American Standard Circuits
Sunstone Circuits

Ultra High Density Interconnects (UHDI)

Ultra HDI - Beyond the Traces - Materials, Up and Coming Capabilities

Ultra HDI uses novel technology that is evolving quickly. It allows for a wider freedom in design with potentially lower end cost, better reliability, and improved performance - due to superior line width control and new materials.

Thin dielectrics and low-loss materials go hand in hand with Ultra HDI.
To fully appreciate the importance of material selection, one must first understand the methodologies used to manufacture Ultra HDI products.

Ultra Thin Foils

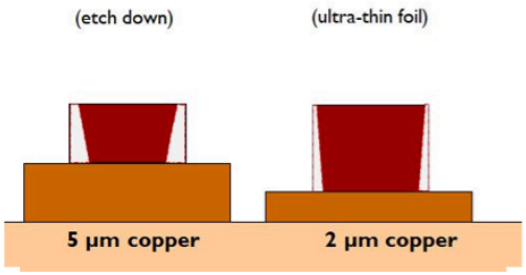
- Starting with thin/ultrathin foils or foil thickness reduction
- Limits around 25 um
- Relatively straight sidewalls with some etch of sidewall

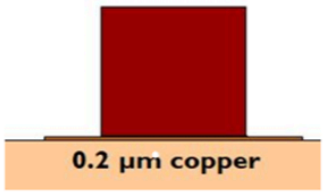
Additive Plate-Up

- Liquid Metal Ink (LMI™) to deposit dense catalyst
- Licensed technology
- Easily adapted to sub-25 um
- Road to Package Substrates

Other Methods

- **Special Electroless Cu**
  Requires a custom line
- **Specialty Inks**
  Variety of deposition methods, may be limited for line width
- **Sputtering**
  Volume process is costly





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New Materials Unlock Designs
Lower Dk/Df materials are on the way for enhanced signal integrity with UHDI.

Coreless Materials or ABF (Ajimoto Buildup Film) have taken Asia by storm as an ultra-thin build-up material. While Dk can be as low as 3.2, Df is reported to be 0.0044 in the best case.

- **Several options coming to market:** Fast Rise TC/Hf materials have Dk values of 3.18 and Df of 0.0021
- **New Fast Rise materials in development** are focused on Dk values of 2.28 and Df of 0.0018
- **Several other options** are claiming Dk and Df performance in that range or lower.

New materials entering the North American market rival Asian offerings like ABF and are transforming UHDI possibilities locally:

- **Lower Dielectric Constants (Dk)** Down to 2.3, enabling tighter impedance control.
- **Reduced Dissipation Factors (Df)** As low as 0.0018 for high-frequency designs.
- **High Glass Transition (Tg)** Temperatures Improved thermal stability and reliability under stress.

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Compatible Dielectrics and Laminate Materials

- **Liquid Crystal Polymers (LCPs):** With low Dk and Df values, LCPs enhance performance in fine-line applications.
- **Ultra-Thin Foils & Sputtered Copper:** Support trace widths down to 10 microns using SAP methods and dense catalyst deposition.
- **Coreless Buildup Films:** Like Ajinomoto's AFX, they remove the variability from glass weaves, producing uniform dielectric consistency.

The Roughness Factor: Foils & Adhesion

Copper foil roughness directly affects signal attenuation and adhesion.

- **Naming Conventions Matter:** H-VLP, VLP-2, and RTF foil names vary by manufacturer; designers must interpret them carefully.
- **Roughness Metrics:** Ra, Rz, and RMS measurements offer different views into foil texture and its impact on SI.
- **Adhesion Techniques:** Etched foil topography paired with advanced laminates ensures mechanical reliability.

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UHDI-Compatible Materials at a Glance

Material Class	Examples	Notes
Low-Loss FR-4	Panasonic Megtron, Isola I-Speed	Widely used, moderate DK/Df
LCPs	Rogers R/flex, Murata LCP	Excellent SI; compatible with UHDI
PTFE Substrates	Rogers 3003, AGC Fast Rise	Ideal for RF & microwave
Buildup Films	Ajinomoto ABF, Tayo Crystal Film	Ultra-thin, glassless resin systems
Flex & Rigid-Flex	Pyralux, adhesiveless polyimide films	Supports 3D integration, minimal footprint

Additional Consideration: Equipment

ASC has made major investments in manufacturing, test, and inspection equipment to provide our customers with options that align with their program goals.
For example:

LDI Systems: Current setups at ASC achieve 25 µm trace widths, soon approaching 10 µm with LED-based exposure.

Talk with our experts today about the optimal solution for you!

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