

Is .063" (1.57 mm) a standard PCB thickness, and if so, why?

The 63 mil PCB thickness appears often as the thickness specification for PCBs. The question often asked is why is this thickness specified and is it an industry standard? This is one of those topics that warrants looking at the history of PCBs as they have evolved from simple single-sided boards to dozens of layers. After this review it will be seen that this is one of those specifications not unlike the often told story of how American railroad rails came to be 4' 8.5" apart. In this case it is said to be traceable to spacing of the wheels on Roman chariots!

When the transition from vacuum tubes to transistors took place in the mid-twentieth century, it was no longer necessary to build electronic products using large metal chassis and sockets. It became possible to build electronic assemblies in much smaller form factors. A handy way to build transistor-based electronics was with a method often known as bread boarding. The method involved taking a sheet of nonconducting material such as wood, inserting eyelets or standoffs and wiring the parts together with pieces of hook-up wire. The problem with wood is that it splinters when it is thin resulting in fragile assemblies.

During this time, the surfaces of many workbenches were made from Bakelite, a thin insulating material that is a good, sturdy insulator. Most Bakelite was manufactured in sheets, many of which were included as the top layer of a piece of plywood. These sheets of plywood were then used as the tops of work benches. It was a simple matter to order these thin sheets and use them as substrates for electronic assemblies. It happens that one ply of this plywood is 1/16 inch or .063". So begins the story of PCBs specified at this thickness.

Wiring all of the components together using standoffs on a PCB is labor intense. It did not take long for someone to devise a way to glue a sheet of copper foil to this sheet of Bakelite and etch the wires between components into the foil yielding the first single-sided printed circuit boards. Soon multiple board systems evolved creating the need for some form of board to board connection system.

The first board-to-board connection systems were two piece connectors that were often organized into a rack that allowed the cards to be plugged in from the front of a chassis. The connectors in the rack were wired to each other making up the board to board connections. This method required two connectors for each PCB one for the PCB itself and another in the rack. As cost pressures mounted, attempts were made to eliminate the connector on the PCB. Since there was a sheet of foil on the unetched PCB that covered the entire surface, it was a simple matter to etch connector fingers on the PCB edge that fit into an "edge" connector in the rack resulting in a cost savings.

Since the PCB material was 63 mils thick it follows that the connector in the rack needed to match this thickness. As time went by, copper foil was bonded to both sides of the Bakelite producing the double-sided PCB along with the double-sided connector, still with an opening that fit a PCB of 63 mils thickness. This is how the industry came to call 63 mils a standard thickness.

Bakelite did not lend itself to the chemistries involved in etching and plating the copper foils on the PCB, so polyimide and epoxy composites were developed to fill this need. From this has followed the wide variety of materials that are offered to manufacture multilayer PCBs.

Many PCB designs do not use edge connectors. Examples of this are PC motherboards and single PCBs in game products. Is there a reason to make these PCBs 63 mils thick? Since the only reason for specifying the 63 mil thickness is to mate with an edge connector, clearly there is no reason to hold to this thickness. All too often, extra material is added to a stackup for no reason other than to comply with this thickness. If the signal integrity and rigidity requirements are met with a thinner PCB, adding extra laminate to reach the 63 mil thickness adds cost for no reason.

As layer counts mounted to meet the wiring needs of more complex integrated circuits, circuit boards began to be manufactured with high layer counts. When layer counts exceeded ten layers it became difficult to remain within the 63 mil envelope. A jump to 93 mils (2.325 mm) was made to allow room for the added layers. This became the next defacto "Standard" board thickness. What is so special about 93 mils? It happens to be 1.5 times 63 mils or 3/32 of an inch.

So both 63 mils and 93 mils are thickness specifications that can trace their origins to the plywood industry. Two of the long held standards for PCB thickness turn out not to be standards at all! They just happen to be thicknesses borrowed from another industry.