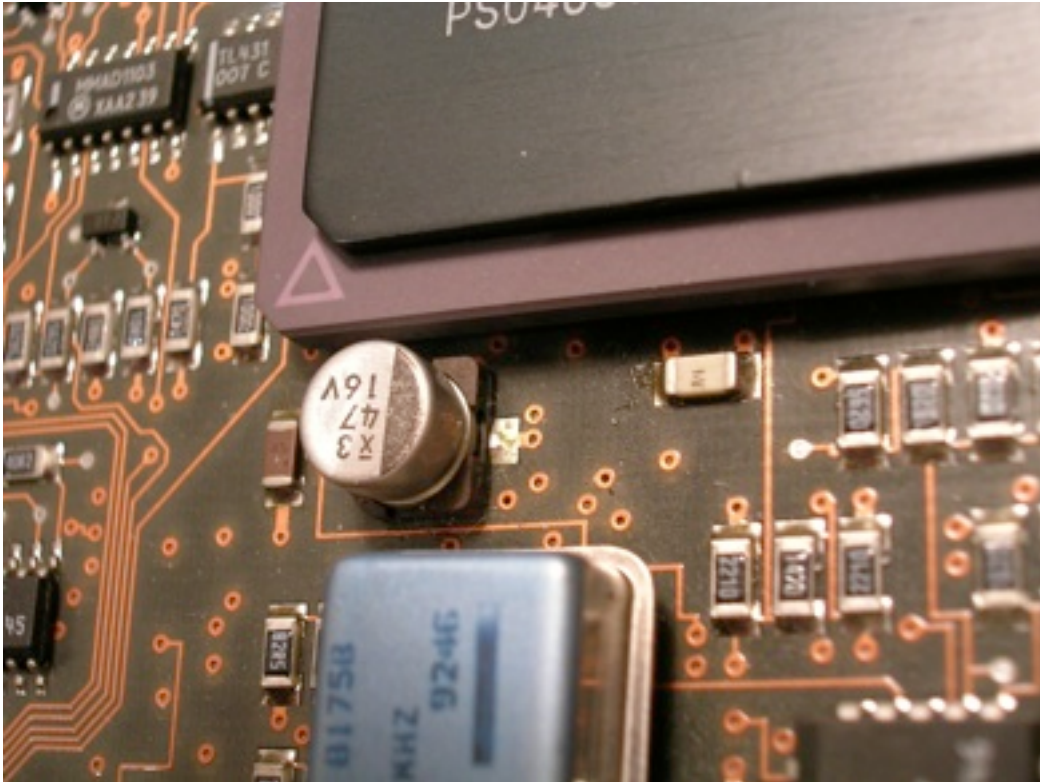


NEXTSTATION TURBO COLOR MAIN BOARD

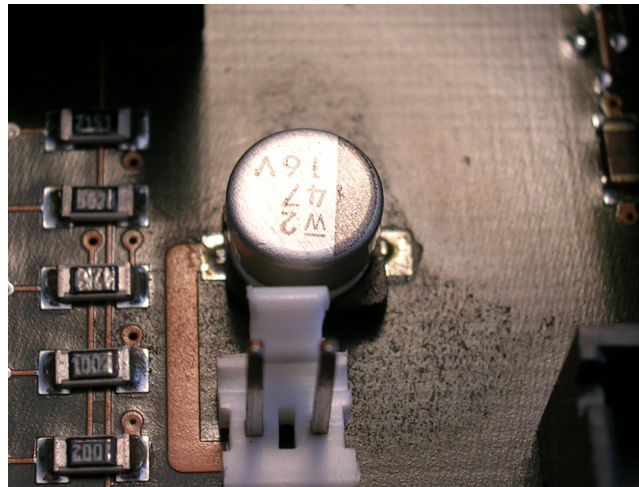


PREPARED BY T-REXKY

1. Background

I recently resurrected my Turbo Color station and spent a considerable amount of time and money restoring it into a good operating condition. I bought RAM, SCSI hard disks, a true multi-sync capable LCD monitor and even a spare "just in case" Turbo Color unit from Rob at BlackHole.

I finally got the station all set-up and was in the process of tidying up the "computer museum" room when I noticed something quite alarming. The lighting was just right to show a stain around one of the electrolytic capacitors on the "spare" motherboard. Upon closer inspection it became clear that all of the electrolytic capacitors have vented with 1 to 1.5 inch stains around them and even some evidence of leakage through the board vias to the opposite (lower) side. The following photograph illustrates a partially wiped-off electrolyte stain around one of the capacitors:



I opened the second station and noticed that the capacitors started venting electrolyte as well, although not as badly. It is not surprising that the capacitors are at the end of their life, considering that they are almost 20 years old. In addition, the early surface mount electrolytic capacitors are well known to have reliability issues - many expensive Tektronix oscilloscopes from late 80s and early 90s have been damaged by leaking surface mount capacitor electrolyte.

I spent a number of hours cross-referencing various component suppliers and I ordered a full set of replacement electrolytic capacitors for both of my stations, two sound boxes and also two power supplies. For anyone else wanting to rework their NeXT machines, this document outlines the parts and the procedure that I used to rework my slab motherboards. I focused this document primarily on the SMD capacitor replacement since the through-hole part replacement is pretty straight forward. The power supplies are very challenging to rework due to their mechanical design and I may cover them in a separate document some time in the future.

2. Tools

1. A good quality, temperature controlled solder station with an appropriate tip is the only truly critical tool. I used my [Weller WTCPT Solder Station](#) with a [PTF7 Tip](#) and it worked extremely well. I found that the flat portion of the conical tip worked well and that the size of the tip was a good compromise between its thermal capacity and accessibility to component solder pads. I selected 700°F tip temperature to prevent pad overheat while minimizing the required solder time. I did not experience any issues with pads lifting off the boards that I reworked.
2. Sewing needle with maximum diameter slightly larger than the capacitor leads for clearing through hole solder. If you are in a bind I also successfully used wooden toothpicks in the past.
3. Medium size tweezers to hold the replacement capacitors aligned in place while soldering them onto the board.
4. Bright task light.
5. A pint of good beer, or perhaps a few pints. Other liquids can also be substituted.

3. Consumables

1. CHIPQUIK no-clean rosin core solder ([CHIPQUIK SMDSWLF.020 1OZ](#), [DigiKey SMDSWLF.020 1OZ-ND](#)). This is a small diameter rosin core solder with mild flux, perfect for SMD work. This solder is available in various spool sizes, so pick an appropriate part number. Note that this is lead free and the original solder is lead based but this will not be an issue.
2. LOCTITE / Multicore 0.03 no clean desoldering wick ([Multicore M291017](#), [DigiKey 82-152-ND](#)). Perfect for SMD work. Will also work well with through hole devices, but you will use more of it. For extensive through hole rework, such as the slab power supply, I would recommend a wider wick, such as 0.06. Note that I tried several different wick brands and this one BY FAR works the best. Always buy the best wick if you want to avoid frustration and component or board damage!
3. Kester 186 flux pen ([Kester 83-1000-0186](#), [DigiKey KE1803-ND](#)). This flux is easy to apply and very easy to remove. It is also mild enough to be left on after the solder process and will not cause any damage or corrosion to the components or to the board.
4. A can of electrical contact cleaner from your local hardware store. This will work better than alcohol for board cleanup. Or you can use a proper flux cleaner.
5. A supply of Q-tips for electrolyte and flux cleanup.

4. Parts

1. Surface mount capacitors ([Qty. 8 for Turbo Color Slab](#)): 47μF 16V Panasonic FP series ([Panasonic EEE-FP1C470AP](#), [DigiKey PCE4530CT-ND](#)). The absolute best choice here would be polymer capacitors such as 47μF 20V Nichicon CV series ([Nichicon PCV1D470MCL1GS](#), [DigiKey 493-4369-1-ND](#)), but they are several times the price and probably completely unnecessary. They may also destabilize the power supply due to their extremely low impedance.

2. Through hole capacitors (**Qty. 3 for Turbo Color Slab**): 220 μ F 35V Panasonic FC series ([Panasonic EEU-FC1V221](#), [DigiKey P10297-ND](#)). These are high temperature 3000 Hr low impedance capacitors (that's 3000 hour estimated life at 105°C. I selected 35V rated capacitors as they have the same can size as the originals, longer life and higher ripple current. The Panasonic FM series and Nichicon PW series are also an excellent alternative. The polymer option would be covered by 270 μ F 25V Nichicon LV series ([Nichicon PLV1E271MDL1TD](#), [DigiKey 493-3865-1-ND](#)). Look for 5mm lead spacing to fit the motherboard through holes.

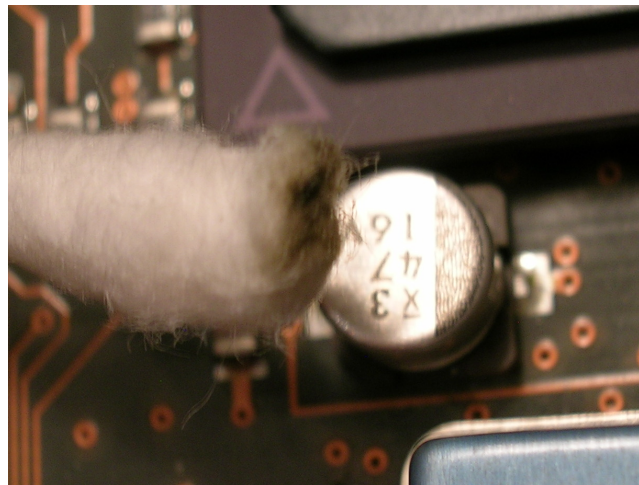
5. Procedure for SMD Capacitors

The right tools and patience are absolutely key to a successful rework! The most important aspect is to not overheat the pads and the components! While desoldering or soldering, if things do not appear to work right, STOP and re-think! My rule of thumb for good solder joints is application of heat for approximately three seconds. One should never apply the heat for more than five seconds, except under special circumstances. In addition, be careful how you position the soldering iron in tight areas in order to avoid touching and damaging the surrounding components.

The overall work flow is pretty straight forward and in-line with the following sequence: (i) clean the area, (ii) desolder the component, (iii) prepare the pads, (iv) solder on a replacement component, (v) clean the residual flux. All of this of course assumes that the board has been first removed from the slab housing.

5.1 Clean and Prepare the Area

Using dry Q-tips first thoroughly clean the area surrounding each capacitor. Then spray a Q-tip with electrical contact cleaner or flux remover and clean the solder on the exposed part of the pads. This will help the heat transfer from the soldering iron into the pads:



5.2 Desolder the Capacitor

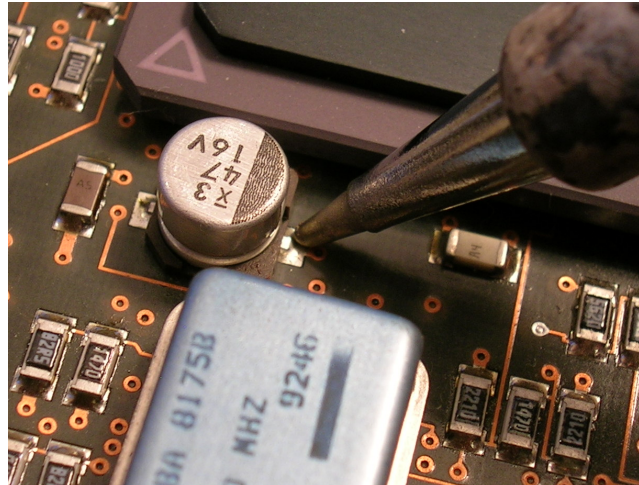
I successfully used the “alternating pad” technique to desolder each surface mount capacitor without any damage to the board. Another method involves cutting the old capacitor can with side cutters parallel to the board and desol-

NEXTSTATION Turbo Color Main Board

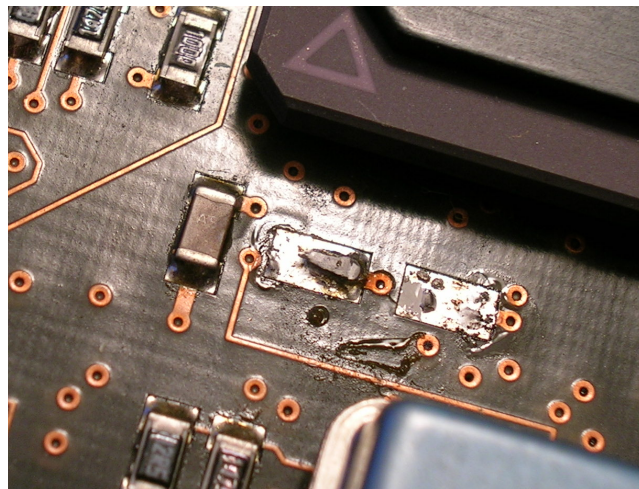
Electrolytic Capacitor Replacement / Refresh

dering the leads individually. For anyone who has not done any SMD rework in the past I would highly recommend reviewing various guides that are available online.

Apply the soldering iron tip to one of the solder pads ensuring a firm contact with the solder. Wait for one to two seconds and then carefully lift the same side of the capacitor away from the board, but do not force it. Immediately remove the tip of the soldering iron from the pad.



At this point one side of the capacitor should be slightly lifted, but the solder will likely still be holding it to the pad. Repeat the same process on the opposite capacitor pad, and then repeat it again as required, until the capacitor is detached from the board. Once done, you will be looking at empty solder pads like these:



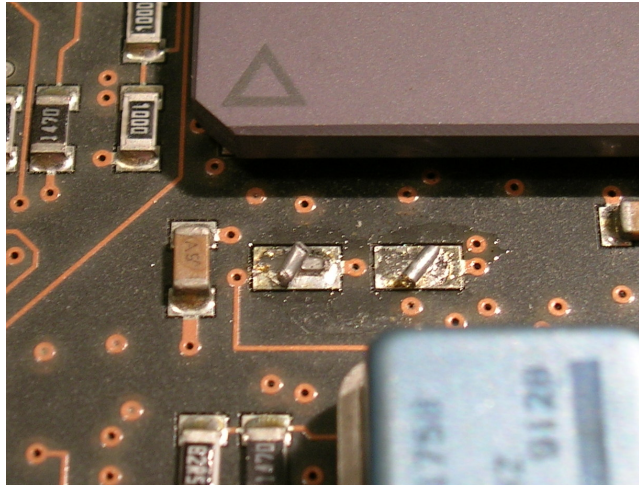
NOTES:

- (i) the initial movement of the capacitor may be a bit difficult because of adhesive used to affix the capacitor to the board during original manufacturing
- (ii) adding a small quantity of rosin core solder to the pad will help the heat transfer from the iron tip if you encounter a stubborn pad

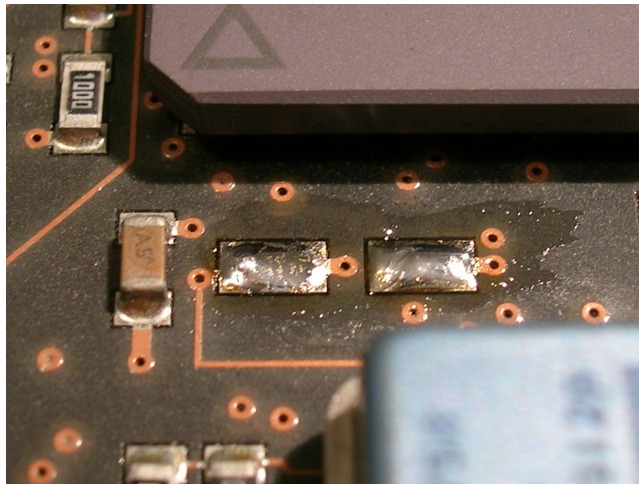
5.3 Prepare the Solder Pads

Spray a Q-tip with electrical contact cleaner or flux remover and clean the solder pads and the surrounding area from any remaining electrolyte, adhesive and old flux. Apply a small quantity of new flux to the pads with the flux pen.

Cut approximately 1mm long pieces of rosin core solder and place them on the pads:



Apply the soldering iron tip to the pad and solder pieces for approximately one second to form clean solder meniscus on each pad. Once cool, reapply a small quantity of flux with the flux pen:

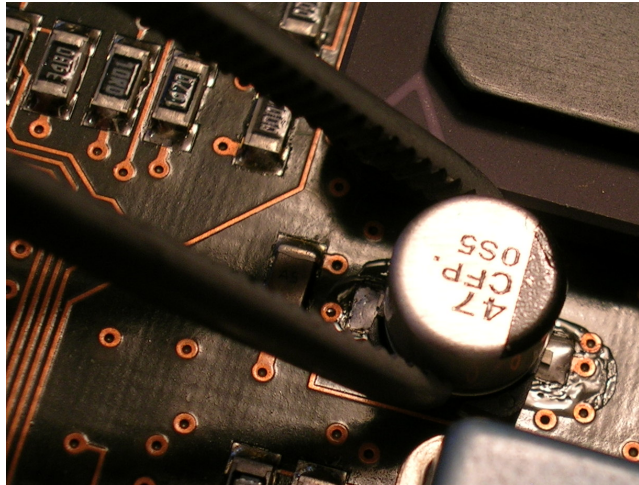


The pads are now ready to accept a new replacement capacitor.

5.4 Solder-on the Capacitor

This is actually by far the easiest part of the process. Begin by applying a small quantity of flux to the capacitor legs with the flux pen:

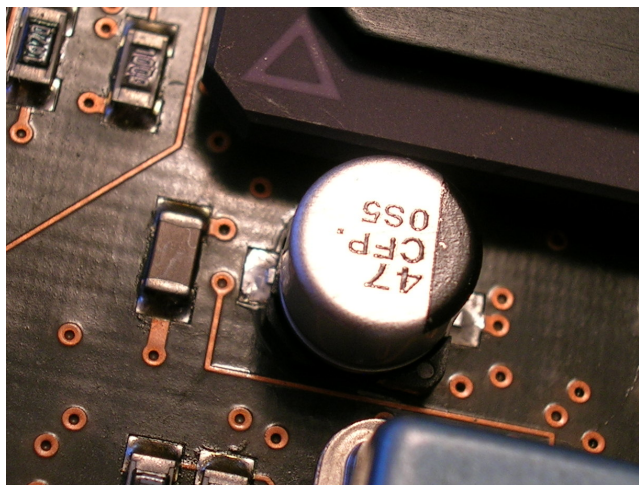
Then align the capacitor with the pads, maintaining the correct polarity. Hold the capacitor aligned using tweezers while applying slight downward pressure:



Now apply the soldering iron tip to one of the solder pads ensuring a firm contact with the solder. The solder should melt immediately and the capacitor will “sink” onto the pad surface. Wait for two to three seconds and then remove the soldering iron away from the pad. Reposition the tweezers and repeat the solder process on the second solder pad.

5.5 Clean the Residual Flux

Spray a Q-tip with electrical contact cleaner or flux remover and clean the surrounding area from any remaining flux. The capacitor installation is now finished:



6. Abbreviated Procedure for Through Hole Capacitors

I focused this document on the SMD capacitor replacement since through hole components are much easier to replace. The basic steps of the process are effectively the same: (i) clean the area, (ii) desolder the component, (iii) prepare the pads, (iv) solder on a replacement component, (v) clean the residual flux. I normally use my Hakko 808 desoldering gun that leaves the through holes nice and clean. Without one, the best procedure would be to also use either the alternating pad approach or to cut the capacitor can with side cutters and remove the pins individually.

Removing the capacitor without a desolder gun will require additional cleanup of the through holes to ensure that the new component pins can easily slide through. Either a toothpick or a sawing needle work well to accomplish this: first heat the pad and the through hole with a soldering iron to melt the solder, then carefully push the toothpick or sawing needle through the hole while the solder is melted. Push the tool in the same direction as the component pins you will be inserting later.

7. Closing

I hope this document is useful to others who want to keep their NeXT equipment in top notch operating condition for many more years to come.

If you have any additional questions, comments or suggestions please feel free to contact me through nextcomputers.org forums under user name t-rexky. You can also check out a few additional photographs on my flickr account at www.flickr.com/photos/t-rexky/

Happy retro-computing!