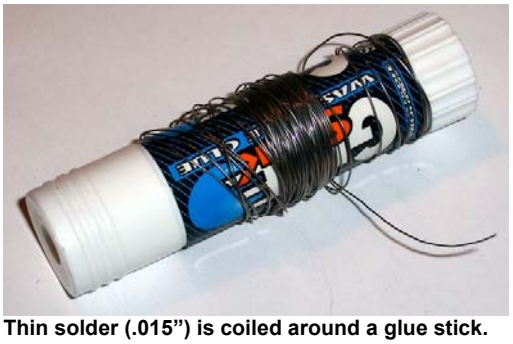
Section 4: Installing the Surface Mount Components

Preparing for the job

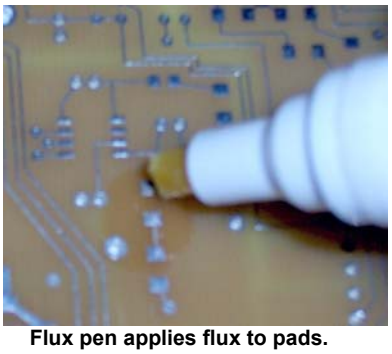
The key to being successful with any construction project is selecting and using the proper tools. For projects using SMT (Surface Mount Technology), the tools are easy to find**.** A magnifying lamp is essential for well-lighted, close-up work on the components. Tweezers or fine-tipped pliers allow you to grab the small chip components with dexterity. Thinner solder (.015") than you might normally use is preferred because of its being quicker to melt and smaller in solder volume on the component lead. Use of a super fine-tipped soldering iron make soldering the leads of these small parts straightforward and easy. A clean work surface is of paramount importance because SMT components often have a tendency to fly away even when held with the utmost care in tweezers – you'll have the best chance of recovering your wayward part if your table is clear. When the inevitable happens, despite your best efforts of holding an SMT part in your tweezers, you'll have lots of trouble finding it if it falls onto a rug-covered floor covered. It's best to have your work area in a non-carpeted room, for this reason as well as to protect static-sensitive parts.

Attaching SMT Components to the PC Board

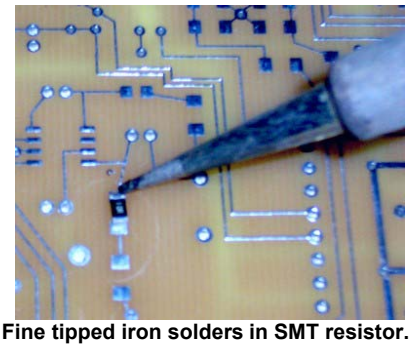
We've supplied two items in this Micro908 Kit that will greatly help you successfully solder these small surface mount components to the pc board. The first is a small coil of **.015" solder**. As described above, this thin solder is perfect for soldering small SMT parts. Just wrap the solder around a convenient tube as shown below on the left) so you can easily play out the solder as you go along in the board assembly. The other helpful item is the **Flux Pen**. By making the pads to be soldered wet with the liquid flux, you are greatly helping the joint be clean and ready to accept the soldered component. (Just press down a little on the tip of the flux pen and the liquid flux will start flowing out through the sponge tip.) In order to solder these small components in place, having a fine-tipped, 600-700 degree soldering iron is essential, as illustrated in the rightmost photo below.



Thin solder (.015") is coiled around a glue stick.



Flux pen applies flux to pads.

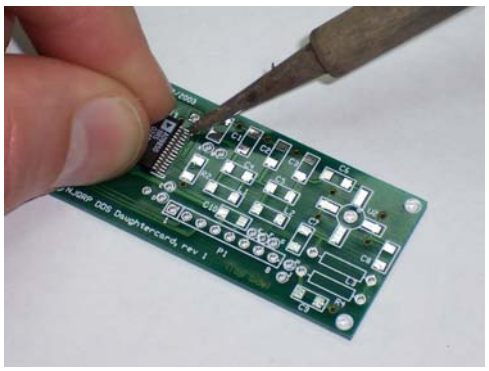


Fine tipped iron solders in SMT resistor.

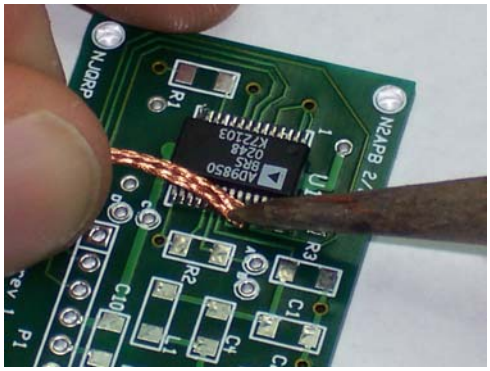
The trick to soldering surface mount devices to pc boards is to (a) pre-solder one of the pads on the board where the component will ultimately go; (b) hold the component in place with needle nose pliers or tweezers on the tinned pad; (c) re-heat the tinned pad and component to reflow the solder onto the component lead, thus holding the component in place; and lastly (d) solder the other end of the component to its pad.

Attaching a Surface Mount IC

There are four surface mount integrated circuits to attach on the Micro908 pc board: U2 (memory chip), U3 & U4 (op amps), U5 (audio amp) and U6 (a pretty tiny driver IC). Pre-solder the pad in one corner of the given layout then carefully position the leads of the IC over its set of pads on the pc board. I generally use my fingers to carefully align the IC over all its pads and then reheat the corner pad to reflow the solder onto the IC pin. This should leave the IC attached by that pin. Again making sure the IC pins are aligned over all pads, carefully solder the opposite corner lead to its pad. This should leave all other pins of the IC aligned over their respective pads, making it easier to solder them. Next solder each of the other pins to their respective pads, being careful not to bridge solder across any adjacent pads or pins. If this does happen, that's okay! Just grab some **solder wick** (also supplied in the Micro908 Kit) and use it to draw off the excess solder, which should be fairly easy and clean because of the solder mask on the circuit board.



First corner pin of surface mount IC being attached.



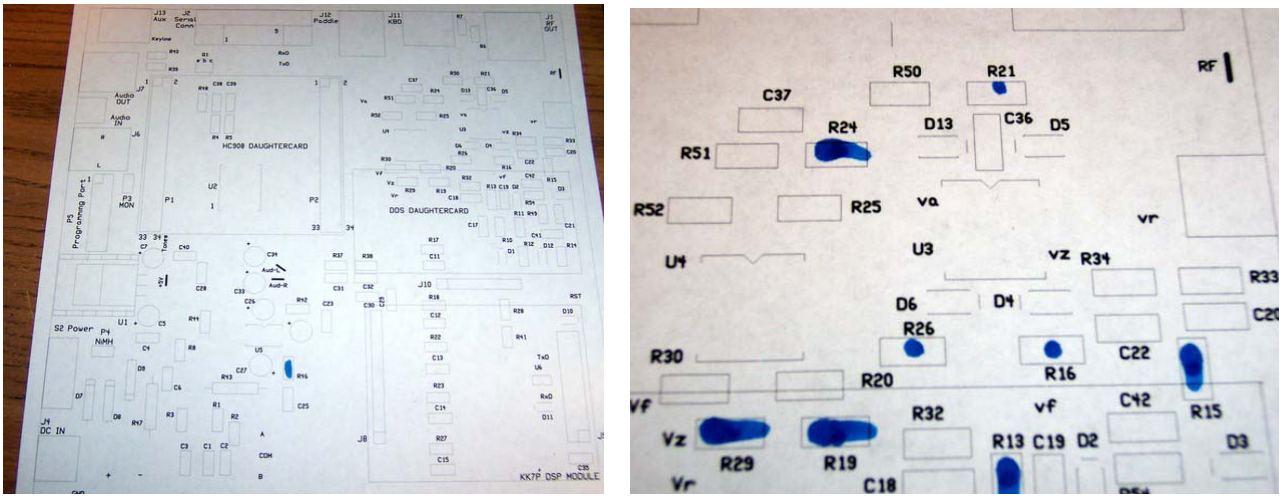
Solder wick easily absorbs excess solder between pins.

(IC shown being attached here is the DDS chip onto the DDS Daughtercard. The techniques are the same for the Micro908 ICs.)

Using the Component Layouts During Assembly

A helpful practice to develop is to mark the supplied Layout diagram as you install each component. As you go along, the diagram will fill up with more and more marks, enabling you to more easily find the location of the remaining components, and have confidence that you haven't omitted installation of a component along the way.

A useful marking technique is to identify with a "dot" the location of the parts you are about to install, making it easier for you to place and solder the part in the right spot. Once soldered in place, going back to the diagram and placing a full line in that same spot will indicate that you've soldered it in place, as shown in the photo on the right.



The component layout diagram is a useful tool if you mark it up as you proceed along in installing the components.

1) Install components from Resistor Card 1

Using the Component Layout Diagram in Appendix A as a guide, install the SMT components from the Resistor Card 1. Check off each row as you complete installing those components.

	QTY		
[ ]	1	R46	Resistor, 10, SMT, 1206
[ ]	3	R11, R12, R14	Resistor, 49.9, SMT, 1206, 1%
[ ]	1	R7	Resistor, 330, SMT, 1206
[ ]	1	R8	Resistor, 1K, SMT, 1206
[ ]	1	R6	Resistor, 4.3K, SMT, 1206
[ ]	1	R44	Resistor, 4.7K, SMT, 1206

[ ]	**4**	**R37, R38, R39, R40**	**Resistor, 5.1K, SMT, 1206**
[ ]	**12**	**R1, R2, R3, R4, R5, R17, R18, R22, R23, R27, R42, R48**	**Resistor, 10K, SMT, 1206**

2) Install components from Resistor Card 2

Using the Component Layout Diagram in Appendix A as a guide, install the SMT components from the Resistor Card 2. Check off each row as you complete installing those components.

	QTY		
[ ]	**1**	**R41**	**Resistor, 10.0K, SMT, 1206, 1%**
[ ]	**1**	**R28**	**Resistor, 22K, SMT, 1206, 1%**
[ ]	**4**	**R10, R13, R15, R49**	**Resistor, 47K, SMT, 1206**
[ ]	**3**	**R19, R24, R29**	**Resistor, 100K, SMT, 1206, 1%**
[ ]	**3**	**R16, R21, R26**	**Resistor, 220K, SMT, 1206, 1%**
[ ]	**2**	**R20, R30**	**Resistor, 221K, SMT, 1206, 1%**
[ ]	**1**	**R25**	**Resistor, 549K, SMT, 1206, 1%**
[ ]	**4**	**R32, R33, R34, R54**	**Resistor, 1M, SMT, 1206**

3) Install components from Capacitor & Diode Card

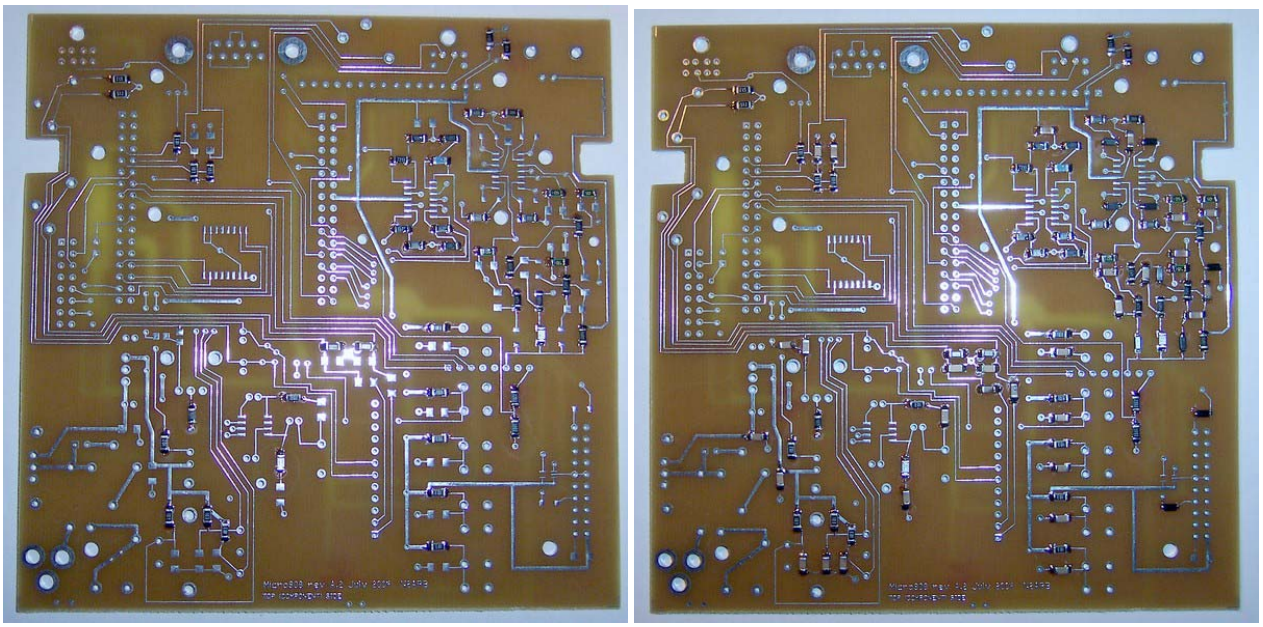
Using the Component Layout Diagram in Appendix A as a guide, install the SMT components from the Capacitor & Diode card. Check off each row as you complete installing those components. Be careful to identify the cathode of the diodes on this card. The cathode is the side of the diode with a single straight line on the schematic symbol, and with a (faint) single straight line on the package. You will surely need to use your magnifying glass to see this mark. Orient the end of the diode with the single straight line onto the pc board with the diode outline also containing the straight line indicating the cathode.

[ ]	**2**	**C31, C32**	**Capacitor, 560 pF, SMT, 1206**
[ ]	**6**	**C18, C20, C22, C23, C28, C40**	**Capacitor, 0.01 uF, SMT, 1206**
[ ]	**18**	**C1, C2, C3, C4, C6, C11, C12, C13, C14, C15, C17, C19, C21, C25, C36, C37, C38, C39**	**Capacitor, 0.1 uF, SMT, 1206**
[ ]	**2**	**C29, C30**	**Capacitor, 0.33 uF, SMT, 1206**
[ ]	**8**	**D1, D2, D3, D4, D5, D6, D10, D11**	**Diode, Schottky, 1N5711, SMT** ***(These diodes have faint cathode markings)***

4) Install components from the Additional Card

Using the Component Layout Diagram in Appendix A as a guide, install the SMT components from the Additional Card. Check off each row as you complete installing those components.

	QTY		
[ ]	1	R49	**Resistor, 10K, SMT, 1206**
[ ]	1	R51	**Resistor, 100K, SMT, 1206, 1%**
[ ]	1	R50	**Resistor, 220K, SMT, 1206, 1%**
[ ]	1	R52	**Resistor, 221K, SMT, 1206, 1%**
[ ]	1	C42	**Capacitor, 0.01 uF, SMT, 1206**
[ ]	1	C41	**Capacitor, 0.1 uF, SMT, 1206**
[ ]	2	D12, D13	**Diode, Schottky, 1N5711, SMT** ***(Faint cathode marking)***



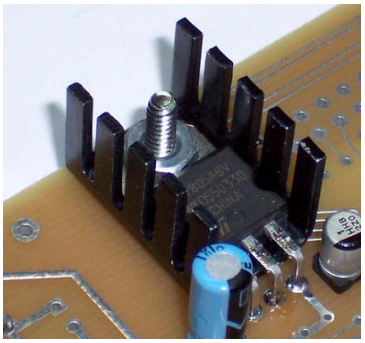
PCB with all SMT resistors mounted (shown on left), and then with all SMT capacitors and SMT diodes added.

5) **Install components from Semiconductor Bag**

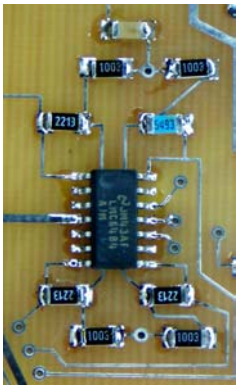
Using the Component Layout Diagram in Appendix A as a guide, install the components from the Semiconductor Bag. Check off each row as you complete installing those components.

	QTY		
[ ]	**1**	**U1**	**Voltage regulator, 3-terminal, 7805**
[ ]	**1**		**Heatsink - TO220** ***(From Controls Bag)***

Position the voltage regulator over the mounting hole to determine where to bend the three leads so they can be inserted to the pc board as shown below. Before soldering in place, orient the heatsink as shown and use the metal screw & nut to connect the two components to the pc board. Then, when aligned nice and straight, solder the three leads of U1 to the pads.

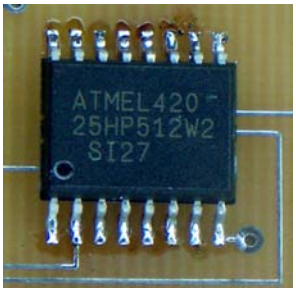


[ ]	**1**	**U2**	**Memory, SEEPROM, 512Mb** ***(16-pin surface mount IC.)***
[ ]	**2**	**U3, U4**	**IC, Op Amp, LMC6484, SOIC** ***(14-pin surface mount IC packages.)***
[ ]	**1**	**U5**	**IC, Audio Amp, LM386, SOIC** ***(8-pin surface mount IC)***
[ ]	**1**	**U6**	**IC, Level Translator, TC7SET08F, SOIC** ***(Pretty small 5-lead surface mount IC.)***
[ ]	**3**	**D7, D8, D9**	**Diode, Schottky, 1N5817, DO-41** ***(Faint cathode marking)***
[ ]	**1**	**Q1**	**Transistor, NPN, 2N3904, TO92** ***(Familiar 3-lead thru-hole package.)***

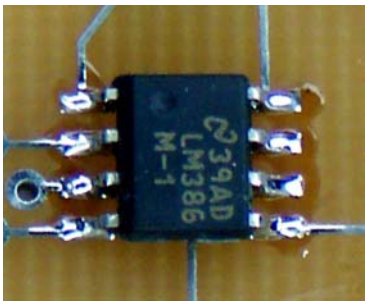


U4 op amp

U6 translator



U2 SEEPROM Memory



U5 LM386 Audio Amp

