

Determining PTH Integrity with Cross-Section Analysis

The following three primary requirements must be addressed for verification of any press-fit zone design:

- Plated Through Hole integrity (cross-section analysis)
- Mechanical Forces (insertion & retention forces)
- Contact Resistance (electrical measurement)

Before considering the use of any press-fit zone design, it is critical to know that it has been through and has passed a comprehensive environmental test program based on the core requirements of IEC-60352-5.

This Tech Bulletin addresses the first of these techniques: Cross Section analysis

Maintaining PTH integrity is one of the most important factors to assure success with press-fit interconnects. Cross-section analysis is used to prove the basic integrity of press-fit pins for use within specified production parameters. Cross-section analysis needs to be done in a test program that addresses all legs of environmental stress, including but not limited to: thermal shock, high/low temperature exposure, vibration, climatic cycling, temperature and humidity cycling and other similar test requirements. When evaluating any press-fit pin application, it is important to confirm that the supplier has conducted post-environmental stress test cross-section analysis in conformance with IEC-60352-5 and that hole deformation is within specified limits.

After environmental stress testing, microsection samples with press-fit pins fully inserted into the PCB are prepared and then visually analyzed and measured at key transverse and longitudinal locations in order to determine if any deformation has occurred. The drawing below illustrates specific locations for conducting measurements.

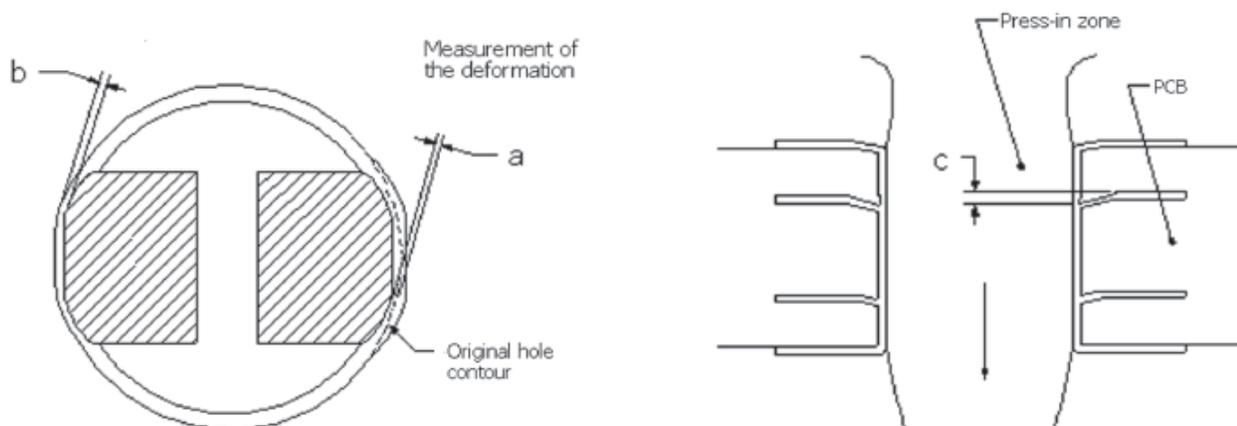


Figure 1: Transverse and Longitudinal Cross-Sectioning Measurement Locations

Press- Fit Interconnect Cross-Sectioning Examples

Shown below are cross-section images and analysis data resulting from an extensive testing program of Interplex press-fit terminals conducted by independent certified labs. This information is for 0.8mm thick terminals inserted into a 1.57mm thick FR4 PCB. Press-fit pins tested have been made with various alloys, ranging from a cost-effective CuSn up to a high performance, highly conductive CuCrAg. Plating types tested were both Immersion Tin and Immersion Silver. Final PTH sizes were 1.41mm lower limit and 1.56mm upper limit, with copper wall thickness of 0.025mm minimum.

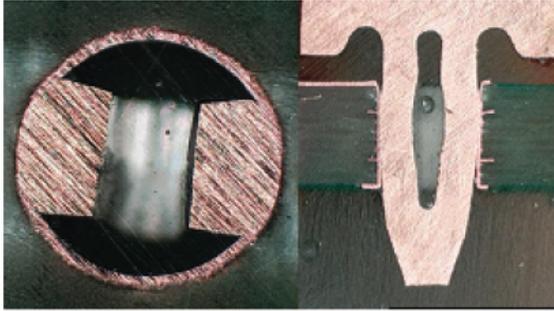


Figure 2 – Cross-Section of Lower Limit PTH

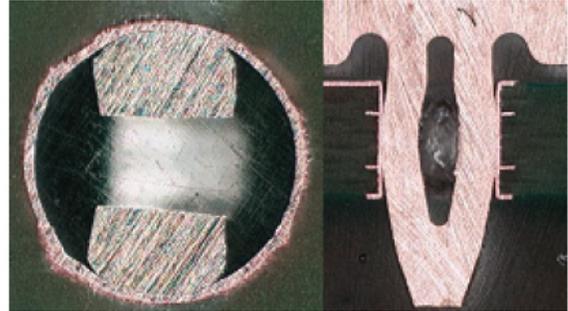


Figure 3 – Cross-Section of Upper Limit PTH

PTH Size	Drill Hole Contour Deformation "a" (µm)		Remaining Plating Thickness "b" (µm)		Vertical Trace Deformation "c" (µm)	
	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
Maximum Value	28.6	27.8	45.7	43.5	44.5	26.0
Mean Value	20.3	14.9	33.4	31.9	30.9	17.4
Minimum Value	11.8	7.0	21.5	26.0	13.5	12.0
Requirement	50.8 Maximum		8.0 Minimum		50.0 Maximum	

Table 1 – Cross-Section Dimensional Data for Immersion Tin PCB

PTH Size	Drill Hole Contour Deformation "a" (µm)		Remaining Plating Thickness "b" (µm)		Vertical Trace Deformation "c" (µm)	
	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
Maximum Value	26.7	25.4	40.6	37.8	26.0	10.0
Mean Value	22.0	23.3	30.0	30.7	18.5	4.5
Minimum Value	17.1	20.3	20.3	25.9	9.0	2.0
Requirement	50.8 Maximum		8.0 Minimum		50.0 Maximum	

Table 2 – Cross-Section Dimensional Data for Immersion Silver PCB

Plated-through hole deformation values for both transverse and longitudinal sections are within design requirements and conformance with IEC-60352-5. The maximum transverse deformation was 28.6 µm and the minimum remaining plating thickness was 20.3 µm. In the longitudinal direction, the maximum vertical trace deformation was 44.5 µm.

Cross-sectioning is one of the three key analysis techniques used to assure the integrity of solderless press-fit interconnects. The other two test areas, Mechanical Forces and Contact Resistance will be covered in separate Press-Fit Tech Bulletins.

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