Practical Surface Mount

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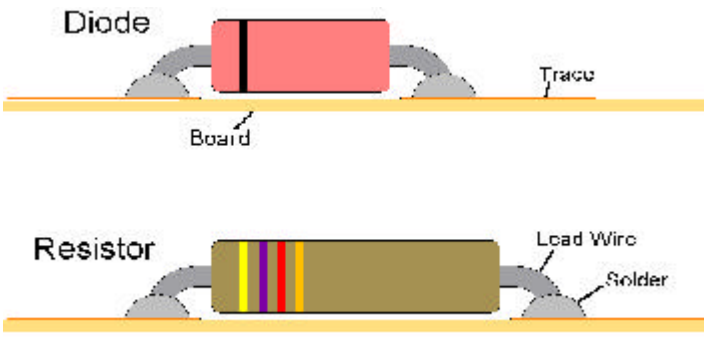
In my opinion, the most tedious task in a project is making a printed circuit board (PCB) especially if there are many integrated circuits (IC) on it. They look nice when finished and add that touch of professionalism, but having to produce them is a large pain in the butt (PIB). And the most un-fulfilling part is drilling all those holes. I once made a memory board for my PC and had to drill (no kidding) 1200 holes! I have a small drill press and I use a finger drill chuck that helps with the precision, but after doing a large board, my back hurts, my hands hurt, and afterward, I can't focus my eyes for about a week.

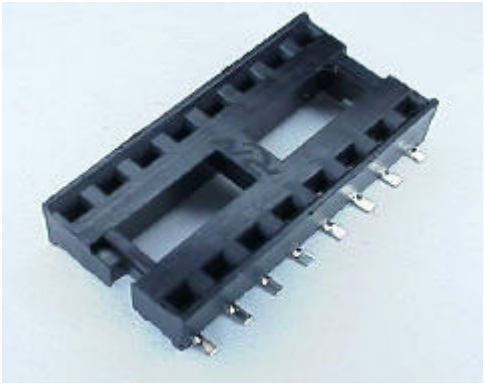
The solution to this problem is surface mount devices (SMD). This would definitely help with the drilling, but the parts are so small, soldering would then become the PIB. Furthermore, I have a HUGE stock of parts that I would have to replace with surface mount devices. The main benefit of SMD, of course, is the small size. You can't beat them for that, but usually I'm not trying to get things into the smallest possible package. Small is nice, but again, you have to assemble and test the thing.

I began to think about surface mounting the standard devices I already have. Diodes and 1/8 watt resistors seemed pretty easy to do. I simply bent the leads down as sharply as I could, put a pair of side cutters against the body of the diode or resistor, and clipped both leads flush with a single cut. The resulting size is only about twice that of a real SMD. Similarly, a TO-92 or TO-220 transistor can be mounted by bending the leads down, trimming them flush with the transistor case, and soldering the device to three traces. This technique also worked for capacitors and LEDs. My conclusion: discrete devices are easily adaptable to surface mounting.



The parts that required some thought are IC packages. I always mount ICs in sockets. ALWAYS. Sockets cost about a penny a pin, and worth their weight in gold when you need to replace a chip because some static zapped it. Yes, the socket does not make as good electrical contact as direct solder, but until my project boards go for a ride in the Space Shuttle, I don't really need to worry about losing electrical contact due to vibration.

So, I had to develop a scheme to surface mount IC sockets. I looked at several types of sockets and found some simple ones that use a flat metal tab for the lead (leg). This leg is usually phosphor bronze with tin or gold plate. What makes these sockets adaptable to surface mount is that the flat side of the leg is parallel to the long side of the socket. In other words, you can easily bend the legs 90 degrees and have them stick out past the side of the socket.



To bend the socket legs, I rest the socket against the edge of a table with one set of legs against the table top. I then lift the free side of the socket while keeping the legs against the table top. I bend the legs just past 90 degrees to allow for some spring back. Then I turn the socket around and do the other side. After the legs are bent, I trim them so that they stick out past the side of the socket about .030"-.040". This gives me a nice square lead to solder using a fine tipped soldering iron. It sounds like a lot of work, but after you do a few, you'll find that it takes less than 30 seconds to complete the entire process. So if you have 10 sockets to modify, it will only take you about 5 minutes. Compare that to what it would take to drill 160 to 240 holes and you see why I'm enthusiastic about this process.

Two sided boards are easier using SMD, too, since now you only have to drill holes for necessary pass throughs. For holes that occur at components, you can just drill as before and pass one lead through the hole. For the sockets, you no longer have to run a little wire through the hole along with the socket leg. Just drill a hole near the socket leg and run a spare resistor or capacitor lead wire through it and solder both sides. In addition, since there are probably one-tenth the number of feed through holes as before, registration between sides is improved. Soldering your project board will also be easier with SMD since you will be working from the top -- no more flipping the board to insert-then-solder your parts.

Although you could glue each device to the board with a cyanoacrylate, I find it easier to hold the part with a small pair of pliers or tweezers and solder tack one lead to the copper trace. Then I solder the other leads completely and come back to re-solder the first one. On large sockets, however, I do like to use hot melt glue to hold them down because this helps them stay there when you have to pull the chip. Also, when you stand up a TO-220 or other large device, a dab of hot melt helps keep it there when you drop the board.

So next time you need to make a PC board, try doing it with standard parts, only set them up as surface mount devices. Oh, and remember, the foil is now on the top of the board so you don't have to think upside down when you're making the artwork.

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