

Practical SMD Rework

By Marv Cohen

Slot Machine technicians are continuously faced with the challenge of repairing circuit boards. The old days of the soldering iron, solder sucker and solder braid are no longer the solution that we could always depend on. Soon, through-hole components will be history. We are now faced with a new challenge called SMT (surface mount technology). Now is the time to improve our rework techniques on SMDs (Surface Mounted Devices). The SMD has been a major step in min-

iaturation of modern circuit boards.

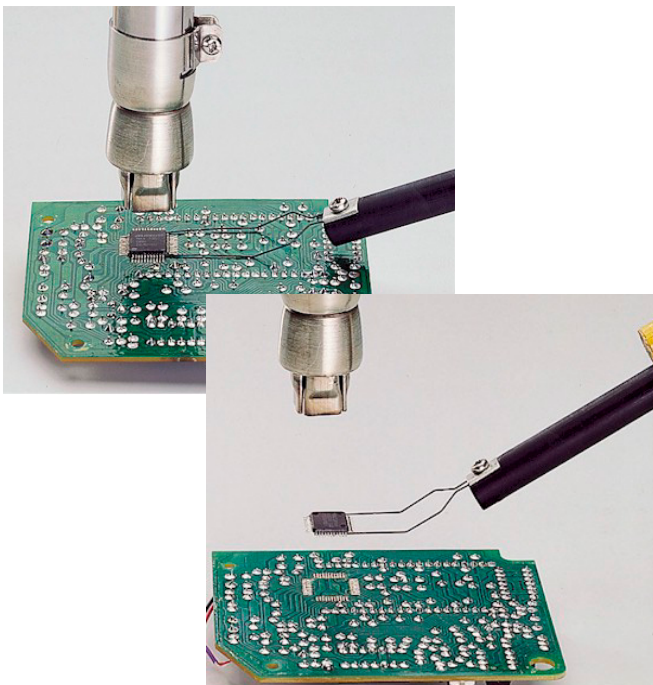
A typical SMD may have as few as 2 pins or as many as 300 or more. The more leads, the finer the pitch (distance between pins). Each SMD pin is connected to a pad on the board, forming a pin pad solder connection. To remove a typical SMD we must simultaneously heat all the pin pad connections into a molten state long enough to lift off the chip. If one or more pins does not release, a pad will be pulled

from the board. Once this occurs, the board may fall into the trash category. As technicians, our job is to repair and save boards. We need to begin by developing SMD methods that work best for us.

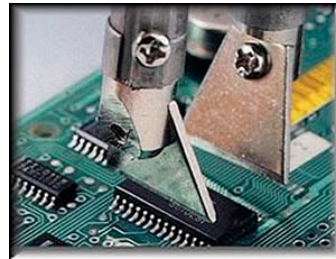
Rework Inflicted by Rework

Modern PCBs (printed circuits boards) are densely spaced with SMDs and are sometimes double sided with multi-layers. The pads (lands) on the circuit board are only held down by an adhesive. If the

Traditional SMD Rework Methods



Left: SMD rework by convection heating uses a hot air tip to heat all of the pins of the device at once. A pick is then used to lift the device from the PCB.



Right: SMD rework by conduction heating uses heated "tweezers" to heat all of the pins at once.

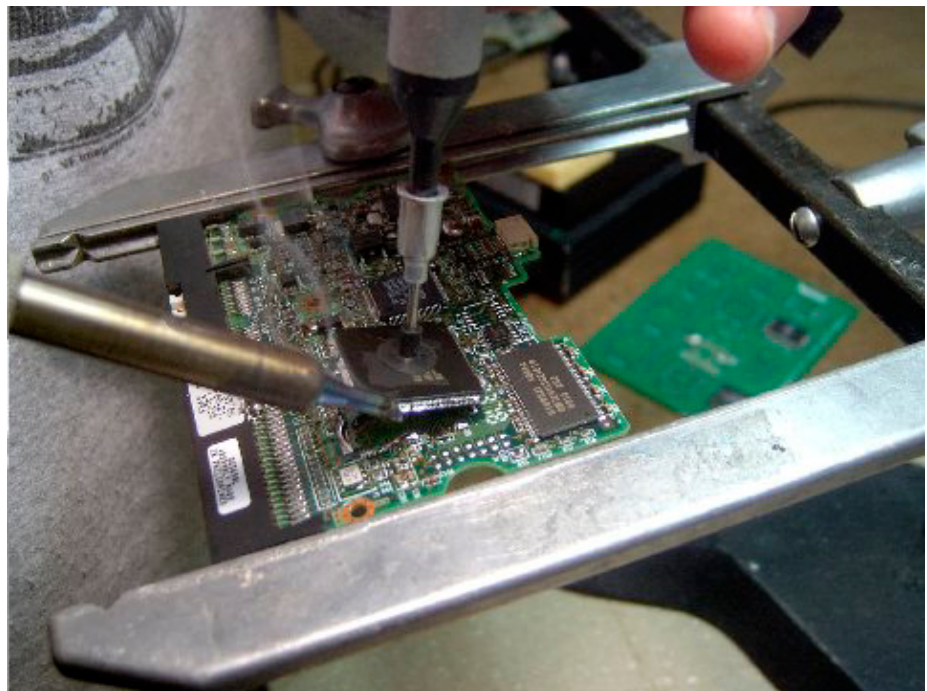
soldering iron is set at too high a temperature for too long a period of time, the pads will lift from the board. Blowing hot air on the chip for too long a period of time will also cause pad lifting, adjacent component damage, releasing of underside components and board delamination. The solution to preventing damage to the PCB will require a careful selection of tools and a safe practical method. Heat causes damage.

Traditional Rework Methods

Today's slot tech needs a method to solder and unsolder that is safe and affordable for low volume rework. Traditionally, the most common methods of rework have been conduction and convection.

Conduction is the use of a soldering head that fits over the SMD and applies heat simultaneously to all the pins. The disadvantage is that the iron has to be set at a high temperature and there is no way seeing or knowing when to lift off the chip. Also, a large inventory of tips is needed for the many SMD configurations. If repeating the same procedure, you can develop a method to duplicate results called profiling. This method is not practical for occasional rework.

Convection is the use of focused hot air through a nozzle shaped to the SMD. With convection, the heat transfer to the pins takes longer and some of the heat goes to the



The Chip Quick alloy's low melting point allows the solder on all of the pins to remain molten while the device is picked off the PCB with a vacuum pick.

adjacent components if they are not shielded. Also, the longer duration of heat increases the risk of releasing the underside components and board de-lamination. This method also requires a large inventory of expensive tips. When performing the

exact same procedure again and again, a profile can be set up to duplicate results. The conduction and convection methods are only good for high volume rework where a safe proven profile of temperature, time, heat shielding and tip can be set up.



Adding the Chip Quick alloy to the pins of the device to be removed.

However, most slot techs are looking for a fast, safe and affordable method that doesn't require special equipment. In the real world of slot machine repair, we have dozens of different problems and we are not always replacing the same component again and again.

A Practical Solder/Desolder Rework Method That Works!

DESOLDER: The most difficult part of rework has always been the safe removal of the SMD from the PCB. Soldering back on the new chip does require a certain skill that most of us can develop. A safe SMD removal solution has long been needed. The Chip Quik® SMD Removal Kit is a patented product that has revolutionized the rework industry. Even those that have never done rework can feel comfortable with this unique method. Now you can remove SMDs safely and easily with a regular soldering iron. The Chip Quik® SMD Removal Kit consists of a low temperature removal alloy in wire form with excellent wetting ability that melts at 136°F (58°C). When melted into the existing SMD connections with a soldering iron, the alloy fuses into the interconnect alloy and the two combine to form a new alloy with a melting temperature below 200°F. With this lower melting temperature and an increase in thermal mass, the new alloy remains in a molten state long enough to safely remove the



Cleaning of the pads before installing the new chip is important. To clean the pads, use a soldering iron to apply heat while polishing each pad with a swab dipped in flux until thoroughly clean.

chip. While the solder iron temperature is not critical, 550°F or lower is recommended. At this low temperature, all potential damage is eliminated. Cleaning of the

pads before installing the new chip is important. To clean the pads, use a soldering iron to apply heat while polishing each pad with a swab dipped in flux until thoroughly clean.



Clean pads - Ready for the new device to be installed!

Chip Quik® Instructions (supplied with kit)

SMD Removal & Cleanup

- * Apply flux to all leads with syringe
- * While molten use a cotton swab and flux
- * Melt Chip Quik® uniformly on all pins to wipe excess off pads.
- * Maintain alloy in molten state long enough
- * While applying heat, polish each pad with a swab and flux until thoroughly clean
- * Lift chip from board with pick-tool
- * Clean residue with alcohol pad
- * You are now ready to install the new chip

Prepare to Install the SMD

When replacing an SMD, the correct choice of equipment and materials will determine the quality of your work. Recommended items needed to correctly solder on an SMD are:

Soldering Iron: Very important and often neglected. The iron should always maintain a set temperature. This means that when you place the iron into the solder joint (thermal load), the temperature must stay constant at all times. In a quality iron, this specification is called thermal recovery. When using a poor quality iron, the tip temperature will cycle up and down while the solder joint is being formed. The time it takes to complete the solder joint (dwell time) will determine the quality of the joint and the amount of potential inflicted damage. Effectively, by using a quality solder iron, the temperature can be set at much lower.

Solder Tip: Use an angle chisel tip wide enough to cover the leads being soldered. Make sure tip is always tinned and clean for better heat transfer. A separate tip for soldering and desoldering is recommended.

Solder: Use 63/37 solder without rosin core and about .030 in. diameter. This solder is eutectic, meaning it liquefies and solidifies at the same temperature. Also the chance of leaving non-activated flux is eliminated.

Flux: Use a good, no-clean rework paste flux. Most rework fluxes are non-corrosive, non-

conductive, have excellent wetting characteristics and tend to keep the SMD from sliding on the pads. Flux is a very important part of SMD rework for both soldering and desoldering.

Ready to Install the SMD

Now that you have carefully selected all the recommended items, we are ready to solder the SMD to the circuit board. Inspect all the pads to make sure they are all clean and equal in height. With the syringe, apply a thin bead of tack flux along all the pads. With a Vac-Pen, pick and place the SMD on the pads right into the flux, making sure that pin #1 is aligned with the correct pad. Use magnification with good lighting to make sure the pin pad alignment is perfectly centered on all sides of the SMD. The tack flux helps to keep the SMD from moving out of place. Hold down SMD firmly with a dental pick so it will not move.

Now you are ready to solder. Set the solder iron to 600°F. Tin the tip and carefully tack down three or four locations. Check pin pad location once more for this is your last chance to make a correction. Now, drag solder by holding the iron at a 45° angle as you slowly run the iron along the pins while adding solder and flux as required. You can watch each solder joint as it is being formed. If you create a solder bridge, use solder braid to remove it. Clean area with an acid brush and isopropyl alcohol. Inspect your work.

With a little practice, you can master and perfect this technique. The best part is, you can do your own rework and prevent expensive boards from becoming trash. Happy Rework!

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