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# Assembly Instructions for Communications Components Demonstration Circuit Boards

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## Applications Bulletin

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### Introduction

This note is intended for use with any of the many demonstration circuit boards available from the Communications Components Division of Hewlett-Packard Co. It describes easy assembly techniques that will ensure optimum performance from the boards.

The procedure presented below includes handling Isopropyl Alcohol, solder paste, solder, and high temperature tools such as hot plates and soldering irons that could have harmful properties if handled incorrectly. Please review and observe manufacturer's safety precautions and procedures associated with handling such

materials and tools when working on the boards. Always wear safety glasses when working on the boards.

### Assembly Notes

Table 1 lists items that will be useful when assembling the boards. Part numbers are recommendations only - feel free to substitute equivalents

1) Small electrostatic discharges can damage semiconductor devices without totally destroying them. We want you to obtain the best possible performance from our semiconductors and demo board so we strongly suggested that you work at a grounded work station, wear a grounding strap and work with grounded tools.

These suggestions apply whether you are working with silicon or GaAs devices.

2) Prepare the board for soldering by cleaning it with Isopropyl Alcohol (IPA).

3) Heat up a hot plate to approximately 200 °C (392 °F). Please be careful not to burn yourself and warn others that the hot plate is HOT!

4) While the hot plate is warming up, apply solder paste to the pads on the board where the surface mount components will be placed. The syringe type applicator works well and allows easy control of the amount and placement of paste applied.

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| <ol style="list-style-type: none"><li>1. Safety glasses</li><li>2. Grounded work surface and wrist strap</li><li>3. IPA (Isopropyl Alcohol) and tank to wash board</li><li>4. Hot plate with some means of temperature measurement</li><li>5. Solder paste and syringe applicator (ESP Solder Plus 6-SN63-400-A)</li><li>6. 50-60 Watt grounded soldering iron (Weller EC-2000)</li><li>7. 20-30 Watt grounded soldering iron (Weller EC-4001)</li><li>8. Heat gun, high temperature, low air flow (Ideal Industries 46-013 w/46-922 nozzle)</li><li>9. Steel tweezers</li><li>10. Circuit board vise or "third hand" jig to hold board</li><li>11. miscellaneous solder (60-40, rosin core), solder wick, cutters, stiff brush, etc.</li></ol> |
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Table 1: Useful items for circuit board assembly

5) When all the surface mount pads have been pasted, place the chip caps, resistors, inductors and semiconductors in the appropriate locations. Note that locations of some components are critical. Follow the diagrams on the data sheets for the demo boards. Be sure you place the parts exactly where they need to be soldered down. Pay special attention to the alignment of IC leads with their solder pads. Once the parts are positioned, the solder paste will keep them in place but handle the board carefully because the solder paste doesn't hold them very strongly.

6) Place the board with the surface mount components on the preheated hot plate. When the board heats up sufficiently (15-30 seconds), you will see the solder paste melt and fuse the surface mount components to the board. You can speed up the process by applying additional heat from a low air-flow, high temperature heat gun. Be careful not to overheat the board when using the heat gun. When you set the heat gun down, don't let the hot air blow onto anything you don't want to burn. Don't leave the board on the hot plate for more than a few seconds longer than the time it takes the solder to flow, or you may "cook" the components and/or have problems with the metal traces on the board lifting.

7) Once the solder has flowed and all the surface mount parts are soldered, use a pair of steel tweezers to lift the board off the hot plate and place it on a block of aluminum or other heat resistant surface to cool. Be careful - even though the solder hardens as soon as you lift the board off the hot plate, it will take several seconds for the board to cool off sufficiently to be touched.

8) Once the board has cooled, you can add the SMA connectors. Note: the board's ground plane acts like a heat sink so soldering parts to it will be difficult if you use one of the low temperature, low power irons commonly used to solder small parts to boards without ground planes. The relatively high mass of the SMA

connectors adds to the problem. Use a 50-60W soldering iron with a tip temperature of about 350-370 °C (650-700°F) and you will have no trouble. Start by quickly soldering the center pin from the connector to the board. Don't get it too hot or the metal trace on the board may lift up. Next solder the ground pins on the top side of the board to the ground pads.

Finally, use a generous amount of solder to solder the ground pins on the connector to the ground planes on both sides of the board. Again, don't heat things up any longer than necessary to get the solder to melt. It is a good idea to let the board cool off for a minute or two after mounting each connector.

9) Next mount the stakes or wire loops that you will be using to make low frequency and DC connections to the board. Wire loops are particularly good because you can connect to them using "mini-grabbers".

The high temperature soldering iron will work best for connections to the ground plane. Other connections can be made using a lower power iron. The easiest method is to pre-tin the wire and the pad where the wire will be attached, then, holding the wire with tweezers, press it against the pre-tinned pad and apply the soldering iron until the solder melts and sticks to the wire loop.

10) Finally, to give the board a professionally built look and improve your image with your boss, wash it in IPA again to remove solder flux. A small stiff brush may be useful to get into tight spaces between IC leads, etc.

### **Hand Soldering:**

You may not have a hot plate and paste type solder to use. In that case, you will probably build up the board by soldering each component down by hand. The following are some tips for easy and successful hand-soldering of surface mount components.

1) Use a 20-30 Watt soldering iron. A larger iron may end up heating the chip components so much that the solder on both ends of the chip melts, making it very difficult to get the parts to stay in place on the circuit board.

2) Chip capacitors and resistors: First tin one side of the pad where the part will be mounted. If the device will have one end connected to ground, its best to tin the ground side pad first. Use only a very small amount of solder! Next pick up the chip component and hold it in position on the board with a pair of steel tweezers. Touch the soldering iron tip to the end of the component where it contacts the just-tinned pad on the circuit board. When the solder melts, remove the iron but hold the chip until the solder hardens again. Now solder the other end of the component down, then go back to the first end and resolder if it isn't a good, shiny connection.

3) Surface mount ICs: The trick here is to get the IC pins to line up over the pads where they are to be soldered. One method of achieving accurate match is to tin pads on opposite corners of the IC location (for a 16 pin IC, you could tin the pads for pin numbers 1 and 9). Then, holding the IC in place on the circuit board with steel tweezers, touch the tip of the soldering iron to one of the two pins under which the pads have been tinned. As soon as the solder melts, remove the soldering iron and let the joint cool. Check the alignment of the remaining pins and pads. If the pins don't match the pads, you may be able to correct the problem by just twisting the IC into alignment, otherwise, use the soldering iron to reheat the one pin that has been tacked into place, and adjust the position of the IC. Once the IC is properly aligned, tack the other pin down to the already tinned pad. Now solder each of the remaining pins to their pads, then go back and clean up the first two if required.

4) Add the connectors and wire loops or stakes per instructions in number 9, above.

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