Using Surface Mount Components
By Don Steinbach, AE6PM

Surface Mount Devices (SMDs) are tiny leadless components. They are designed to mount onto the foil side of a PC board, and are soldered directly to foil pads on the board. Most of us have built projects using PC boards, but used components with leads that extend through holes in the board, and that are soldered to the foil pattern on the back side of the board.

Why use surface mount technology? For one thing, since the components don't have leads, they are physically smaller and cheaper to make. They've been used in electronics like ham radios and computers for years. Also, since they mount on top of the PC board directly to pads on the foil traces, there are no holes to drill for component leads to pass through. Component packaging, leads and holes take up a lot of PC board real estate. The board in Fig. 1 is one that I built from a kit. It includes 7 resistors, 2 diodes, a transistor and an electrolytic capacitor. It measures 1.0" x 1.2" and most of the right-hand side of the board consists of pads for soldering the three leads of a conventional TO-220 package to the board.

Constructing homebrew equipment that uses surface mount components is not as difficult as some would like to think. First of all, the components are usually available in several sizes and only an idiot would choose the tiniest. The common 0805 or 1206 size for resistors and capacitors and similar sizes for semiconductors are not difficult to deal with, but you'll require some new tools. First of all, you can't solder these parts with your soldering gun or a blow torch. You need a pencil style iron in the 25 to 40 watt range with a small tip. The soldering iron I generally use has a 0.03" conical tip. Some method of controlling the temperature is desirable, but not mandatory. Temperature control in the 360-370 deg F range is ideal. Secondly you'll need small solder. I use .020" diameter Sn63/Pb37 rosin core solder. A 60/40 solder is ok too, but you'll need to hold the part in place a bit longer while the solder cools down. Third, you'll need small tweezers to handle and hold the parts. I prefer the kind that you squeeze to open – that way you don't have to try to position the part and keep a grip on it at the same time. Forth, plan on purchasing some sort of hands-free magnifier; if it includes a light, that's a plus. I use an OptiVISOR ™ binocular headband magnifier with a 4X lens and a fluorescent desk lamp. Some desoldering wick (0.05") is handy to clean up excess solder or solder bridges. This is everything you need for hand soldering with an iron. Reflow soldering using solder paste is another option for the serious hobbyist. The normal ESD safety procedures should be followed.

The PC board will have a pad for every terminal of every component. Tin just one of the pads with a small (as in tiny) bit of solder. Pick up the component with the tweezers and position its terminals on the PC board pads. Use the iron to melt the solder on the pad and then slide the iron toward the component. When the iron touches the component, the solder should flow to join the component to the pad. You'll feel the component sink a bit as it settles into the molten solder. Remove the iron and hold the component in place for a second and you're done with that pad. It's ok to melt the solder again to reposition the component if necessary, but let the component cool down first. Next, solder the remaining terminals on that component to their respective pads by applying solder first to the pad and then moving the puddle of solder to the component. Repeat this process until all of the components are soldered to the board. If a component has several terminals, I'll usually solder one and then move to a different component and come back later just to avoid cooking the component. The first thing you'll probably learn is that you will want to use very little solder, especially if you're soldering a component with side-by-side terminals on 0.050" centers.

What can go wrong? Well, the markings on the components can be difficult to read or sometimes nonexistent. Once the component is separated from its carrier (typically a piece of tape or cardboard or plastic) its identity can be lost forever. The next most exciting thing is when the component, formerly

held in the tweezers, decides to eject and fly across the workbench or the room. If it lands on the carpet, you'll probably never see it again. Always have some spares.

If you would like something to practice on, Chaney Electronics has a kit called the C6719 Deluxe SMD Learn to Solder Kit that I can recommend. The assembled product appears in Fig. 2. It cost $8.25 the last time I looked. One section of the board is just for practice and the other section is a Dual LED Flasher circuit. The practice section includes 5 ceramic capacitors, 4 diodes, 5 resistors, 4 transistors, 2 electrolytic capacitors, 3 8-pin ICs and a 44-pin PLCC (plastic leaded chip carrier) IC. By the time you've soldered all of these parts in place, you should be fairly comfortable with the process. The Flasher section is a real working circuit consisting of 5 resistors, an electrolytic capacitor, an 8-pin IC and a dual LED. The instructions with this kit say to glue the parts to the board first and them solder them later. That's a little unorthodox for single sided construction, but whatever works for you is ok. Too much glue will create a real problem if it gets on the pads and component terminals.
See http://www.chaneyelectronicsstore.com/servlet/the-65/Deluxe-SMD-Learn-to/Detail for more information on this kit.

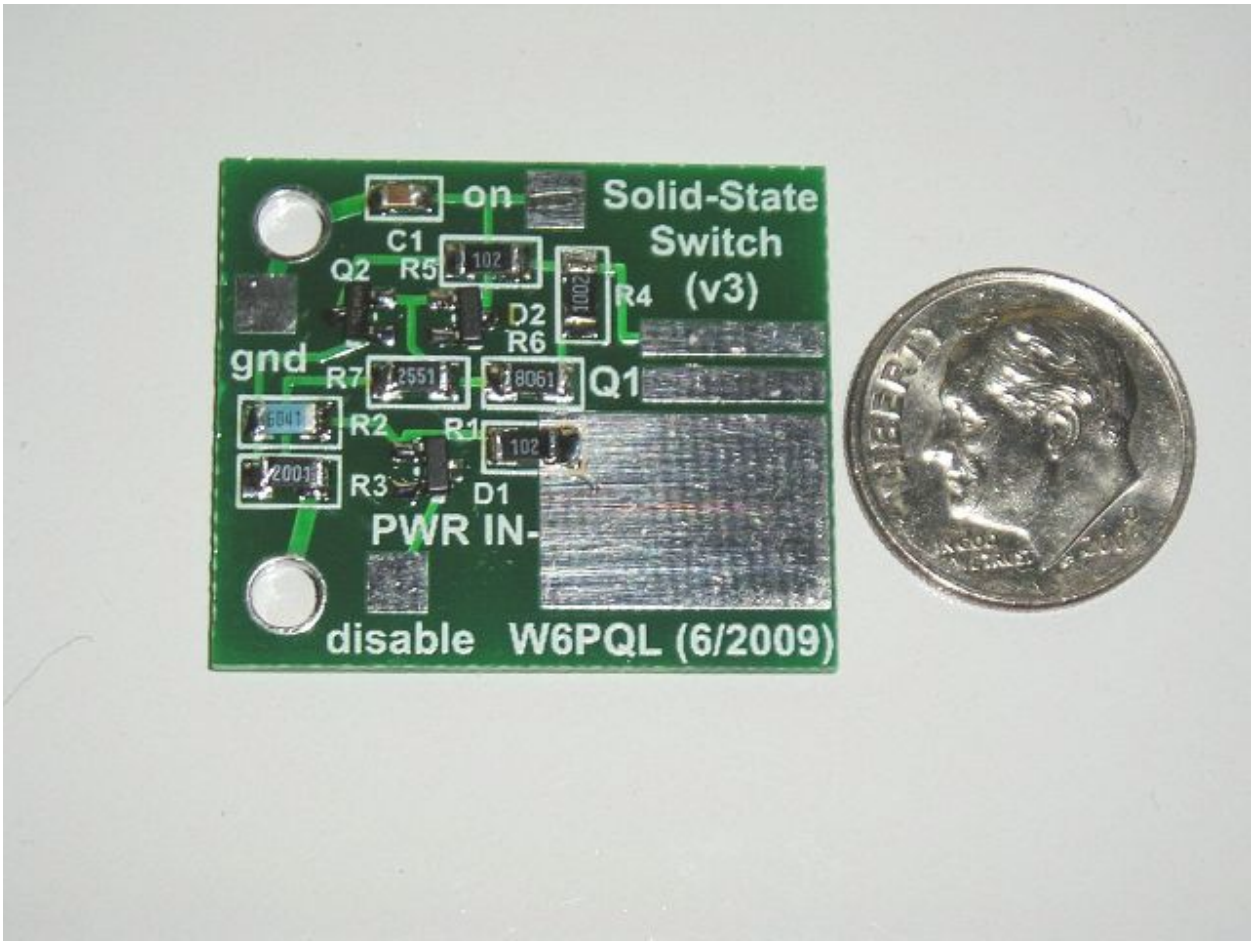

Fig.1. This PC board uses only surface-mount components. It was assembled using the methods described in this article.

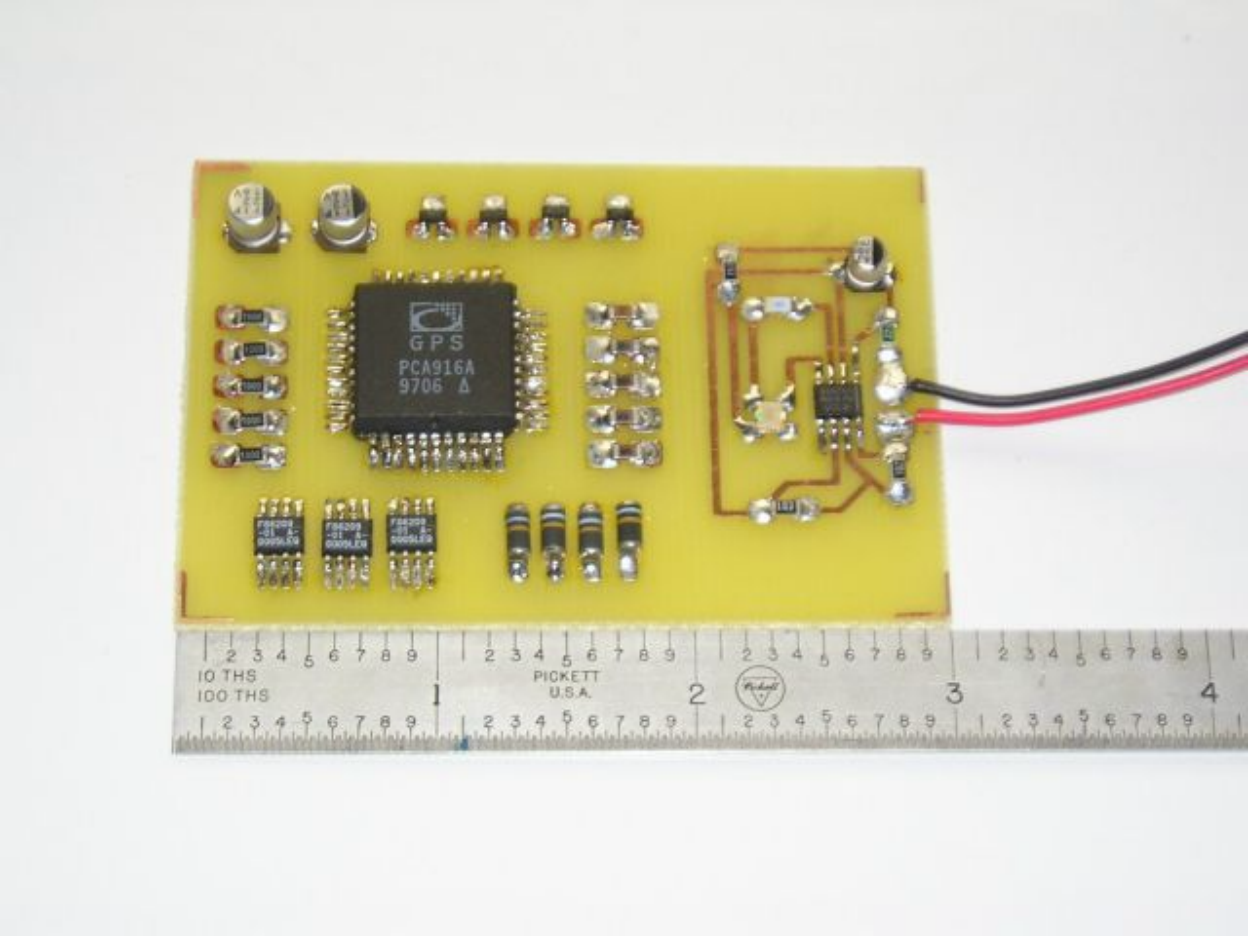

Fig. 2. The Chaney Electronics C6719 'Learn to Solder' kit fully assembled. An excellent way to become familiar with handling and soldering surface-mount components.