

# Soldering Techniques for Building Printed-Circuit Boards (PCBs)

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Printed-circuit board (PCB) design is important not only to evaluate circuit ideas before integrating them onto a chip but also because the performance of integrated prototype chips is highly dependent on the evaluation board used to test them. Consequently, developing PCB-building and soldering skills are important, which is why the purpose of this document is to review some basic soldering tools and techniques.

## Basic Soldering Tools:

- **Soldering Iron** – Used to melt solder and connect component pins to board pads. A cheap soldering pencil may be sufficient, but a temperature-controlled solder station is best for high performance boards.
- **Solder** – An alloy of tin and lead with a low melting point. Based on diameter and metallic and core content, various soldering solutions are available. For example, thick and thin solders are useful for connecting power devices and surface mount technology (SMT) components, respectively.
- **Flux or Rosin** – A substance used to channel solder flow and prevent oxide formation. Rosin was first used for this purpose, but it is a bit messy. Flux is better and therefore more popular today.
- **Solder Wick or De-soldering Braid** – A tool used to extract solder and de-solder components from the board, for which a pump is sometimes helpful, if large amounts of solder are present.
- **Flux Remover** – A liquid used to remove flux residue.
- **Hot Plate** – A tool used to seamlessly solder SMT packages and multi-pin chip components to the PCB.
- **Pliers, Knife, Multi-Meter, and Magnifier** – Pliers are used to cut, bend, and sometimes strip component leads; a knife to strip wires and trim traces; multi-meters to test electrical connectivity; and a magnifier for soldering small SMT chip components.

## Rules of Thumb:

- **“Practice makes perfect”** – Patience, time, and training are important (Georgia Tech’s IEEE student branch offers entry-level solder training annually).
- **Order is important** – Assemble small, flat, multi-pin, surface-mount (SMT) devices first (there may be insufficient space left for them otherwise) and place visible labels around the components to avoid mistakes and facilitate the debugging process during the evaluation phase of the prototype.
- **Immobilize components before soldering them** – Use glue or any mechanical means to stabilize the devices before soldering them (this frees both hands to handle the solder and soldering pencil or gun).
- **Heat the joint, not the solder** – Heating the solder directly prevents it from flowing into the joint, staying on the tip of the heat gun instead. Consequently, to avoid this, the joint should be heated, not the solder, and because the joint is a good thermal conductor, the solder will melt and adhere to the joint only.
- **Use capillary forces** – Molten solder naturally flows along metal-plated traces and pads by capillary forces and applying flux facilitates this process, removing undesired oxidants in the process.
- **Test connectivity** – Examine and evaluate solder connections both visually and electrically (with a multi-meter), especially for small joint connections.

## References:

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