



ASSOCIATION CONNECTING  
ELECTRONICS INDUSTRIES®

IPC-DR-572A

# Drilling Guidelines for Printed Boards

Developed by the Drilling and Routing Subcommittee (4-12)  
of the Fabrication Processes Committee (4-10) of IPC

***Supersedes:***

IPC-DR-572 - April 1988

Users of this publication are encouraged to participate in the  
development of future revisions.

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# Drilling Guidelines for Printed Boards

## 1 SCOPE

This document is intended to provide guidelines for generating good quality holes in printed circuit boards (PCBs) made from a wide variety of materials.

## 2 APPLICABLE DOCUMENTS

### 2.1 IPC<sup>1</sup>

**IPC-T-50** Terms and Definitions for Interconnecting and Packaging Electronic Circuits

**IPC-DR-570** General Specification for 1/8 Inch Diameter Shank Carbide Drills for Printed Boards

**IPC-PE-740** Troubleshooting for Printed Board Manufacture and Assembly

**IPC-6012** Qualification and Performance Specification for Rigid Printed Boards

**IPC-6013** Qualification and Performance Specification for Flexible Printed Boards

**IPC-TM-650** Test Methods Manual<sup>2</sup>

2.1.1 Microsectioning

2.4.24 Glass Transition Temperature and Z-Axis Thermal Expansion by TMA

2.4.25 Glass Transition Temperature and Cure Factor by DSC

## 3 TERMS AND DEFINITIONS

The definition of terms shall be in accordance with IPC-T-50 and the following:

### 3.1 Aspect Ratio for Stack Drilling

$$\text{Aspect Ratio} = \frac{\text{Stack Height}}{\text{Drill Bit Diameter}}$$

**3.2 Backup Material** A sheet of material placed on the exit side of a stack to terminate the drilling stroke and to prevent the formation of exit burr.

**3.3 Bird Nesting** A condition that occurs when drilling debris wraps and remains around a drill bit.

**3.4 Burr** A defect characterized by a ridge left on the copper of a drilled interface. It may occur at the entry or exit surfaces of a drilled hole. It may be localized or generalized over the entire drilled surface.

**3.5 Chip Load** The depth or distance through a stack that a drill bit travels for each revolution it turns. Chip load is typically measured in mils or inches per revolution (IPR), or micrometer per revolution ( $\mu\text{m}/\text{rev}$ ).

$$\text{Chip Load (IPR)} = \frac{\text{Feed Rate (IPM)}}{\text{Spindle Speed (RPM)}}$$

$$\text{Chip Load } (\mu\text{m}/\text{rev}) = \frac{\text{Feed Rate (m/min)} \times 10^6}{\text{Spindle Speed (RPM)}}$$

**3.6 Connector Array** A series of holes related to one connector.

**3.7 Cutting Speed** The distance a point on the circumference of the drill bit travels over a period of time. Typically, it is expressed as “V” and measured in surface feet per minute (SFPM or SFM) or meters per min (m/min).

$$\text{Cutting Speed (SFM)} = \text{Spindle Speed (RPM)} \times \pi \times \frac{\text{Diameter (in)}}{12}$$

$$\text{Cutting Speed (m/min)} = \text{Spindle Speed (RPM)} \times \pi \times \frac{\text{Diameter (mm)}}{1000}$$

**3.8 Debris** Usually called drilling debris. Chips and residue left from the drilling operation.

**3.9 Debris Packing** Debris deposited tightly in holes, cavities, and tool flutes.

**3.10 Drill Bit Wander** The deviation of an exit location from the entry location.

**3.11 Drill Construction** The composition/construction of a drill bit commonly used for drilling printed circuit boards. The types of composition/construction are described as one of the following: Solid Carbide, Composite, Carbide flute with steel shank, Carbide-to-Carbide, Staked construction or Brazed construction.

**3.12 Drilled Hole Size (DHS)** The diameter of a hole prior to plating.

**3.13 Dwell Time** The period of time between a downward and upward motion of a drilling stroke, or the delay prior to a downward stroke allowing the table to stabilize after positioning.

1. [www.ipc.org](http://www.ipc.org)

2. Current and revised IPC Test Methods are available on the IPC Web site ([www.ipc.org/html/testmethods.htm](http://www.ipc.org/html/testmethods.htm))