MUS-1099 CMS/Game Blaster clone Sound Quality Mod guide

Update: You can buy our kits to build this project (including the mods) here: https://www.tindie.com/products/trilobytesretro/creative-cms-game-blaster-clone-isa-sound-card-kit/ (fully assembled option also available)
This mod DOES NOT require you to cut traces in the PCB!! Also please make sure to isolate everything with tape so your mods won't touch pads in the PCB!!!

The original design of the MUS-1099 has two main issues that affect sound quality. Fortunately they can be easily solved by a couple of hardware mods.

High Gain Issue

After building MUS-1099 you'll notice the volume is very high, and slight increases in the volume knob add way too much volume. Even though this is not a critical issue (as you can always slightly turn the volume up for a normal sound), it would be best to be able to use the whole volume knob turn normally.

In order to fix this you need to reduce the gain of the amplifier loop by adding **two 1K Ohms resistors** from C17 and C20 (100uF electrolytic capacitors) to ground.

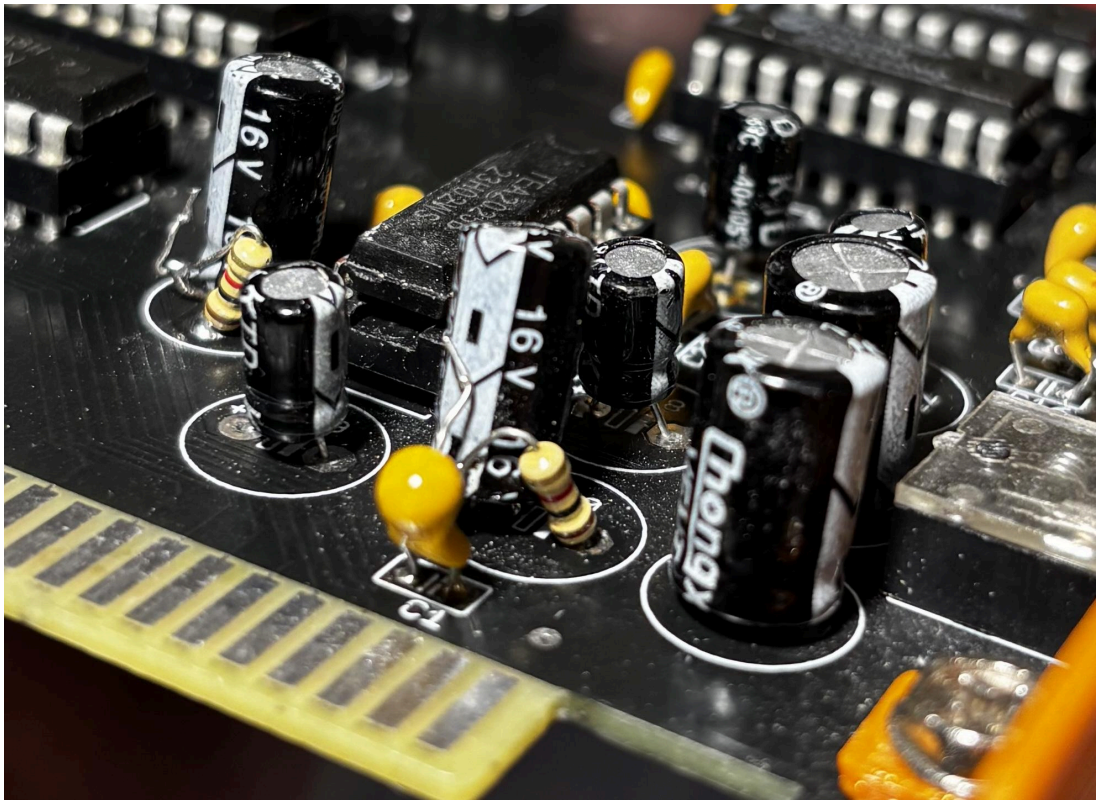

Figure 1: two 1k resistors added vertically connecting C17 and C20 capacitors to GND
C1 at the front of the photo is not connected to this mod (leave as is)

If you already soldered C17 and C20 you would have to desolder the pins that go to ground (marked with a solid white rectangle on the PCB / the pin that doesn't have a '+' near it / the one closer to the stripe mark on the capacitor) and solder them in the air to a 1K resistor.

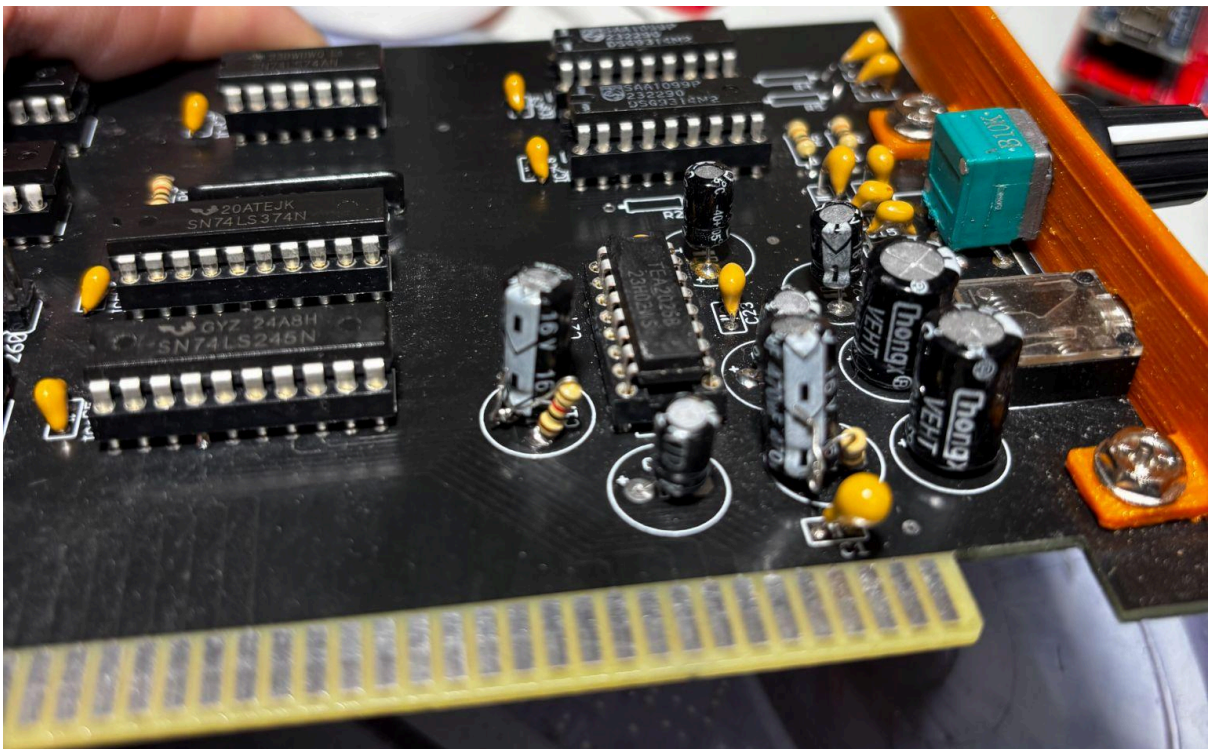

Figure 2: same two 1k resistors added vertically connecting C17 and C20 capacitors to GND

Then, the free pin of the resistor must be soldered to the ground pinhole that you just freed up (where C17 or C20 connected to ground).

And problem solved! Now your volume knob acts normally (you can increase the resistor value if you still want less gain/volume, eg. try resistors of 2.2K Ohms instead).

Noise Issue

Another thing you'll notice is some bus background noise. Sound cards should have an isolated amplifier loop but MUS-1099 is taking 5V straight from the ISA bus to feed the amplifier (in spite of the filtering caps, this still introduces noise from the ISA bus into the amplifier). We can solve this by adding a **78L05 voltage regulator** to provide a clean and smooth 5V to the amplifier. But a 78L05 requires a higher voltage to derive the +5V source which the sound card doesn't have, so we'll have to take it straight from the ISA port by hooking up to ISA header's B9 pin in the PCB (+12V).

When looking at the 78L05 from the front (the flat face) we'll connect the right pin (the input) to B9 (ISA), the center pin to ground (eg. the ground pin of C19) and the left pin (the +5V output) to the left side of R2, R3, R4 and R5 (their lifted left pins when looking at the PCB from the front). This way we're effectively removing these resistors from the noisy +5V line and connecting them to the clean +5V line provided by the 78L05.

Since B9 is on the back of the PCB, to make things easier, we're going to move the resistors R2 to R5 to the back of the board (BTW don’t use too much solder on B9 otherwise insertion will be difficult).

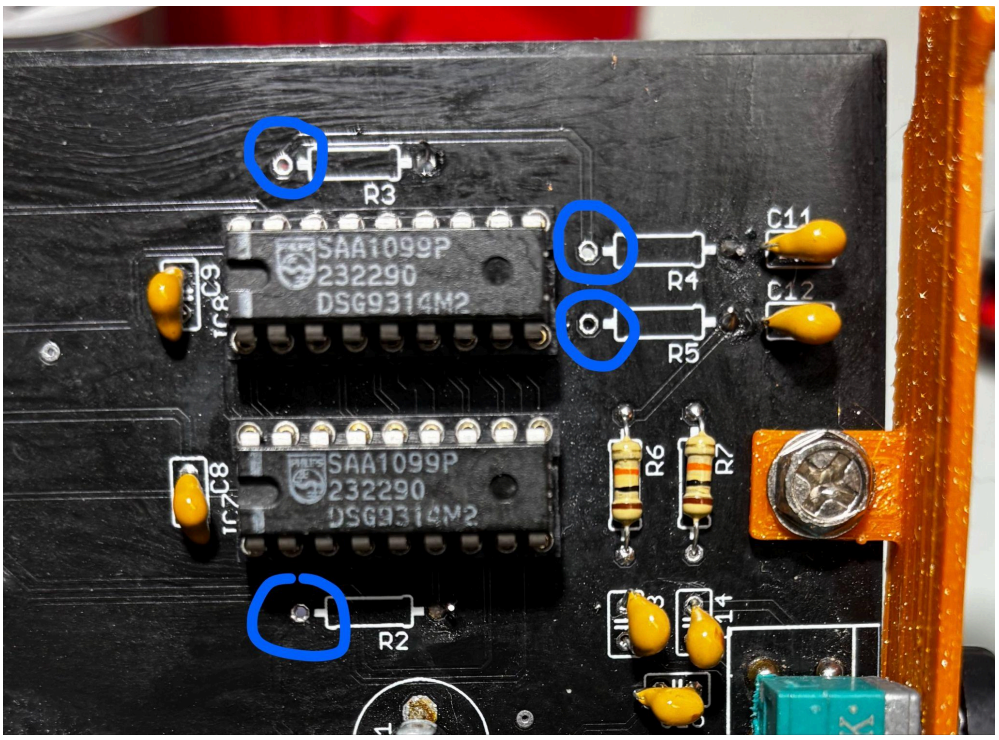

Figure 3: R2 to R5 are no longer at the front of the PCB (moved to the back) and their left pins go unsoldered

Now when we look at the back of the PCB we see a resistor array with left pins of R2 to R5 converging to the +5V output of the 78L05 voltage regulator (use tape below this).

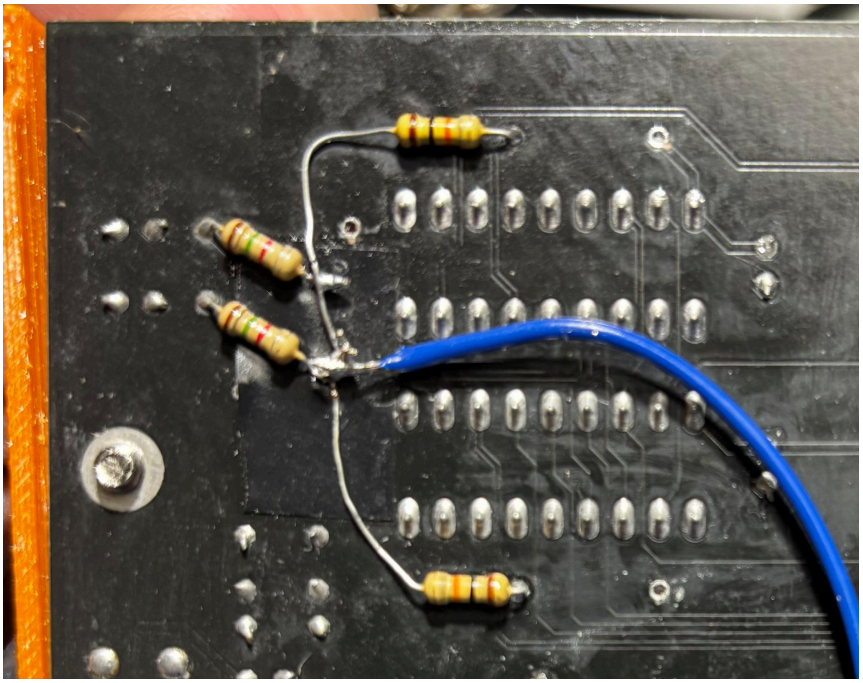

Figure 4: R2 to R5 are now at the back of the PCB and connect to the 78L05 via a cable

Finally, in order to smooth the operation of the 78L05, we'll also attach **two 100nF ceramic capacitors** to it: one from **left pin to middle pin** and another one from **right pin to middle pin**.

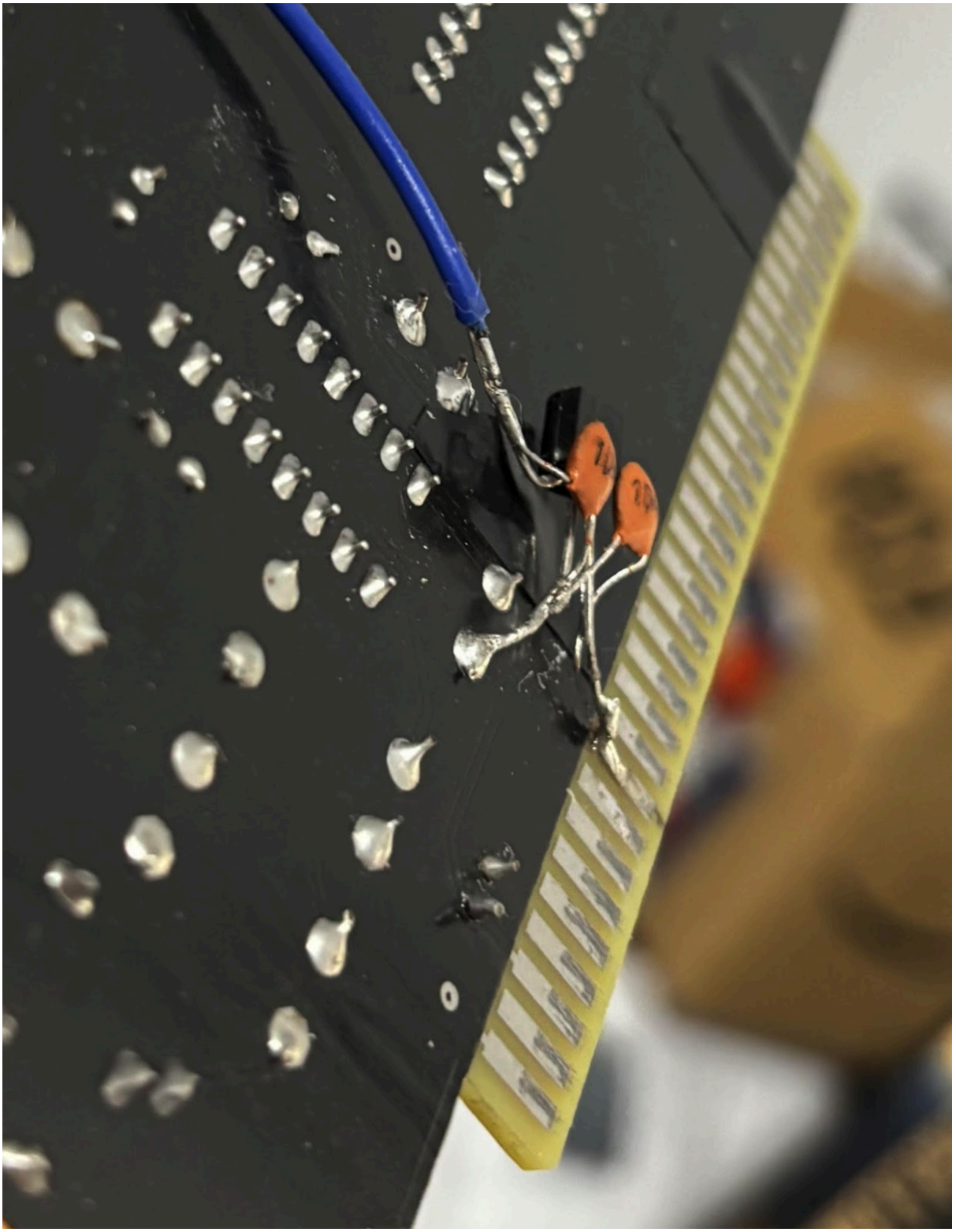

Figure 5: 78L05 and 100nF caps. ISA B9 connection. A pad is pretty close to the blue cable but it's not touching it (be careful, that's not a connection!). Place tape below to avoid shorts.

And voilá! Noise is gone!

With these mods the sound experience from a real CMS/Game Blaster should be indistinguishable (or even better)..

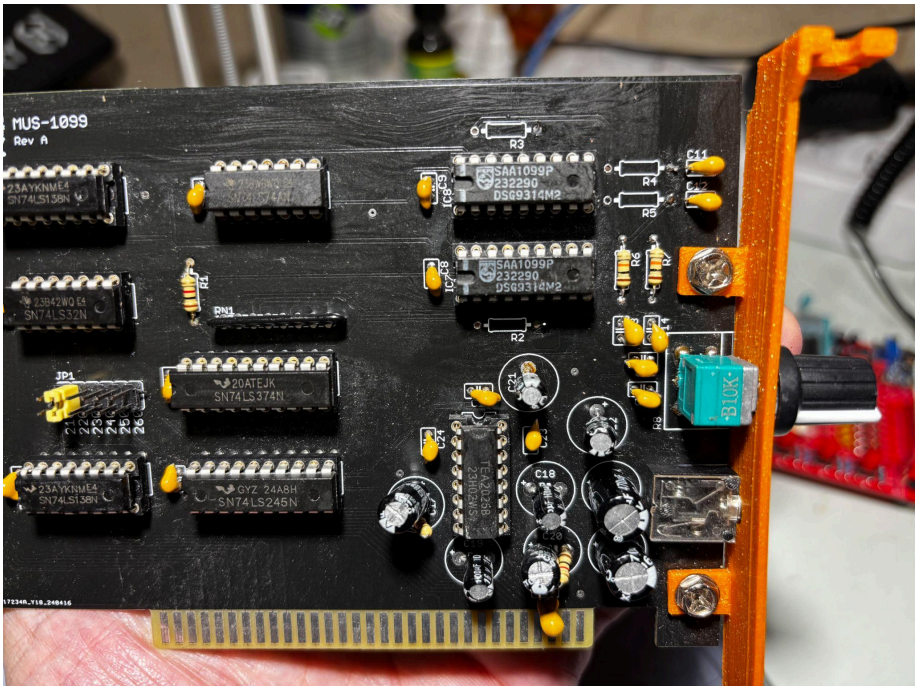

Figure 6: full front view of the sound quality mods

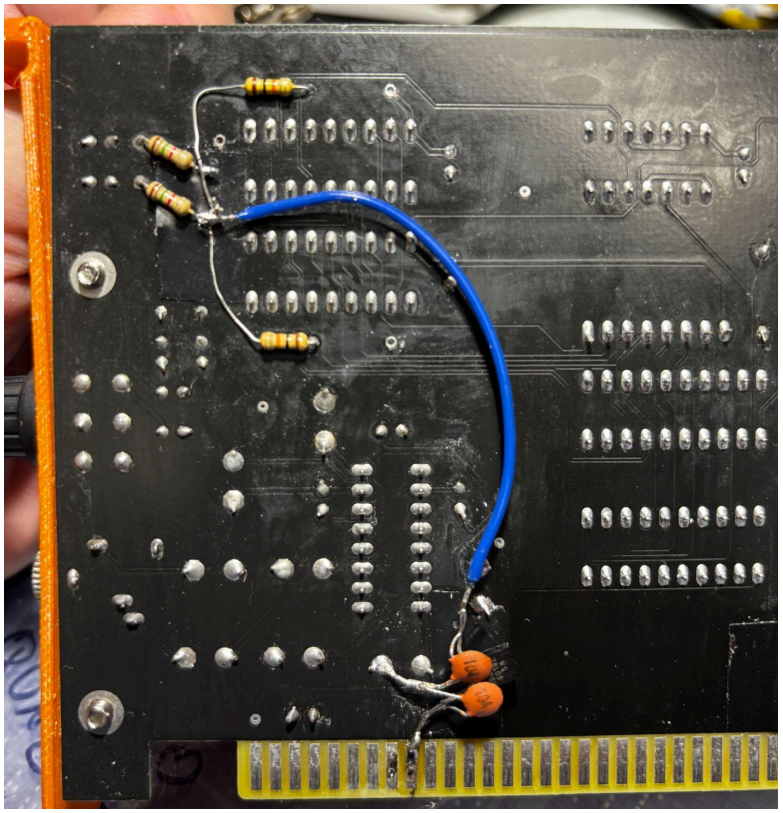

Figure 7: full back view of the sound quality mods (notice the 78L05 behind the caps)

Summary

Parts needed:

- Two **1K resistors** (1/4W) (or slightly greater for even less gain)
- One **78L05 voltage regulator** (TO-92 is enough)
- Two **100nF ceramic capacitors** (no polarity)
- One short **cable** (seen as blue in some of the photos)

Detailed steps:

- Desolder C17 and C20, and only the negative pins (lift pin up/set free, do not cut!)
- Desolder R2, R3, R4 and R5 (from the front of the PCB)
- Solder R2, R3, R4 and R5 on the back of the PCB but only the right pins (when looked from the top of the PCB, left pins when looked from the back of the PCB)
- Apply a bit of solder to the tips of the provided cable
- Solder one pin of a provided 1K resistor to the pinhole that you fred up from C17 (should be ground)
- Solder the free pin of the 1K resistor above to the free pin of C17 (do this in the air, not on PCB)
- Do the same process for C20: Solder one pin of the other provided 1K resistor to the pinhole that you fred up from C20 (should also be ground)
- Solder the free pin of the 1K resistor above to the free pin of C20 (do this in the air, not on PCB)
- Solder one pin of the provided 100nF capacitor to the left pin of the provided 78L05
- Solder the other pin of the capacitor above to the middle pin of the provided 78L05
- Solder one pin of the other provided 100nF capacitor to the right pin of the provided 78L05
- Solder the other pin of the capacitor above to the middle pin of the provided 78L05
- When looking at the provided 78L05 from the front (flat face), solder the right pin to B9 on the ISA connector at the back of the PCB (9th pin of the ISA connector at the back of the PCB counting from the side facing the back of the computer). Don’t use too much solder, don’t use too little solder. You want this pad to be able to be inserted flawlessly in the ISA slot but, also, you don’t want it to snap loose easily! And it tends to snap indeed, make sure you have a solid connection to B9!!!
- Solder the middle pin of the 78L05 to ground (I use the negative pad of C19)
- Solder the cable to the left pin of the 78L05
- Put some insulating tape below the 78L05 which is now in place (don’t let it touch PCB pads)
- Solder the free pins of R2, R3, R4 and R5 together (use tape below so pads below are not touched)
- Route the cable up the bottom of the PCB and solder it to the joint pins of the resistors above
- Test:
    - No sound? check the 1K resistor job and or the R2-R5 resistor job. Check the connection of the 78L05 to B9
    - Still hear background noise? Check the connection of the 78L05 to B9