Optimizing PCB Performance and Cost through Lamination

- Methods
- Applications
- Performance Impact
- Cost Impact
Four Major types of Multilayer PCB Lamination

1.) Standard Lamination
   (Low Frequency/Digital applications)
   FR-4 Material with Pre-preg bond ply
   (Fiberglass/Epoxy/Resin bond ply)

2.) Hybrid Lamination
   (Digital and RF/High Frequency mix applications)
   FR-4 and RF/High Frequency Material
   Pre-preg and bond ply to match High Frequency material used.

3.) FEP Lamination
   (RF/High Frequency Applications)
   High Frequency Material
   FEP thermoplastic bonding film
   (.001/.002 thick film, 2.15 DK, .0005 loss-DF)

4.) Fusion/Direct Bond
   RF/(High Frequency Applications)
   Teflon Material
   No Bond Ply (Self-bonding material)
   Highest Temp Lamination
   Homogenous DK
Standard Construction

- Copper-Clad FR-4
- Pre-Preg (Fiberglass/Epoxy/Resin) Bonding ply
- Copper-Clad FR-4

- Copper-Clad Material (Photo printed, Etched and Pattern Plated)

- Layered or “booked” together with sheets of Pre-Preg between layers

- Vacuum bagged and laminated in a hydraulic lamination press while concurrently applying pressure and heat that causes the Pre-Preg to “flow” and bond adjacent layers together.

- As the boards cool, the epoxy resin cures creating a permanent bond.

- Pre-preg is constructed of fiberglass-reinforced (or unreinforced) thermoset resin. The properties of these materials causes signal loss between layers.
A Hybrid board is created through the use of dissimilar materials that are bonded together, often in multiple lamination cycles, using a combination of Pre-Preg and other bond ply to match the high frequency material used. The resulting benefit is an increase in performance and thermal control.
A bond with very thin FEP thermoplastic film creates a secure bond and, when combined with high frequency material, increases the electrical performance over the use of low frequency materials and pre-preg. A sequential lamination approach was used above with FEP film in combination with fusion bonding.
Teflon/PTFE Microwave laminates are increasingly used in RF and high frequency designs due to low electrical loss, consistent DK, and tight thickness tolerance.

These qualities are fully exploited through the use of “fusion bonding”.

In Fusion Bonding the PTFE is laminated directly, without any bond ply, to an adjacent PTFE layer through a very high temperature, precisely controlled and very lengthy lamination process.

The bond that is created is at a molecular level and highly unlikely to experience de-lamination.

The encapsulation of the inner-layer circuitry and copper features along with the absence of any bond ply increases performance and has a homogenous DK construction.
Transline worked closely with Rogers Corp to develop our capability to manufacture fusion bonded boards. Pictured above is a cross section performed at the Rogers Corp laboratory, confirming our success.
This is another cross-section evaluated at The Rogers Corp laboratory. The secure bond line and good solid fill around the copper features are illustrated.
Electrical Performance by lamination method

- Fusion (Highest Performance)
- FEP
- Hybrid
- Standard (Lowest Performance)
Cost Impact by lamination method

- Fusion: Highest Cost
- FEP
- Hybrid Bond
- Standard Bond: Lowest Cost
TTI is one of very few PCB suppliers in the COUNTRY that are able to successfully manufacture Fusion Bonded PCBs. We routinely build Hybrid PCBs and are adept at using FEP film, as well, for companies like the Lockheed-Martin Aeronautics, Skunk Works Division.

Our success has been validated independently by the Rogers Corp laboratory, as well as practically in our day-to-day success with our customers.

This gives You a major competitive “edge” in product performance when you use TTI---both in technological expertise and value.

We have engineers and resources available to help address your specific DFM issues with your development team in these advancing technologies. In this way we put our team to work for you—saving you valuable time and overhead.
NOVEMBER 2010
LOCKHEED/SKUNK WORKS AWARDS TTI FOR
100% QUALITY PERFORMANCE OVER THE PAST
12 MONTHS

Quality Month 2010
Lockheed Martin Aeronautics Company
Recognizes
Transline Technology Inc.
For 100% Quality Performance Over the Past 12 Months

"Right the First Time and All the Time Quality"

Larry Plite, Vice President
Quality and Mission Success

We're a Better Team Because of You!
Please contact us to discuss any information in this presentation, or to schedule a “live” presentation of this material for your company or engineering team. We look forward to hearing from you!

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