

## Printed Circuit Board Design, an Introduction

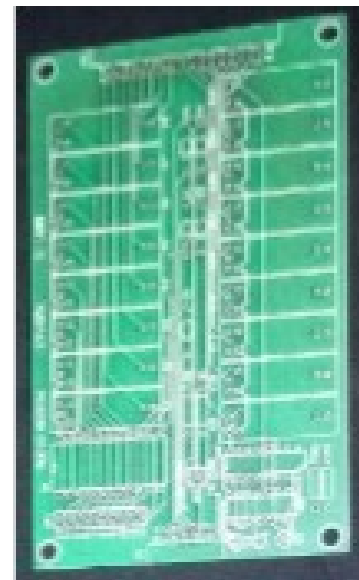
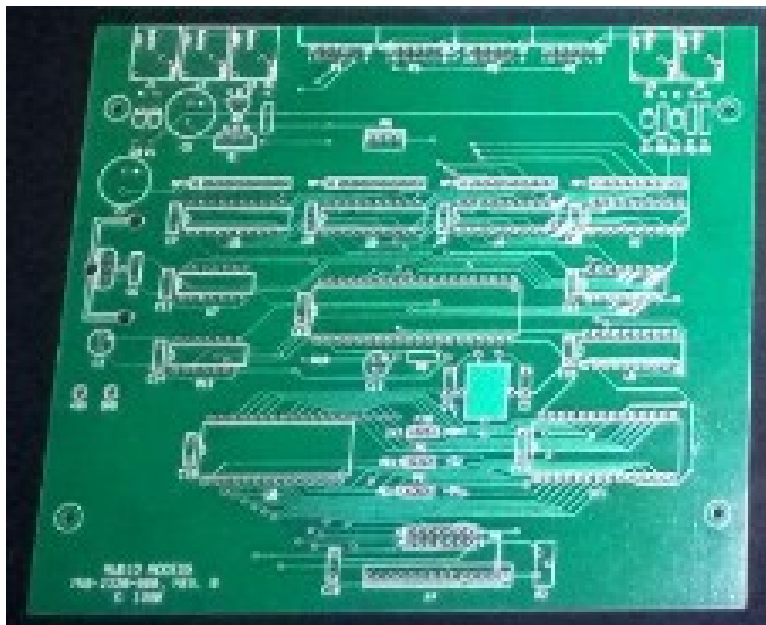
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What is a Printed Circuit Board and what does it do?

A Printed Circuit Board, commonly referred to as a PCB, simplifies a group of wires connecting electronic components. Hand wiring components takes time and if you are making several identical products, errors can easily happen, such as a wire can be left off or connected to the wrong place.

If you remove the cover and look inside of an electronic device, you will probably find some sort of PCB covered with electronic components. If you have never done this, watching some of Big Clive's videos will give you an idea of what you may find. Here is a link to his videos: [Big Clive's YouTube Channel](#)

To ease mass production issues, the PCB was developed. It is basically a type of thick plastic sheet that has a thin sheet of copper glued to one or both surfaces. A layout of the needed wires is applied to the copper surface and then the copper is chemically etched to remove the unnecessary metal leaving only the wires. At the ends of the wires there are different shaped pads where the components are attached by soldering. Holes are later drilled in the pads that require them and in other places that are used to attach the board to an enclosure or allow some other mechanical device to be mounted. Examples of blank boards (before the addition of components). Copper is normally placed in these holes to connect the front to the back.



Today, most boards are complex multi-layer in structure. Once the two layer boards are etched, they are stacked with a blank substrate (made only of plastic without any copper) in between until the desired final number of layers is achieved.

A liquid Solder Mask is normally applied over the metal wires using a type of silk screen or a dry film may be placed on. This Solder Mask prevents the wires from shorting to each other or to any of the devices that might be contained in a metal case and any other nearby surfaces. This plastic liquid hardens into a tough protective surface. The silk screen mimics the pattern of the pads so that they remain open for soldering. Normally the Solder Masks are green, but they can be made in any color. Green, being the most common, is also the cheapest.

Over the top of the Solder Mask, a Silk Screen is normally printed. It is a non-conductive ink, normally white, that indicates the outlines of the components and also provides the component's Reference Designator and any other necessary text, such as the company name, board revision number, etc. The Reference Designator indicates the type of the component (such as a connector) and also it's number, which aids in finding it's location. If you have more than one, you have to know which one is which.

Some components have wires protruding from which are called leads (as they lead the electricity to the component). These "through-hole" components require holes so that the lead may be soldered to the pad on the opposite side of the board. Other types of components are soldered directly to the pads and do not require holes. These are Surface Mount Devices, referred to as SMD components. You will also hear them referred to as SMT devices, for Surface Mount Technology.

Surface Mount Devices also require an additional coating on the pads that they attach to. This is called Solder Paste. This is a kind of glue mixed with powdered solder that holds the components in place while the boards are run through an oven that attaches all of the components to the board.

Although most PCB's tend to be square or rectangular, they can be any shape, depending on their usage and whatever enclosure they need to fit in. The boards are normally produced on large panels of multiple boards and then cut to the needed shape.

Although, today, this is highly automated in production, in the past, much of the layout process was done by hand. With the advent of Computer Aided Design, called CAD, the process of creating the layout has been greatly simplified.

That's enough for now. We will get into more of the process later.