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Ultra High Density Interconnects (UHDI)

Beyond Ultra HDI: UHDI Design: It Depends....

To ensure manufacturability, designers should follow UHDI-specific Guidelines.
Essentially, they must account for process shifts.

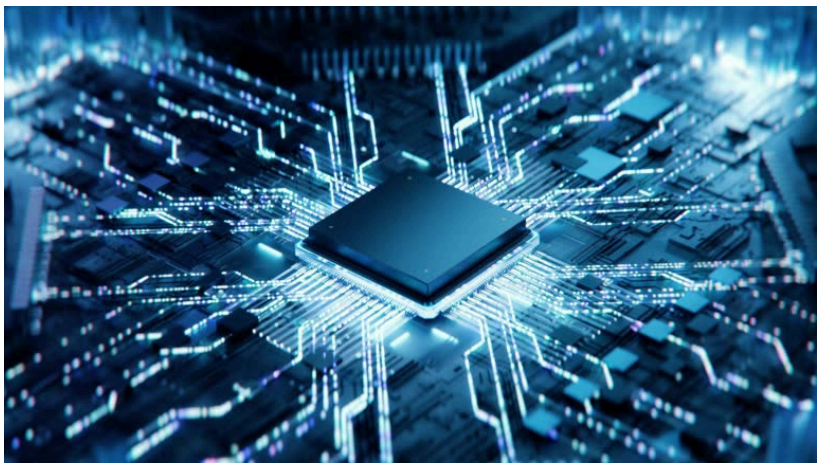
Traditional film-based exposure systems typically achieve only ±50–75µm alignment, but registration tolerances shrink with Ultra HDI: misalignment of just a few microns can expose copper or cause bridging

What is the minimum spacing from trace to pad - external layer?
It depends …on how pads are defined by soldermask.

- If pads are mask-defined: spacing can be as low as 25 microns.
- If defined by the copper: then other features need to be at least 50 microns away, preferably 75 microns.

Why is tight control of manufacturing processes so critical for Ultra HDI?
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.



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PRACTICAL DESIGN TIPS

For leveraging Ultra HDI technology to manage complex layouts

With these practices and modern mask technologies, very fine-pitch Ultra HDI designs can be manufactured reliably.

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  - If pads are mask-defined: spacing can be as low as 25 microns.
  - If defined by the copper: then other features need to be at least 50 microns away, preferably 75 microns.

- 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.

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- 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.

- Start working with your fabricator early in the project timeline. A “capability draft” or initial pilot run can identify mask registration issues before full production.

To help ensure high yield: keep solder dams ≥0.1 mm, using mask-defined pads for tight spacing, and designing for ±20μm alignment

ASC is the solid manufacturing partner you need - for guidance early in your process. Contact our experts at sales@asc-i.com . Or call +1 630-639-5444

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