Next-Generation High-Speed Materials: An Updated List

by Tom Doslak
STREAMLINE CIRCUITS

The evolution of high-speed PCB materials moves just as quickly as the circuit that passes through them. It is no surprise that sometimes a very busy product developer might be confused by, or simply be unaware of, the newest advancements in cutting-edge substrates. Because of this, I would like to reach out to the product development community to help educate them and make them aware of the latest in PCB materials.

Designers must develop products with more functionality, at faster speeds, in smaller packages. This has been going on for generations, but there has been a major push by chip manufacturers. These chip packages (BGAs and now microBGAs) allow tremendous functionality with pin counts in excess of 7,000 points on .25 mm pitch microBGAs, while demanding extreme circuit speeds in excess of 50 gigahertz and tighter tolerances throughout the PCB.

This seems like an impossible task. But forward-thinking PCB and material manufacturers continue to reinvest in advanced equipment for critical process consistency and advanced capabilities. We can now support today and tomorrow's next-generation high-speed requirements. This leaves a product designer or engineer with two critical decisions: Choosing the right PCB vendor, and selecting the product material that optimizes both performance and cost.

Analog or Digital?

Two basic types of circuits fall in the category of high-speed and low-loss materials. The first is high-frequency analog (RF/microwave), and the second is high-speed digital. The RF microwave circuits need to have process precision for tight tolerance on their signals. These material types have been developed over time for critical signal loss and high frequency. There are two types of critical signal loss—one is due to reflection and other is loss of circuit energy by way of the dielectric material. Signal reflection is caused by controlled impedance variations or mismatches. These impedance variations are caused mostly by the PCB vendor's process consistency and capabilities, along with material functionality that can vary with change in temperature and frequency.

The high-speed digital products are usually very complex, high-layer count, high-density (sub 3 mil traces) performing at very high frequencies and speeds. These products also have demanding material parameters, along with advance physical requirements as well. The overall industry still sees these two basic types of stand-alone circuit requirements, but the trend in the last couple years has been towards all-in-one next-generation materials.

These advanced materials now focus on both material parameters (Dk,Df,CTE,T_g,T_d, Z-axis) and physical structures (thin cores and consistent variation) with high-performance blends for manufacturing advantages and overall costs savings. These new materials help product developers in today's products with more robust thermal and electrical properties.

We deal with these high-speed materials every day, and we know what substrate works, and with which applications. We do not sell materials of any kind, so I believe we can provide an unbiased description of each material.

We have created this updated list of high-speed materials. We consider these to be the best next-generation, high-speed PCB materials available today. All of these materials have been tested, proven, and are ready for production. For easy reference, each material line item features a product name, vendor, summary, and data sheet.

This list will be continuously updated. I hope it proves to be a valuable resource for PCB designers, engineers and fabricators. I value your feedback. Let me know if you have any questions or comments about these materials. **PCBDESIGN**

Tom Doslak is vice president of sales and marketing for Streamline Circuits and has more than 22 years of PCB sales experience. To contact Doslak, click here.

THIS ARTICLE APPEARS IN THE JUNE 2013 EDITION OF

THE pcb design™ MAGAZINE