Interplex

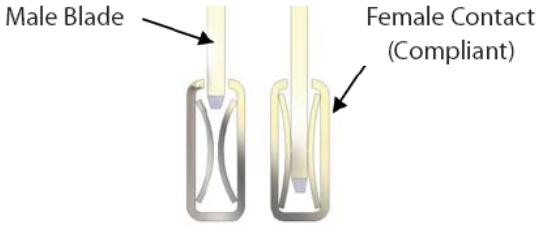
Press Fit Tech Bulletin

PCB Hole Construction and Material Requirements for use with Press-Fit Technologies

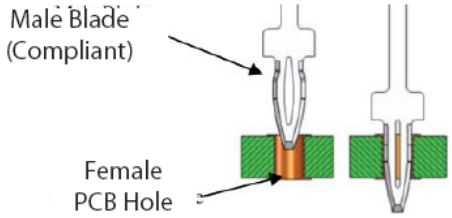
Press-fit technology allows for the insertion of a specially stamped terminal into a plated-through hole (PTH) in a printed circuit board (PCB) in such a way that a highly reliable electro-mechanical connection is established without using solder.

This solderless connection functions like the blade and socket pair in a connector, except the genders are reversed. In a traditional blade-and-socket pair, the socket has flexible beams that provide the necessary normal force for an electrical connection, and the blade is rigid. Conversely, in a press-fit joint, the “blade” which is called either a compliant pin or a press-fit pin, has the flexible beams and the socket, which is the PTH, remains rigid.

Typical Male/ Female Interconnect



Typical Press-Fit Male/ Female Interconnect



Normal Force is the force exerted on the walls of the PCB hole by the spring characteristic of the press-fit pin. Insertion Force is the force exerted back against the pin when inserted into the PCB. Because press-fit joints on PCBs are more permanent than blade-and-socket connectors, which are designed to be disconnected and reconnected, the PCB to press-fit terminal interface needs to have much higher Normal Force after insertion.

Having the proper PCB hole construction and selecting appropriate PCB materials plays a critical role in the correct functioning of a press-fit pin.

Topics covered in this Press-fit Tech Bulletin include:

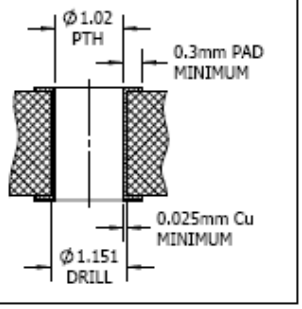
- Proper PCB Plated-through-hole construction (drill hole, copper thickness, etc.)
- Performing PCB Hole verification without the need for cross-sectioning
- PCB materials and thermal characteristics to meet operational temperature specs

Although the basic requirements are not complex and do not add cost, following these few fundamental methodologies will ensure the success of a program using press-fit technology.

Proper Plated-Through-Hole Construction

PCB construction requirements and application drawings need to specify the required parameters in order to maintain consistent control over the plated-through-hole size. If the raw hole is drilled too large and back filled with copper, over time the copper will push away and contact resistance will grow. Conversely, if the drill hole is too small or the copper is too thin, the copper in the hole can be pushed out and/or delaminate from the internal layers during press-fit pin assembly.

		mm	in
REQUIRED PCB HOLE CONSTRUCTION 1.57 (.062) THICK FR-4	DRILL	Ø1.151±0.025	Ø.0453±.0010
	COPPER THICKNESS	0.025 MIN	.0010 MIN
	FINAL IMMERSION PLATED HOLE DIAMETER	Ø1.020±0.076	Ø.0400±.0030
PIN INSERTION FORCE: 100 N (22.5 lbf) MAXIMUM PIN RETENTION FORCE: 20 N (4.5 lbf) MINIMUM SEE 0.64 PRESS-FIT TEST REPORT SUMMARY FOR TYPICAL VALUES			



PCB Hole Construction for Interplex's 0.64mm Press-fit Section

Performing PCB Hole verification without the need for cross-sectioning

A simple procedure that can be helpful to ensure proper hole size is to include additional test drill holes on the PCB that are not filled with copper. By measuring the non-plated holes, and comparing them to measurements of the same hole but plated through, the hole construction can be verified. In addition, when PCB manufacturers know why you've included the verification holes, they pay more attention to hole size and the focus on quality goes up.

Designing PCBs to Exceed Specified Operating Temperatures

Designers also need to keep in mind the operating temperature requirements and to assure that the Tg (glass transition) point of the PCB exceeds the target operational conditions by a safe margin. For example, automotive industry SAE specifications define five classes of operating environments. The most common applications are SAE class II (100°C ambient) for passenger compartment locations, and SAE class III (125°C ambient) for under-hood locations. Class IV & V applications are less common.

SAE Temperature Classifications	
Class	**Ambient Temperature Range**
1	-40° C to + 85° C
2	-40° C to + 100° C
3	-40° C to + 125° C
4	-40° C to + 150° C
5	-40° C to + 175° C

PCB Tg needs to be about 15°C above the target operational temperature of the application. For an under-hood application at 125°C the Tg minimum should be 140°C. If the Tg is too low then the PCB could soften during operation and the press-fit to PCB interface could weaken, which can result in increased contact resistance that impedes current flow.

The bottom line is that press-fit technology provides significant benefits by simplifying manufacturing processes, eliminating solder and improving reliability. Achieving these goals requires good PCB design and following the basic steps outlined above.

More information regarding Press-Fit technologies and products can be found on the web by visiting www.interplex.com or by calling (718) 961-6212.