Hand-soldering Surface-mount parts

It *is* possible to hand-solder surface mount parts – as long as you have good eyesight, a steady hand, and something at least **approximating** the right tools.

In this little document, I'll explain some of the techniques I've used as a professional electronics (and engineering) tech over the years.

To start with, you'll almost certainly want some kind of magnifying visor, similar to one of these:

The one on the left has an additional magnifying lens for those occasions where you need to get in close, but either will work just fine. Cost will be anywhere from $15-25, depending on where you get it, and how fancy you want to be. You may see some models with additional lighting built into them; you can get those, if you like, but I've found that they really don't help all THAT much. There's no substitute for good, bright, general lighting that doesn't cast shadows on your work area.

One of the other things you'll need will be a set of electronics-type tweezers (the kind that includes tweezers with curved and/or angled tips). Ordinary tweezers like in a drugstore won't cut it – they're too short, and won't open up enough sometimes. The longer electronics-type have a finer tip, and make it easier to hold the surface-mount part **gently**.

Next, you'll need the finest-gauge solder you can get hold of. Surface-mount parts (obviously) don't need much solder, and regular .065-diameter just makes it too easy to use too much. If you can get it, .035 diameter (or smaller) 63/37 (or "eutectic") solder is best. All solder has a "plastic range" where the temperature means it is somewhere between solid and melted, making it easy to get a "cold" solder joint if anything moves; 63/37 has a *very* narrow plastic range, so there's a lot less chance of getting a cold solder joint. This presumes you can get Lead-Tin solder; the lead-free substitutes that I've tried don't work anywhere ***near*** as well.

The last thing you'll need is a **good** soldering iron/station that at a MINIMUM lets you select between a couple of temperatures - "cool" at about 15W, and "regular" of 25-35W. Better still is if it's adjustable so you can set it for optimum temperatures. For surface mount soldering, you'll want to use that lower range to avoid burning up the part, de-laminating a pad off the board, or something equally annoying. Also, you'll want the finest tip you can get. Even a 1/16th will be difficult to work with - 1/32nd is better, and something that goes down to an actual point is best. If an iron or station like that is out of your price range for some reason, then there is an alternative: simply forming a coil from something like a large paper clip, but leave about half an inch of one end of it straight, and sticking out along the axis of

the coil. The coil diameter should be *just smaller* than the diameter of the tip of your soldering iron – what you want is for the coil to stay nice and snug around the tip of your iron. You'll use the short, straight section as an extension of the tip – small, and not too hot, to let you get in to those pins and pads. You may have to experiment a little bit to find what length that straight section should be.

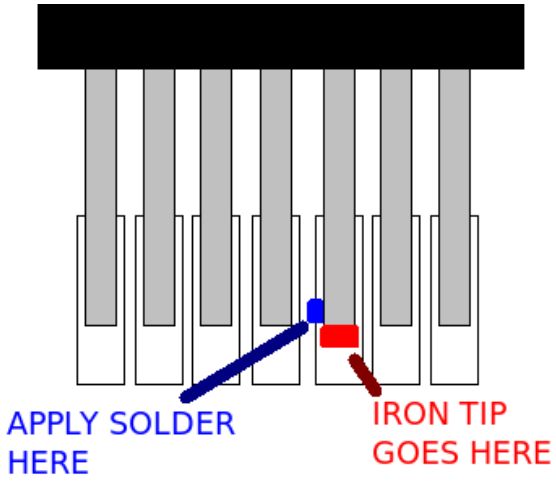
Actually *soldering*

The soldering part is actually fairly easy.

For resistors, caps, and that sort of two-pad device, simply apply a **small** dab of solder to one of the pads. Position your part, then heat the pre-soldered pad; after it cools, the part will stay in place so you can do a "regular" solder job on the other end.

For multi-pad devices, such as ICs, my technique has been to put a small dab of solder at opposite corners, position the device, and heat the solder one pin at a time. Again, that will hold the part in place (or let you reposition it easily, if need be) until you get the remaining pins.

For soldering surface mount, I've found that the best technique is a minor modification of what is considered good regular soldering methods. In regular soldering, you're generally instructed to heat the pad and the lead of the device, then apply solder to the side opposite of your soldering tip. For surface mount, I simply apply the tip to the end of the part lead and the pad, twist the iron about 90 degrees to ensure a clean connection, and *briefly* touch the solder to the side of the lead near where the iron is.



That minimizes the chance of overheating anything, but still getting a good solder joint. As always, a clean soldering iron tip is critical to good connections, since a clean tip transfers the heat to BOTH sides better. ANY finished solder connection should be shiny; if it looks like the surface of the moon, re-do it. You should use as little solder as possible; what's on the finished connection should form a concave (inward-curved) shape. Looking straight, like the sides of a volcano is *acceptable*; under **NO** conditions should it resemble any kind of blob.

If you use these techniques, you should find yourself easily soldering .050-pitch leads in no time; with more practice, you won't have much trouble with even more finely-spaced parts.