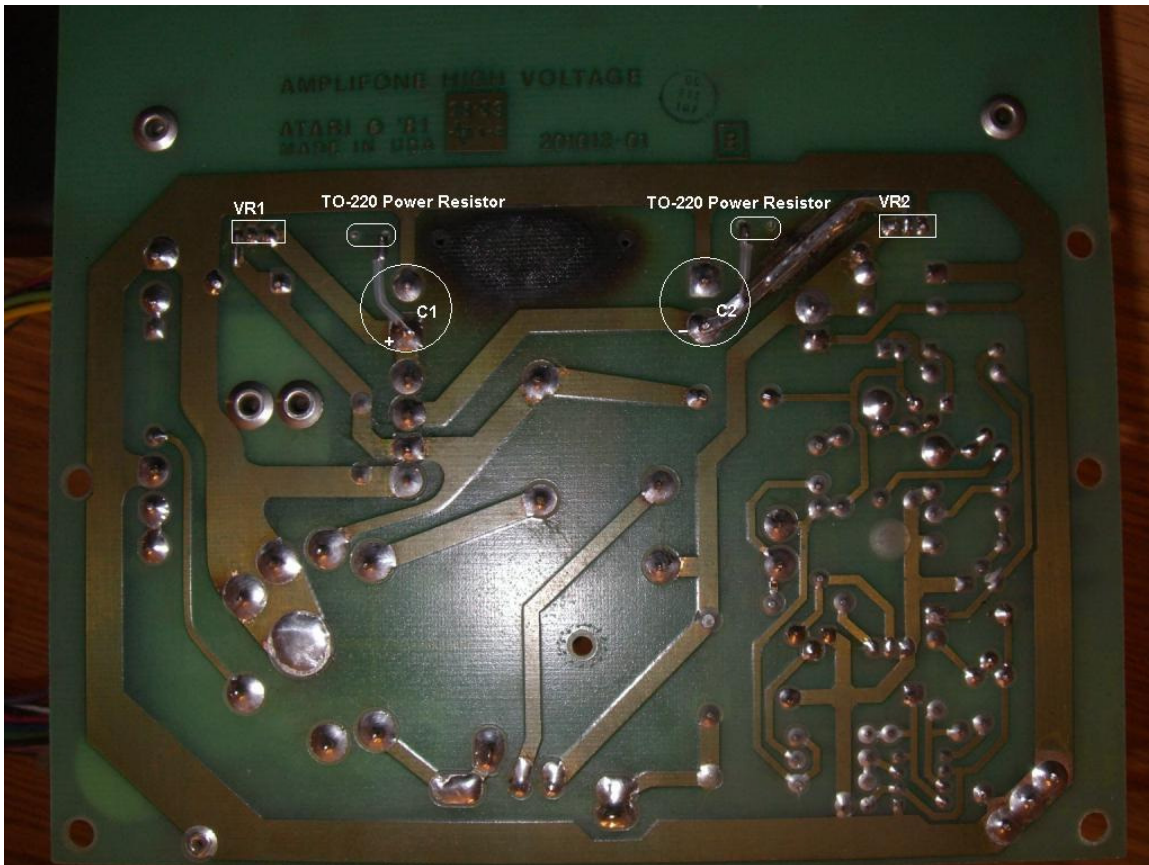


Figure 4 Solder Side Component Reference

Clip the leftmost lead of the power resistor that is to the right of VR1 flush with the board. This lead is not needed as it is the one that is connected on the parts side of the board. Bend the rightmost lead down flat against the board towards the inside of the PCB (away from the edge trace).

Clip the rightmost lead of the power resistor that is to the left of VR2 flush with the board. This lead is not needed as it is the one that is connected on the parts side of the board. Bend the leftmost lead



down flat against the board towards the inside of the (away from the edge trace).

With a piece of the heavy gauge 18AWG jumper, solder and connect the rightmost lead of the power resistor that is to the right of VR1 to the + side of C1 (this is a square pad on the PCB, see Figure 4).

With a piece of the heavy gauge 18AWG jumper, solder and connect the leftmost lead of the power resistor that is to the left of VR2 to the - side of C2 (this is a round pad on the PCB, see Figure 4).

You are finished with the modification! Your work should look similar to what is pictured in Figure 4 and Figure 5.

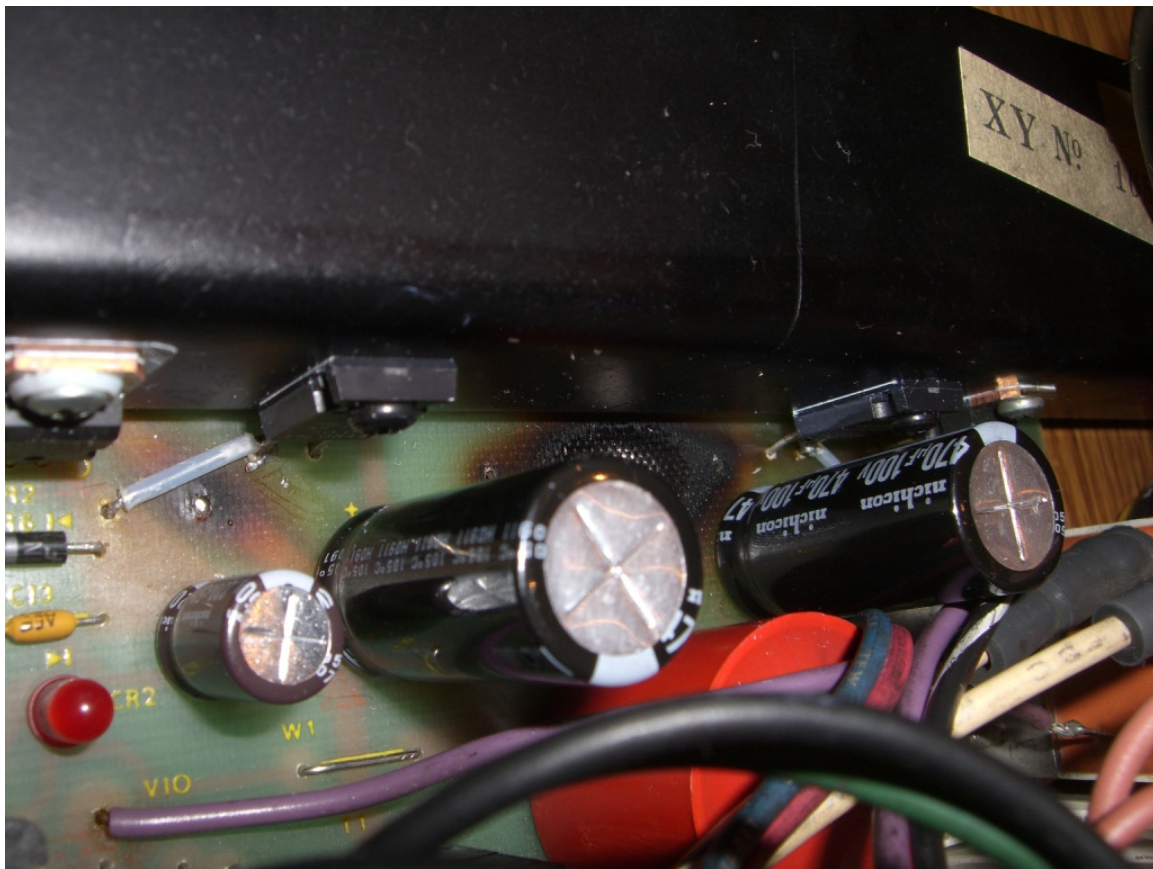


Figure 5 Power Resistor Top View