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Ultra High Density Interconnects (UHDI)

Ultra HDI - Beyond The Traces - Solder Mask - Fine Mask Capabilitiess

Ultra HDI boards demand soldermask features only a few tens of microns wide, with extremely tight alignment and reliably cleared microvias — requirements that strain conventional processes.

Small drill holes, fine mask webs, and micron-level registration combine to tighten the fabrication window significantly. With these practices and modern mask technologies, very fine-pitch Ultra HDI designs can be manufactured reliably.

Solder Mask Precision & Assembly Challenges

UHDI demands ultra-precise solder mask features

- Pad Openings: Down to 60 µm for fine-pitch devices
- Mask Thickness: Must be <30 µm to allow proper paste deposition
- Soldermask Defined Pads (SMD): Essential for small feature spacing to prevent shorts
- Mask Dams: Achievable down to 50 µm with LDI imaging and specialized dry films
- Mixing SMD (Soldermask Defined Pads) and NSMD (Non-Solder Mask Defined Pads) on the same component is discouraged: consistency is the key to avoiding assembly risks.
- To help ensure high yield: keep solder dams ≥0.1 mm, using mask-defined pads for tight spacing, and designing for ±20µm alignment

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Consideration for tight pitch structures and soldermask dams

The tightest UHDI dam feature that can be held is 50um with liquid photo imageable mask.

One of the new-generation dry film masks may be able to image a tighter feature with 20 um thickness.

Bear in mind that tight features should typically have SMD pads.There still is a registration tolerance on mask imaging- so having mask up onto the pad allows for more tolerance.

Soldermask Is More than Green!

- SMD vs NSMD Pads - The key to avoiding issues
- Mask Thickness on Ultra fine pads sizes is important

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Practical design tips for leveraging Ultra HDI technology to manage complex layouts

- **Use solder-mask-defined (SMD) pads for very fine spacing.** When copper spacing to a pad is <75µm (3 mil), mask-defined pads are recommended. SMD pads let the mask overlap on pad edges, reducing the risk that misregistration exposes adjacent copper.

- **Maintain ample solder dams.** Keep at least 100µm of mask between any two pads or traces whenever possible. If tight spacing is unavoidable, allow generous mask expansion on pad apertures to compensate.

- **Avoid tiny mask slivers.** Extremely narrow mask “islands” (e.g. <75 µm) tend to peel or lift during cure. Ensure that any leftover mask between pads (sliver) is ≥3 mil wide, or redesign to increase spacing.

- **Register pad shapes to panel edges.** Align high-density BGA arrays carefully on the panel so that mask-clearance tolerances accumulate predictably. If possible, orient critical escape routes along orthogonal axes of the exposure machine to minimize distortion.

- **Specify mask color and process upfront.** Remember that non-green masks (black, white) require more exposure energy and have lower effective resolution. If ultra-fine dams are needed: default to green or specify a high-resolution mask type with the fabricator.

- **Layer stack and material choices.** Use consistent copper thickness (typically 12–18µm) and limit build-up variations so that mask coverage remains uniform. Avoid sudden copper step-downs that would throw off mask adhesion.

- **Probe and test features.** Include test coupons or daisy-chains for mask alignment accuracy. Verify that microvias and tented vias do not bleed mask into pads.

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FAQs

I have a tight pitch structure: can I use soldermask dams between features? It depends - Today the tightest dam feature that can be held is 50um with liquid photo imageable mask. One of the new-generation dry film masks may be able to image a tighter feature with 20um thickness.

Does the UHDI processing work with plated holes and outer layers? Yes, exceedingly well. Soldermask Defined (SMD) pads are needed to keep from exposing the adjacent trace (25um).VIPPO (Via-in-Pad Plated Over) needs multiple plating cycles. If needed, keep your UHDI signals on the next layer down or use a copper filled microvia to connect the UHDI outer to the VIPPO structure on layer 2.

ADDITIONAL RESOURCES FOR YOU
OUR WEBSITE:
UHDI NEWSLETTER:
UHDI TECHNOLOGY, ADVANTAGES, DESIGN PARAMETERS AND FAQS IN A BROCHURE: