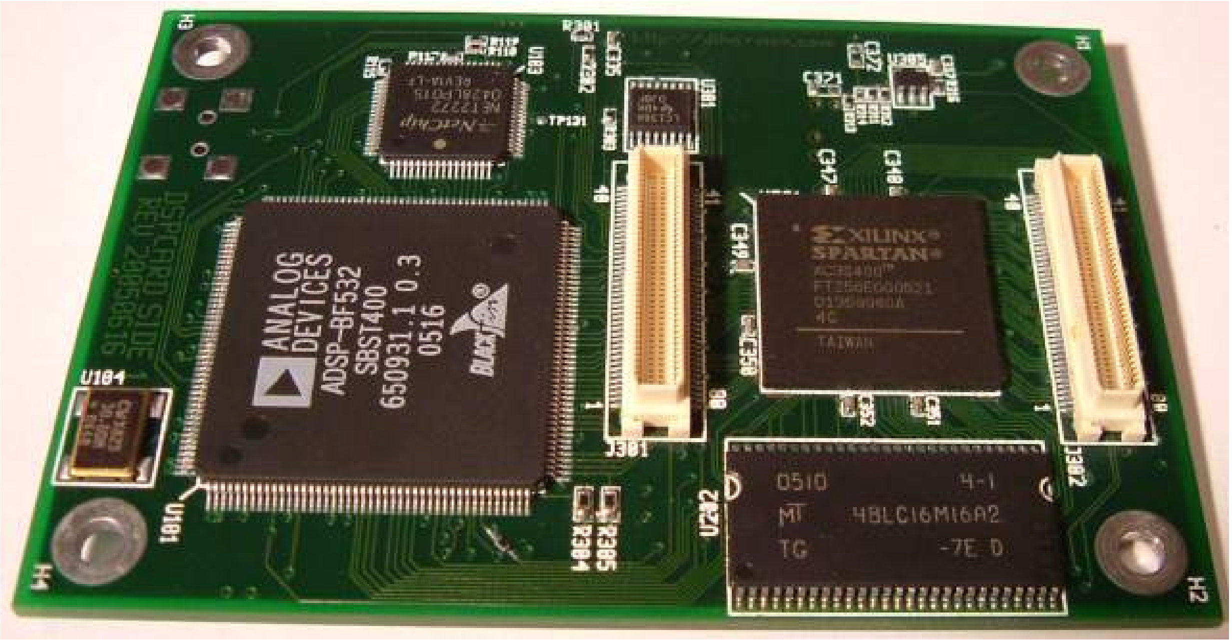
Surface Mount Prototype Soldering



[DSPCARD prototype]

I have recieved many questions about surface mount soldering recently. I am glad to see that so many people have not given up building prototypes using these tiny components. Most of the newer parts are only available in surface mount. I will explain how I solder surface mount parts. Others have different methods, but this works well for me.

Supplies and Tools

Flux Pen

Some form of liquid flux will be necessary for getting the solder to flow well. I use a Kester 2331-ZX flux pen which is stocked by Digikey. The flux pen I have recommended contains water soluble flux which makes cleaning the board easier, but will corrode the board in not cleaned within a few hours of soldering. This flux is also conductive.

I use kester 331 0.020 inch diameter solder in 63/37. It also contains water soluble flux and is available from Digikey.

Weller WP25 (top) and Metcal RM3E (bottom)

Of course you will need a soldering iron. Ideally it would be temperature controlled. I use a Metcal STSS-01 which I purchased used. The handpiece is ideal for surface mount soldering as it is very small. Many tips are available including ones for desoldering surface mount components. Most other irons will work, but avoid the $10 disposable ones with no temperature control as these tend to burn the flux. I soldered the first prototype of my single board computer using a Weller WP25 which costs $30.

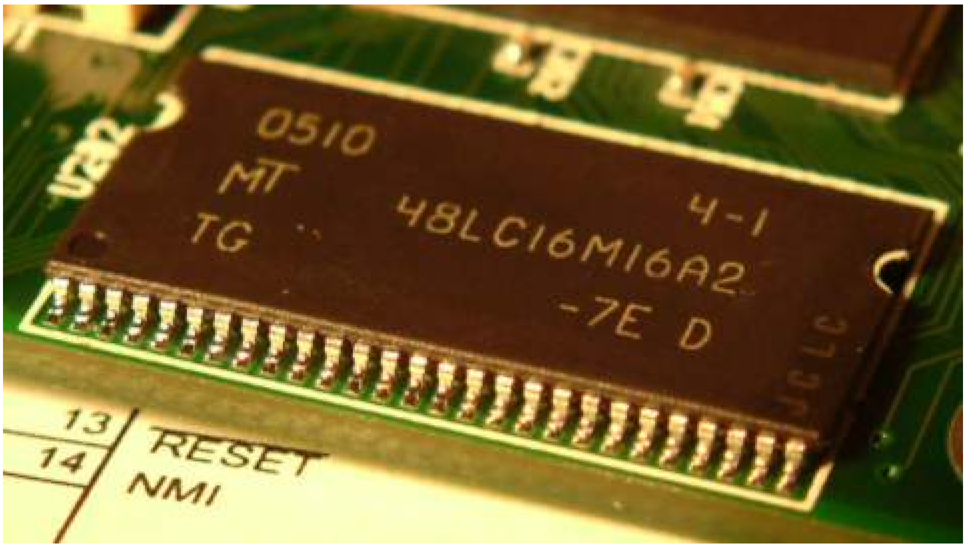
Fine tip tweezers (I use Erem EROP3CSA which are available from Digikey for about $3)

Desoldering Wick

Proceedure

To solder small 2 lead components such as 0603 chip capacitors, I apply a small amount of solder to one pad, apply flux to the pads, hold the component in place with tweezers and heat the end with solder to tack the part in place. I then solder the other end.

When soldering medium pitch devices such as SOIC, I use a small tip and solder each joint individually. A small amount of additional flux is sometimes useful.



Fine pitch components with many leads such as QFP and SSOP are slightly more difficult. I first apply flux to the pads using a flux pen. I then line the device up and tack solder the corner pins. All that matters at this point is that the compent is oriented correctly. I then apply flux over the devices leads then place a small amount of solder on the tip of the iron. This amount of solder will need to be determined by trial and error. The tip used should cover 3 or 4 pins. The flux will cause the pins not to bridge. I Start with one end and drag the tip gently to the other end. If the correct amount of solder is on the tip, all the pins should be well soldered and there will be no bridges. In the case of shorts remove some solder using solder wick. If there is not enough solder on the joints, repeat the preceedure. I find that a bent soldering iron tip is helpful.

Notes:

For cleanup of water soluble flux, I recommend using either hot water of alcohol. TQFPs are easy since the leads are so short and stiff. It is hard to bend them. PQFP leads are weak, and will fall off easily.

BGAs:

I used a BGA in my DSPCARD design. I soldered it using a toaster oven controlled by my laptop computer. A MAX6675 was used to interface a therocouple to the parallel port. Another line in the parallel port controlled the heater via a relay. I applied a large amount of flux to both the BGA and the PCB, but did not use any solderpaste. The balls are made of 63/37 solder and provide all the solder needed for the joints. Keeping the BGA aligned is difficult when getting everything into the oven, so I superglued 8 resitors around the perimeter to keep it near centered. The BGA will center itself by surface tension, so I allowed it some freedom to move (approx 0.3mm). The oven would only do about 0.5 degrees Celsius per second, so meeting the recommended temperature profiles was not quite possible, but I was able to approximate them. I may consider moving the unused lower heating element to the top to double the heating power. A temperature profile achieved on an old board The temperature profile when the BGA was soldered Note that the pink line is the set temperature and the blue line is actual temperature. The X axis is temperature in Celsius and the Y axis is time in seconds. On the run with the BGA, I pulled the thermocould off when I opened the door, so that explains the sudden drop.