

BREAKING THE SPEED LIMIT ON PCB

The operating speed of advanced processors has been constantly increased due to the insatiable demand for higher performance and increasing functionalities. While Moore's law states that the performance of electronic devices is doubled in about 18 months, the immense competition in the industry have driven the International Technology Roadmap for Semiconductors (ITRS) to constantly review their forecast to stay relevant. However, problems arise when the rapid increase in on-chip speed outperforms the development in the off-chip transmission rates drastically. As seen in figure 1, the average on-chip local clock speed for high-performance systems is estimated to reach beyond 7 GHz in 2008 whereas the chip-to-board speed would have only 2 GHz by 2014 if the current pace of development persists. In addition, the total signal communication bandwidth in devices has been increasing by roughly 10 times every four years, driven by increasing chip clock speeds and the number of processors per system. Hence, it is estimated that bandwidth between microprocessors needs at least 40 Terrabits/s by 2010.

On the other hand, as speed and component density increase, power consumption and efficiency issues are becoming more critical. Losses in signal integrity in printed circuit board (PCB) have a significant impact on the speed and distance over which signals can be transmitted between boards in a high-performance computing system. To improve the transmission speed, alternative communication modes such as optical PCB interconnects or ribbon fiber are used. However, these solutions result in higher power consumption since additional electronics are required to convert electrical signals to optical signals and back for each channel. In addition, with increasing demand in computing power and component density, the amount of heat dissipation can be enormous and put a strain on the operating cost. Hence, system designers are exploring alternative technology that could reduce the signal loss and power consumption rates.

Since 2003, Santa Clara, CA-based Banpil Photonics Inc., has been developing cost-effective and low-power high-speed electrical interconnects for chip-to-chip, chip-to-board, board-to-board, and rack-to-rack applications. Recently, they announced the successful demonstration of over 20Gb/s data transmission on a 2-meter long flexible printed circuit (FPC) using its patented metallic interconnects technology. The signal line is routed on 12" x 12" boards and two SubMiniature version A (SMA) connectors. The company believed that this is the highest transmission speed being reported at the moment. At the same time, Banpil has also shown other demonstrations, which have verified 20 Gb/s transmission on a 3 meter long FPC and 40 Gb/s transmission over 1 meter FPC. FPCs are becoming more popular as portable electronics such as mobile computers, cell phones, digital cameras, and avionic electronics have become smaller and lighter in weight.

According to Banpil, using the patented metallic interconnect technology in conventional FPCs can increase the signal-carrying capacity by more than six times over conventional solutions. In addition, the Banpil FPC consumed only a tenth of the power that conventional interconnect technologies draws. Banpil estimates that its flex technology can reduce power consumption by between 80% to 90% in most systems in which it will be used.

"This is a significant breakthrough because it is a purely electrical FPC solution requiring significantly less power to drive the signal over long, practical application-length interconnects. Implementing this FPC will help to significantly increase signal speed and reduce system power consumption." said Achyut Dutta, Banpil's CEO. "This demonstration surpasses our earlier work that achieved up to 10 Gb/s signals over a 1.5-meter long rigid flame resistant 4 (FR4) printed circuit board (PCB) in 2006, and paves the way for more flex applications alongside rigid applications in high-speed systems."

Besides enabling lower power consumption and higher power efficiency, the Banpil FPC can be used for high-speed systems that are currently only using optical or rigid boards. This includes communication systems that have speed of 10 Gb/s to 100 Gb/s. With IEEE's interest in defining the 100 Gb/s standard, it is eminent that demand for high-speed interconnects will be rising. Banpil commented that their FPC interconnect technology has potential application across broad segments of the global electronic equipment market that use high-speed systems. Major applications will be for hardware for infocomm technologies, consumer electronics, and industrial manufacturers.

Looking forward, Banpil aims to introduce a sample-level FPC product during the second quarter of 2008 and a full product in same quarter of 2009. Currently, samples of its high-speed rigid FR4-PCB product are already available.

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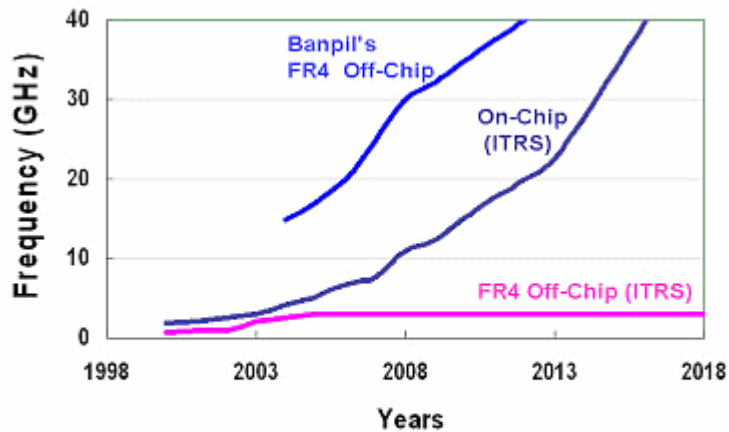


Figure 1: Road map as outlined by ITRS (International Technology Roadmap for Semiconductors), Dec., 2003, and estimated BANPIL Interconnects.

Picture Credit: Banpil Photonics Inc.