



HSI+® (High Speed Interconnect) Impedance Matched Shielding A Cost Effective Process for Flexible Interconnects Requiring EMI Shielding and Controlled Impedance

Over the past decade the use of Flexible Printed Circuits in Electronic Devices has been growing continuously as electrical and mechanical engineers accommodate increased density. We have witnessed the introduction of flexible circuits in everything from simple devices such as cameras, flip phones, and calculators, to more complex interconnects for global positioning systems, lap-top computers and automotive electronic engine controllers. This challenge becomes more complex as devices continue to shrink while signal clock speeds requiring low emission leakage continue to become faster. Advances in technology have created a new set of demands on the once simple flexible printed circuit (FPC) interconnect.

The list of acronyms and buzz words which have recently found their way into the FPC industry, were once exclusively in the domain of the electrical engineer. Today's dialogue includes discussion about electromagnetic interference (EMI), controlled and matched impedance and strip-line, dual strip-line and microstrip circuit design geometry. The combination of these subjects in relation to circuit thickness and flexural fatigue endurance has led to an industry search for mechanical and electrical solutions not found in textbooks or in conventional approaches.

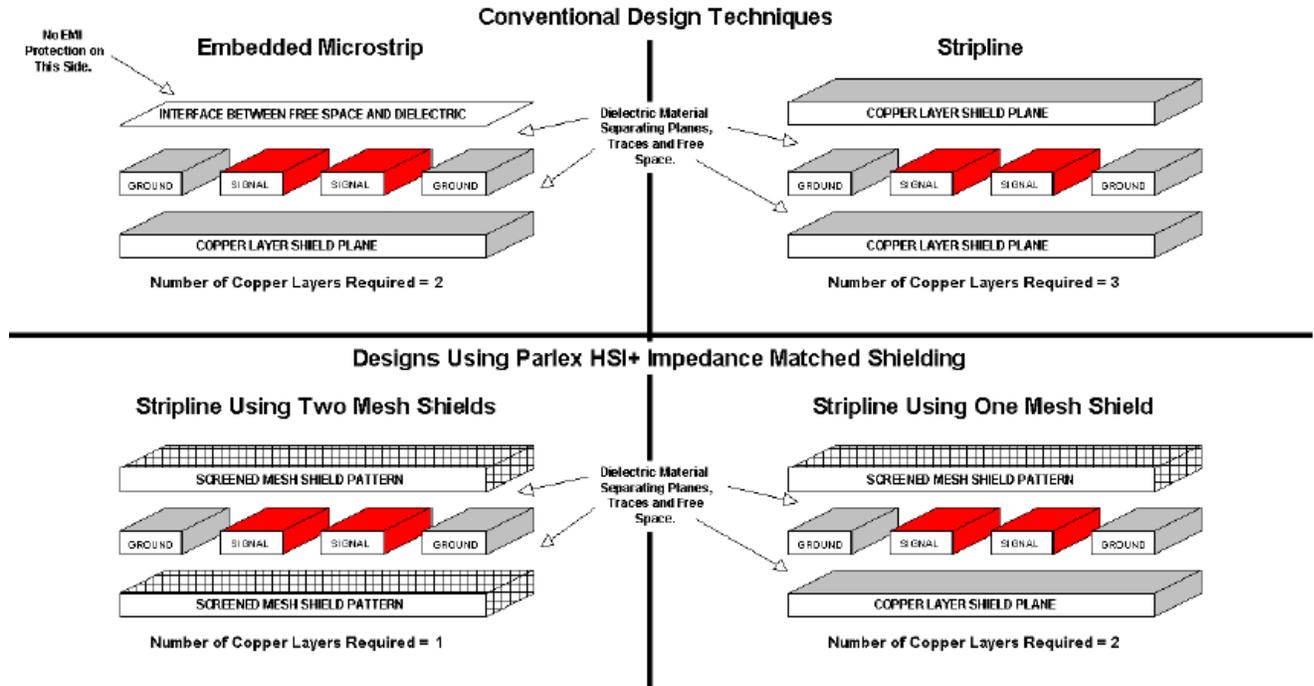
The requirements of printed circuit signal control and isolation are not new to the rigid circuit board industry. Electrical and mechanical designers are well versed in how to accommodate varying configurations as long as the interconnects lay flat and only have a one dimension plane. Unfortunately, these available solutions rarely are transferable for implementation on three-dimensional flexible printed circuits.

Flexible printed circuits and rigid printed circuits requiring shielding have traditionally been modified by adding additional copper and dielectric layers that increase circuit thickness. This conventional approach can double and even triple the thickness of a flexible printed circuit interconnect. The additional copper and dielectric layers may satisfy all of an electrical engineers requirements, but they create a myriad of problems for the mechanical and reliability engineers. Additional thickness is particularly troublesome with FPC installations requiring cyclic flexing over an extended period of time.

An excellent example of this condition is the flexible printed circuit commonly installed through the hinge of a lap-top computer. Connecting the display with its driver. Increased circuit thickness could cause the copper traces to be displaced from their most reliable position, the neutral axis. This configuration causes mechanical degradation from repeated compression and tension of the copper traces. This phenomena poses the challenging question of "how to get additional shielding without adding copper and dielectric"? Additionally we must satisfy performance requirements without sacrificing reliability or adding significant cost.



In addition to shielding, the demand for controlled and matched impedance creates its own set of complications to the circuit design. In order to achieve the required impedance and dB isolation characteristics additional copper and dielectric layers must be designed into the circuit. This additional material severely limits the flexibility of the interconnect and restricts applications to those installations which do not require tight radii or sharp bends.



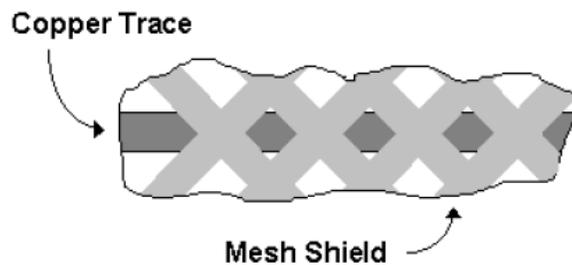
In our highly competitive marketplace, the most significant issue may well be cost. Customers demand performance but are reluctant to pay a premium for additional copper layers or exotic materials. Moreover, cycle time requirements restrict the use of non standard constructions with long lead times. Both of these issues are intensified in high volume, dynamic markets.

Parlex Corporation's Flexible Circuit Products Division has developed a process called Parlex HSI+[®] (High Speed Interconnect) Impedance Matched Shielding which resolves a variety of flexible printed circuit interconnect issues. The Parlex HSI+[®] shielding process applies various types of conductive materials such as silver epoxy or copper epoxy through automated screening techniques. The material is applied in a specific pattern to achieve effective shielding and impedance control while minimizing thickness in order to maintain maximum flexibility.



The shielding pattern allows for a radical reduction in circuit thickness when compared to conventional constructions having solid planes. The selective shield pattern will vary but is always optimized for mechanical and electrical requirements. The crosshatch configuration allows for a higher impedance value by averaging air as a percentage of the plane. EMI is also addressed by the crosshatch pattern that is modeled to minimize the effective length of each window opening.

View Showing Signal Through Mesh Shield:



The Parlex impedance matched shielding technology helps achieve cost efficiencies by reducing copper layer count. This has been demonstrated by reducing three layer designs to double sided plated through-hole circuits with Parlex HSI+[®] impedance matched shielding. The result is an overall circuit thickness reduction of 30% while flex endurance is increased by 37%. Additionally, when freedom of address is allowed, some three layer designs have been converted to single sided circuits with two sided Parlex HSI+[®] impedance matched shielding. These applications resulted in a cost of interconnect decrease of 47%.

In today's robust market the demand for flexible interconnects with EMI shielding and controlled impedance requirements is expected to increase steadily. When a cost sensitive electronic package that requires a flexible interconnect with these requirements is needed, Parlex HSI+[®] impedance matched shielding process should be evaluated.