Why Wide Fine Pitch Pads?

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Fine pitch SMT devices, although certainly not new, present more of an assembly processing challenge than 50 mil pitch devices. In fact it seems that the finer the pitch the more difficult or narrower the process window becomes. Besides the pitch of the leads being less on fine pitch devices narrower pad width on the board is typical. With fine pitch designs the board fabrication process is also stressed in that the strip of mask between the pads is designed narrower, the alignment of the mask to copper becomes more critical. When Hot Air Solder Leveling (HASL) is used, the differences of solder height from pad to pad becomes greater. Typically narrow fine pitch pads that run parallel to the HASL air knives tend to have high solder height that can cause shorts or even stencil damage in extreme cases and large or long pads that run perpendicular to the HASL air knives tend to have much thinner solder height with possible solderability problems.

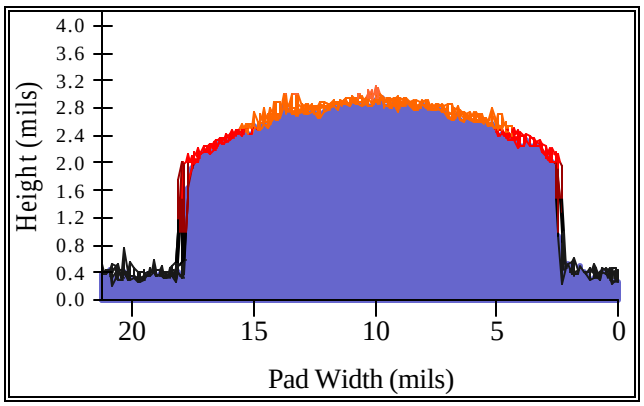

Figure 1 HASL (Parallel)

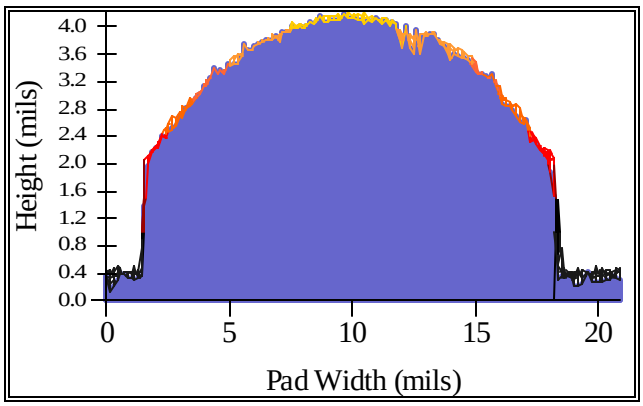

Figure 2 HASL (Perpendicular)

The two solder pad scans above are from the same component location on the same board and include the pad metallization thickness. Typical good solder thickness from an in-control HASL process is exemplified by the fine pitch pad cross section in the Figure 1.

Wide Pads = Consistent HASL

Consider the four frequency distributions in Figure 3. The Intergraph, Automata and Hadco 20 mil pitch (0.5mm) pads are all from the same 12 mil wide pad artwork illustrating the need to specify the finished pad width (± 1 mil is achievable). The HP pad width had no mask between the pads but was an incredible 16 mils wide with a very small space (3.685 mils) between the pads. The HASL consistency Vs pad width relationship is based on surface tension properties of molten solder and is clearly demonstrated by comparing the frequency distributions (Figure 4) of the narrow Intergraph pad width with the wide HP pad width designs.

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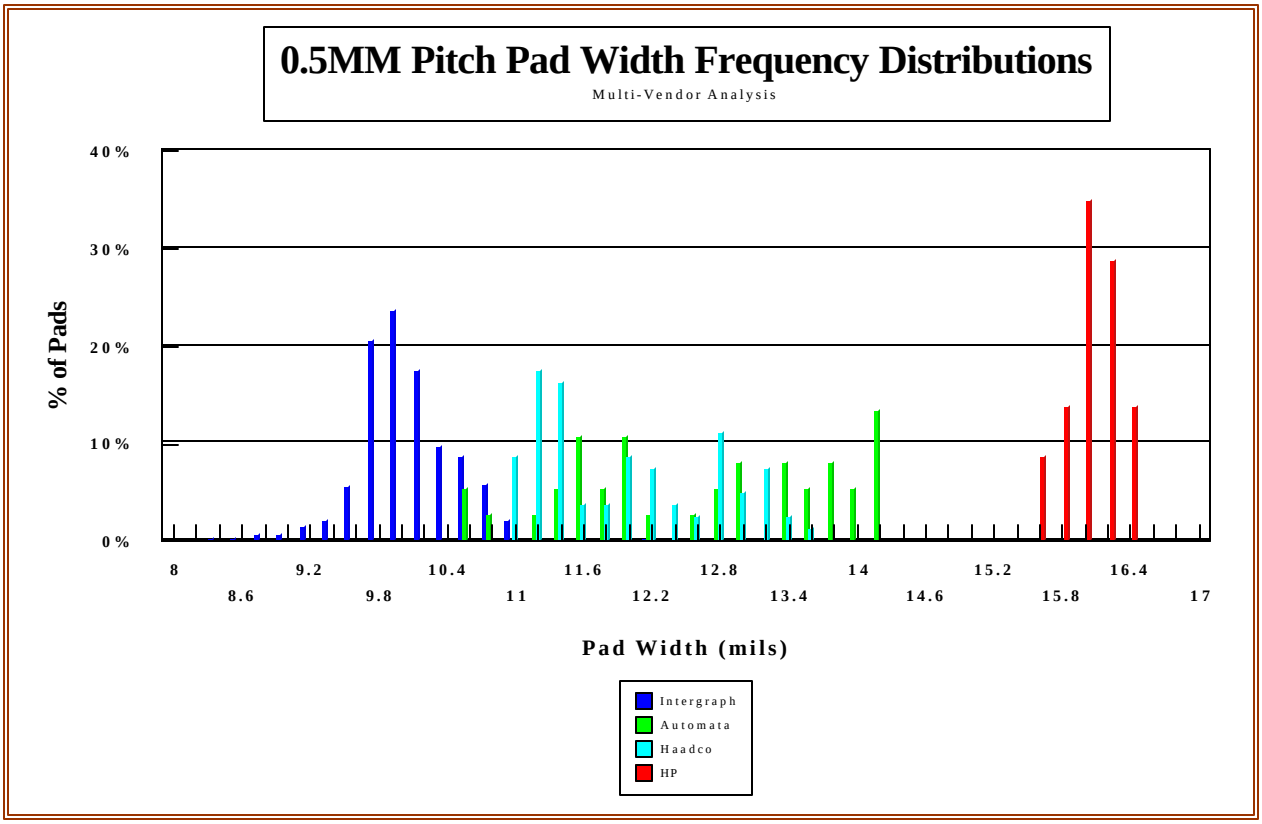
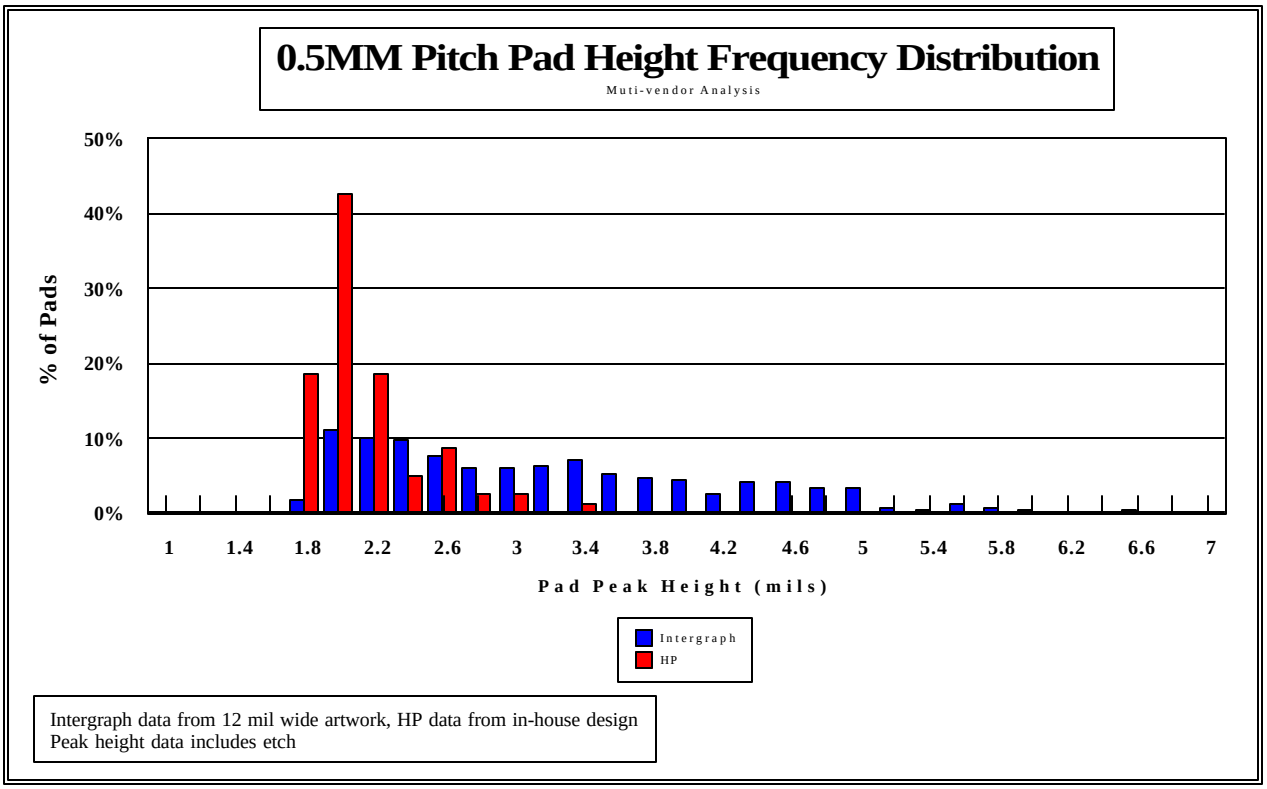


Figure 3 Pad Width Variations



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Wide Pads ¹ Shorts

The move from 12 to 13 to 14 mil artwork at Intergraph not only produced more consistent HASL results but a lower defect rate was realized mainly due to the reduction of shorts without changing stencil apertures. The wide pad designs demand the removal of the solder mask webbing. The reduction of shorts substantiated the suspicions that solder mask between pads had little or no benefit to short reduction.

Wide Pads are Bigger Targets

The IPC-SM-782 *SURFACE MOUNT DESIGN AND LAND PATTERN STANDARD* (8/93, RevA) indicates that the lead width for a 0.5mm pitch QFP can vary from about 4 mils to almost 12 mils (0.1 to 0.3 mm) and recommends pad widths from about 12 mils to almost 16 mils (0.3 to 0.4mm). Obviously a 12 mil wide lead on a 12 mil wide pad leaves no placement tolerance whereas a wider pad enlarges the target and the process window.

Wide Pads Add to Joint Strength

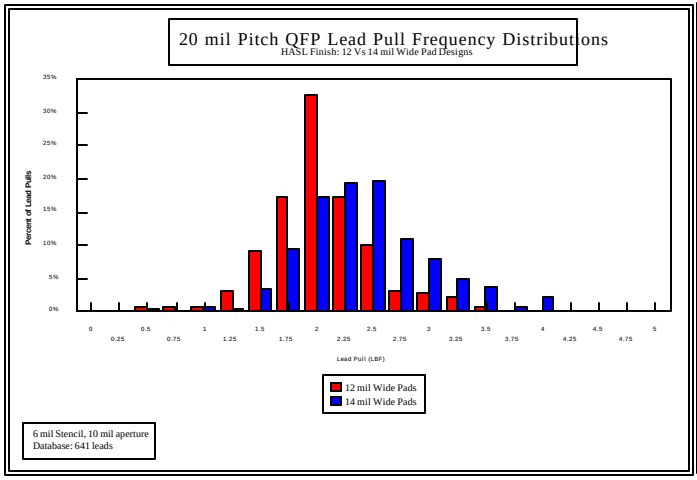

Figure 5 Wide Pad Lead Pull Data over ENTEK

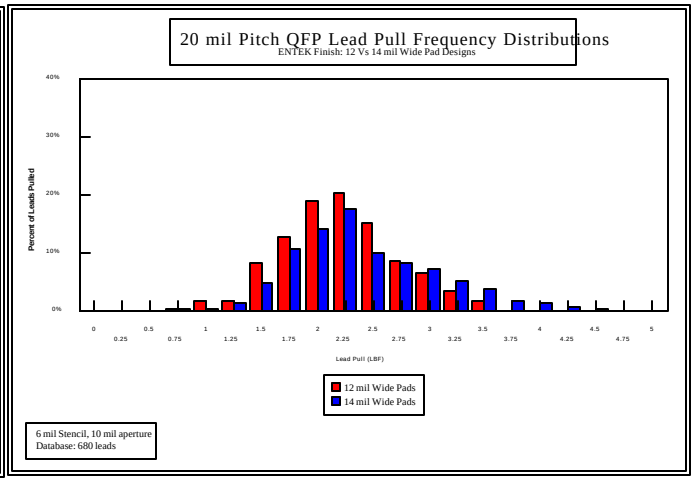

Figure 4 Wide Pad Lead Pull Data over HASL

Although side fillets on fine pitch leads may contribute very little to joint integrity they do ensure that the full benefit of the heal fillet is realized. The frequency distributions below illustrate the subtle increase in joint strength by the shift of the frequency distributions for both ENTEK and HASL board finishes. Technical Bulletin *finepads.pdf* provides fine pitch (0.8 to 0.5mm) guidelines based on actual designs and process studies and supported by the IPC design guidelines.

widepad.doc 12/98

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