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Technical Process

Surface Mount Drag-Soldering Guide for the Electronics Technician

Surface mount (SMD) drag-soldering is a technique used when fabricating printed circuit boards (PCBs) that include integrated circuits (ICs) with a large number of pins, typically microprocessors. The technique involves dragging the soldering tip across many pins at once to increase soldering efficiency and accuracy. Most manufactured PCBs are produced in expensive robotic machines, but for electronics technicians building prototypes in a research and development environment will benefit from this skill.

The following document will guide the practicing electronics technician through the process of selecting the right tools to add to their soldering station, safely preparing themselves and the workstation for drag-soldering, and correctly drag-soldering a four-sided IC.

Prepare Materials and Tools

To perform SMD drag-soldering, we require the normal soldering tools, but with a few changes and additions. See Figure 1, below, for a list of the required materials.

Figure 1

Essential Soldering Tools:

- Soldering iron (50W or greater)
- Beveled or hoof tip
- 26 gauge solder
- Solder wick
- Safety glasses
- Magnifying eyepiece
- Tweezers

First, it is recommended to use a professional-grade soldering station. A standard in the industry is the Pace ST-50 using the PS-90 soldering iron. Many stations are available, however. The two features to look for in a drag-soldering station are high power outputs (greater than 50 W) and interchangeable tip, with beveled or hoof tips available.

Soldering tips vary greatly, but for drag-soldering, the beveled and hoof tip shapes are most appropriate because they allow the user to drag the soldering tip over multiple surfaces at once. See Figure 2, below, for examples of beveled and hoof tips.

Figure 2

Beveled Tip Hoof Tip

The solder gauge should be reduced from the standard 18 gauge to closer to 26 gauge or even smaller, if desired. The smaller gauge allows for more precision in correcting mistakes and tinning a few number of pins on the PCB.

A practicing electronics technician likely has the following components at their station already. Solder wick is useful when fixing mistakes or cleaning up a drag-soldered

component. A magnifying eyepiece allows the user to identify mistakes and bridged pins. Tweezers also make handling the IC easier.

Safety Precautions

All of the same precautions for typical soldering apply to drag-soldering, with the additional requirement that delicate ICs not be damaged in the process of drag-soldering. Reference Figure 3, below, for a reminder on standard safety precautions.

Figure 3

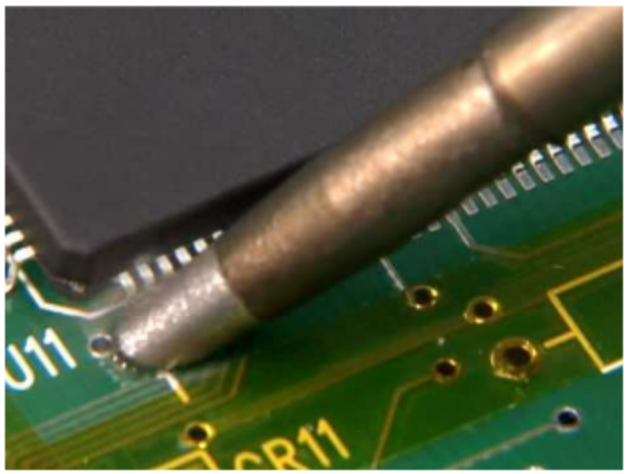
Safety Precautions: Remember to take the following precautions when soldering.

- Set up your workbench in a well-ventilated location
- Keep children away from work location
- Be aware that tip temperatures can reach more than 700°F
- Wear safety glasses
- Wear long sleeves and close-toed shoes
- Remove power sources from electronic components that will be serviced

Drag-Soldering Procedure

1. ***Prepare the workstation.*** Gather the tools and take all safety precautions. Remember to wear safety glasses. Also, be sure to gather your PCB and electronics components. When you've prepared, turn the soldering station on and let it heat up.
2. ***Tin the PCB.*** Placing ICs with many pins on the PCB can be difficult. By tinning the PCB beforehand, it ensures that the IC stays in place, even as you rotate and adjust the vice. Be sure to tin only a very small number of adjacent pins (1-3 pins).
3. ***Place the component.*** Once the PCB has been tinned, find the correct orientation of the IC. Typically, the IC will have an indicator, such as a dot, that lines up with a "1" or another dot printed on the PCB. Once this has been determined, place the component and line up all the pads as accurately as possible. If this is too difficult to achieve by hand, try using tweezers to adjust the position of the IC by nudging its position slightly from the sides.
4. ***Pin the component.*** After the component has been placed, relocate the tinned pads on the PCB. Carefully solder the IC onto the tinned pads. Refrain from displacing the IC while soldering; if the IC moves during soldering, it may need to be reset. It is best to use the flat edge of the tip, as seen in Figure 4, below. Then, once the IC is soldered correctly, verify that all the pins of the IC line up with the pads on the PCB.

Figure 4

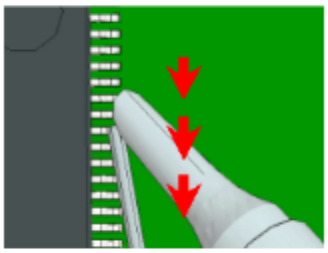


Use the flat edge of the tip to solder the corner of the IC to the PCB.

5. ***Secure the IC.*** Now that the IC has been soldered on one corner, secure the IC to the PCB by soldering pins on all corners of the IC. Verify that all pins match the correct pads on the PCB. If they do not match, reflow the solder and adjust the position of the IC, as before.
6. ***Solder one side.*** Once all corners of theIC have been soldered, we can solder one side of the IC. Make sure to add solder to the beveled or hoof tip. To begin, place the flat end of the tip on one end of the line of pins. Slowly drag the tip across the

ends of the pins of the IC until the tip reaches the other side, as seen in Figure 5, below. Add solder as needed as you drag the tip.

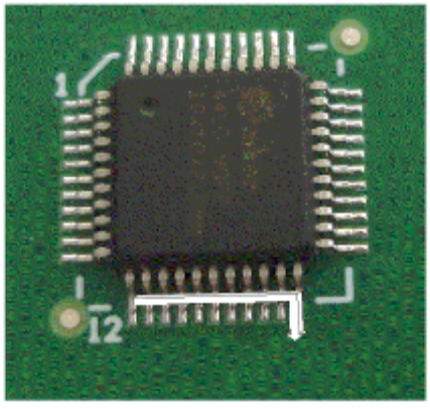
Figure 5



Drag the flat edge of the tip across the pins and add solder as needed

7. ***Touch up the pins.*** Sometimes the process is not as flawless as desired. Use a magnifying eyepiece to inspect the pins and check for bridges and excess solder. Reflow pins with excess solder and use the solder wick, if necessary.
8. ***Repeat on all sides.*** Do this on the remaining sides of the IC. Your IC should look similar to the one shown in Figure 6, below.

Figure 6



All the pins of your IC should line be soldered with the appropriate pads on the PCB.

9. ***Clean up your workstation.*** Be sure to turn of the soldering iron and put away the tools and components. Wash your hands before you leave.

Conclusion

Surface Mount (SMD) drag-soldering techniques require patience and proper technique to master. Refer back to this guide at anytime for a refresher. If the practicing electronics technician follows procedure outlined here, they will produce functional, aesthetically pleasing, and professional electronic circuit boards.