APPLICATION NOTES

Using Polygon Press-fit Pins and Receptacles for Plated Through-Holes in Printed Circuit Boards

Machined pins and receptacles with polygon press-fit features (multifaceted geometries) are recommended for pressing into plated through-holes (PTH's) in printed circuit boards. When a polygon press-fit pin is pressed into a plated through-hole, the points (the major or circumscribed diameter) of the polygon are set or imbedded in the hole while the flat sides of the feature (minor or inscribed diameter) provide relief, allowing the remainder of the plated through-hole barrel to remain intact. The result is internal board layers are not disconnected when the pin/receptacle is pressed in. With a properly specified hole size, the polygon shaped press-fit feature will allow the pin/receptacle to be secured in the hole while maintaining continuity throughout all the layers of the PCB. These types of pins/receptacles are commonly used as solderless press-fits but are also excellent for soldering as the relief they provide in the hole allows for venting of gasses and solder flow without voids or flux entrapment during the soldering process.

Pins and receptacles with barb or knurl press-fit features are not recommended for pressing into plated through-holes, particularly those in multi-layer PCB's. These types of press-fit features may damage the barrel of a plated through-hole, disconnecting internal layers as the pins are pressed in. This is a result of these features having a constant, uninterrupted diameter which provides no relief in the hole. Barbs and knurls are better suited for pressing into molded or machined plastic housings and insulators or bare board PCB holes. If they are chosen to be used in plated through-holes, they should only be used on single layer boards with the addition of soldering to the barrel or shoulder after pressing to insure a good electrical connection.

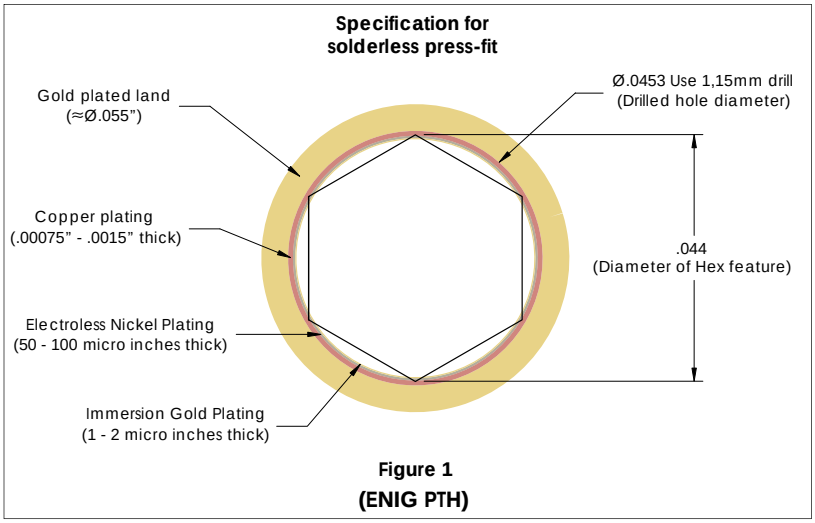
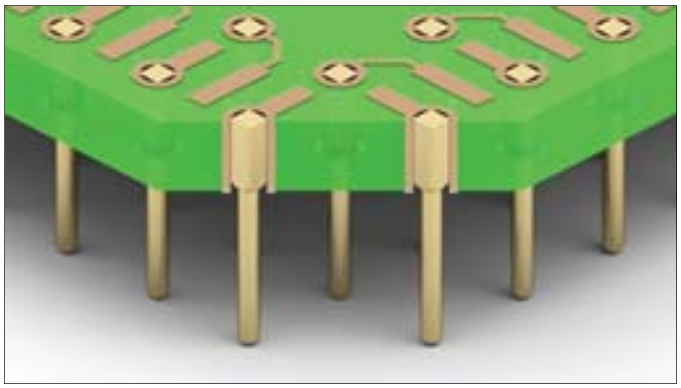


Figure 1
(ENIG PTH)

Hole sizes for multifaceted press-fit pins require more consideration than a standard plated through-hole; particular attention must be paid to the drill size used. Recommended drilled hole sizes are prior to plating of the PCB and based on typical copper deposition of .5 - 1 oz. which results in a reduction of hole size by approximately .0015" - .003". Therefore, the drill size selected should be larger than the diameter of the points of the press-fit feature by approximately .001". In the interest of econ-



omy, the nearest standard drill size which is at least .001" larger should be chosen (the actual drilled holes in FR-4 epoxy are typically .0005" smaller than the nominal drill size). In the example shown in figure 1, a pin/receptacle has a hexagon feature with a diameter of .044" across the points, the nearest typical standard drill size of .0453" (1,15 mm) is chosen. For applications in which the pins will be soldered after press-fitting the relief provided by the polygon press-fit feature becomes more important; smaller board holes may require pins/receptacles with fewer facets (see figure 2). When specifying plated through-holes for press-fit, the PCB fabricator should be given the actual drill size to use, as well as a commercial finished hole tolerance. Depending on surface plating, tin, tin/lead, ENIG etc., typical finished hole sizes are .003" - .005" smaller than drilled hole sizes. The finished hole size tolerance for press-fit applications should be specified as +/- .002".

Some other considerations for press-fit plated through-holes: board fabricators should avoid using re-pointed drills and should limit the number of drill hits based on their equipment and processes to insure consistently drilled holes; when fabricating large panels it's important to mask the edges of the panel in the electro-copper tank to reduce the excessive build-up of copper in the edge holes relative to holes in the center of the panel.

Lastly, when pressing gold-plated pins into gold-plated holes or tin-plated pins into tin-plated holes, there is "cold welding" of the similar metals in contact. This gives rise to high insertion forces that could damage the board or the connector. A lubricant in the holes, such as contact lubricant OS-138, can dramatically reduce "cold welding". A soap solution can also be used followed by a board wash. Alcohol is not as effective a lubricant, but it can be used without leaving a sticky residue. Even with lubricant, some "cold welding" still occurs, and this generates localized heat in the holes during pressing. The press rate should be slow to minimize heat damage to the board.

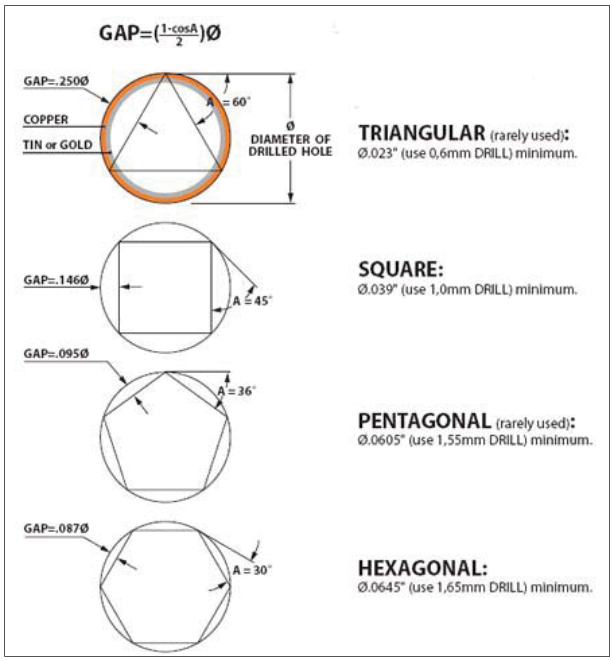


Figure 2