

Liquid Crystal Polymer High Speed-RF High Layer Count Circuits with Embedded Die Options

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HSIO Technologies, LLC has developed a new method for production of very high density multi-chip modules and circuits utilizing high performance Liquid Crystal Polymer (LCP) material sets in multi-layer constructions not possible with historical fabrication methods. The intended paper will describe the basic process sequences compared to conventional circuit fabrication methods, and identify unique design rules to enable much higher density and performance than previous use of LCP and like dielectric materials. Heterogeneous Integration examples aligned with the DARPA CHIPS program will be described and demonstrated with high layer count LCP SiP substrates with sophisticated Micro-Electronics Assembly techniques extending from surface mount through embedded active semiconductors with passive device integration. A manufacturing relationship with Benchmark Electronics and Lark RF Technologies focused on a RF and High Speed Design Center of Innovation will be described to illustrate the manufacturing process highlighting Test at Assembly technology highlighting the importance of Known Good Die (KGD) for any multi-die assembly especially when devices are embedded within internal layers of a high layer count substrate. The paper will use true to industry relevant examples of high density modules developed to validate process, performance and reliability requirements for high reliability applications in the Mil/Aero/Defense/Sat/Auto and Tele/Comm/Mobile/Computing industries. Signal Integrity analysis normalized from empirical measurement data from DC to 112 gbs and 110 GHz RF will be explained to highlight the benefits of LCP vs conventional material sets.