

A mid-life kicker for circuit board technology

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After more than 70 years of manufacturing development and more than a hundred billion square feet of boards produced, what could possibility be new in printed circuit board technology? After more than 70 years of manufacturing development and more than a hundred billion square feet of boards produced, what could possibility be new in printed circuit board technology?

At DesignCon 2011, Jamal Izadian, founder of RFConnex, partnering with Julian Ferry, high speed engineering manager with Samtec, introduced a novel design for lower loss and higher bandwidth transmission lines using conventional circuit board manufacturing technology.

The new design, patents pending with RFConnex, "leverages the Heavyside condition, first derived for the transatlantic cable in the late 1860s by Oliver Heavyside," Izadian said.

The Heavyside condition identifies that signal degradation in an interconnect is not just about the conductor loss, described by the resistance, R , or the dielectric loss, described by the conductance, G , but optimal transmission depends on the ratio of R/L and G/C in a transmission line.



Close up of PMTL transmission line showing the drilled holes in the signal and return paths.

If these ratios are equal, even a high R or high G transmission line can provide low loss. But the challenge, Izadian said, is that limited to conventional transmission line design principles for circuit boards, just changing the cross section geometry does not affect the ratios very much.

In his new interconnect design, Izadian introduced an additional degree of freedom using drilled through holes which can independently affect each of the four transmission line terms.

"This extra degree of freedom lets us optimize the target impedance and the loss of transmission line structures." For example, when drilled in the signal path, the effective dielectric constant and dissipation factor is lowered by the fringe field lines passing through a larger fraction of air.

RFConnex refers to the new transmission line design as a Periodic Micro Transmission Line (PMTL).

Smaller, higher bandwidth, lower loss

"This superstructure of holes in the signal path, the return path and the dielectric between enables us to design a PMTL stripline with lower loss than a conventional stripline or microstrip," Izadian said. With plated holes on either side of the signal line connecting to the return path, each PMTL becomes a coax-like channel, dramatically reducing the cross talk.

Samtec, manufacturing partner with RFConnex, has introduced a new flex cable jumper based on the PMTL concept.

"The PMTL flex cable is smaller, higher bandwidth, lower loss and more flexible than the ribbon

cable version," Julian Ferry, said.



First PMTL product (right) to replace cable assembly (left).

Ferry and Izadian presented measured data at DesignCon 2011 showing a 30 percent reduction in dielectric constant and 30 percent lower loss compared to an equivalent cross section stripline transmission line in the same low cost FR4 boards.

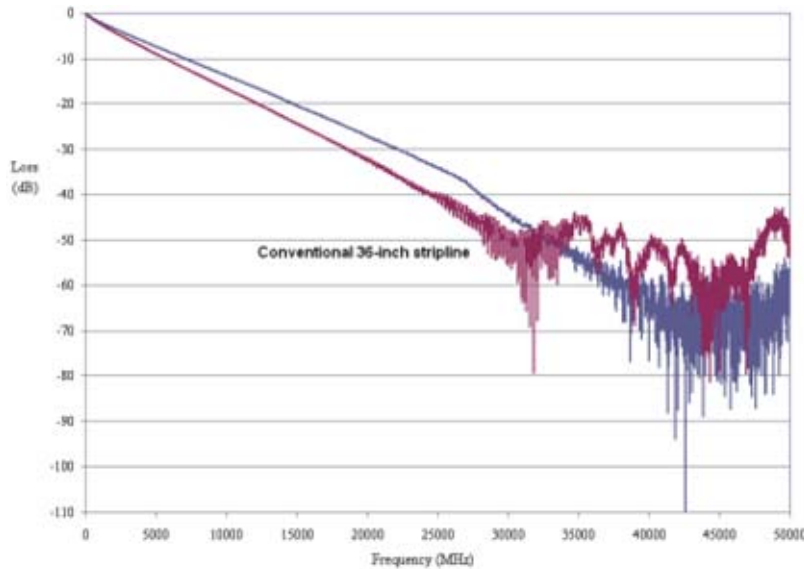
"The basic design features of the PMTL structures are material agnostic," Izadian said. "They can be constructed in any laminate material, and similar reductions in dielectric constant and loss are expected."

"A critical feature of the PMTL structure is that it uses conventional board manufacturing technology. Any board shop can manufacture these interconnects, based on our design guidelines," Izadian said.

Ferry is looking at current applications where the loss in specific backplane channels is so high an embedded optical fiber is being considered as an alternative. "A low loss PMTL channel is a prime candidate to replace the fiber."

The next products Ferry is exploring are low cost flex cables for VNA and TDR test applications. With their low loss, flexibility and mechanical stability, Ferry says these PMTL flex cables have much better phase stability than even high performance coax cables.

More information can be found at www.rfconnex.com, or contact Jamal Izadian at jsi@rfconnex.com.



Insertion loss of PMTL is 30 percent lower than conventional stripline.