

SOLDERING AND ASSEMBLY BASICS

A designed board is bare copper until parts are on it. Hand-soldering with an iron suits through-hole and larger SMD; reflow with paste and heat suits dense SMD. With the reflow profile.

ONE THOUSAND DRONES ENGINEERING TEAM · VERIFIED 2026-07

A finished board is bare copper until the parts are on it. Assembly is either hand-soldering with an iron and solder, which is fine for through-hole and larger surface-mount parts, or reflow, where solder paste and heat melt every joint at once for dense boards. Know which your board needs before you order the parts.

THROUGH-HOLE AND SURFACE-MOUNT ASSEMBLY

Through-hole parts drop into plated holes and solder on the far side; they are forgiving and strong, good for connectors and anything hand-built. Surface-mount parts sit on top of pads and range from easy 0805 chips down to fine-pitch packages that fight a hand iron. The part sizes on your board decide how you will assemble it.

HAND-SOLDERING

Hand-soldering needs a temperature-controlled iron, solder, and flux, plus solder wick to undo mistakes. You heat the pad and the pin together, feed solder into the joint, and let it flow into a shiny fillet. Flux is what makes it easy: it cleans the metal so solder wets instead of balling up. Larger surface-mount parts hand-solder fine with a fine tip and patience.

REFLOW SOLDERING

For dense surface-mount boards, reflow does every joint at once. You apply solder paste (a mix of tiny solder balls and flux) to the pads, usually through a stencil, place the parts on the wet paste, and heat the whole board on a hotplate or in a reflow oven. The paste melts and pulls each part into place by surface tension, which is why reflow is the way to assemble crowded boards.

The heat follows a profile with four stages: a preheat ramp, a soak that evens the temperature and activates the flux, a reflow spike above the solder's melting point, and a controlled cool-down. Common lead-free paste (the SAC305 alloy) melts around 217 to 219 C and is taken to a peak near 245 to 255 C, held only briefly (CompuPhase). The paste datasheet gives the exact profile to follow.

- [CompuPhase. Reflow soldering profiles \(four-stage profile; SAC305 melts at 217 to 219 C, peak 245 to 255 C\).](https://www.compuphase.com) [compuphase.com](https://www.compuphase.com)

THE REFLOW PROFILE: PREHEAT, SOAK, A SPIKE ABOVE THE SOLDER'S MELTING POINT, THEN A CONTROLLED COOL-DOWN.

COMMON DEFECTS

A few faults show up again and again. A solder bridge is stray solder shorting two pins, cleared with wick and flux. Tombstoning is a small two-pad part standing up on one end because one side reflowed first. A cold joint is dull and grainy from too little heat and can fail intermittently. Learn to spot these under a loupe and most assembly problems are quick fixes.

DEEP DIVE · WHY LEAD-FREE RUNS HOTTER

Older tin-lead solder melts near 183 C at its eutectic point; the lead-free SAC305 alloy melts around 217 C, over thirty degrees higher (CompuPhase). That higher melting point is why lead-free reflow needs a hotter peak and a tighter profile, and why the parts and the board have to tolerate more heat. It is also why the soak stage matters more for lead-free: the narrower window between melting solder and damaging parts leaves less room for an uneven board.

CHECKPOINT

1. What is reflow soldering best suited for?

- a. **Dense surface-mount assembly**
- b. A single through-hole connector
- c. Stripping parts off a board

ANSWER · A

Reflow melts every joint at once from paste and heat, ideal for crowded surface-mount boards.

2. What is flux for when hand-soldering?

- a. It cools the iron tip
- b. **It cleans the metal so solder wets into a joint**
- c. It colors the finished board

ANSWER · B

Flux removes oxide so solder flows and wets instead of balling up.

3. A part standing up on one end after reflow is called what?

- a. A cold joint
- b. A solder bridge
- c. **Tombstoning**

ANSWER · C

Tombstoning is uneven reflow lifting one end of a small two-pad part.

- Prerequisite: reading a datasheet (package and assembly)
- See it on a real board: the L1.01 build
- Next: board bring-up, first power