

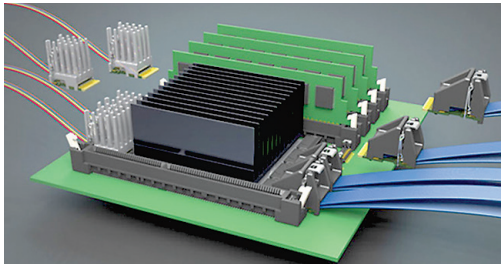
# Backplane Optical Interconnects Speed Past Copper

Changing economics for optical interconnects make them an even more desirable option to handle soaring serial interconnect speeds.

The limitations of copper become more apparent when trying to move data at gigabit throughput. When running digital signals with clock rates over 20 GHz for any distance, the solution is fiber. System interconnects already incorporate fiber, and deployments like Verizon's FiOS use fiber for the last-mile connections. Custom fiber chip-to-chip and board-to-board interconnects have made the rounds, but the technology is gaining more ubiquity among these applications.

Standards like VITA 66.4 (see "Will Optics Spell the Death of the Copper Backplane?" at *electronic*

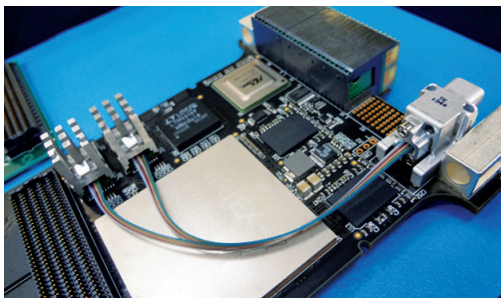
*design.com*) are driving vendors to deliver products like Samtec's FireFly product family (Fig. 1). FireFly actually addresses copper and fiber with data rates up to 28 Gb/s. A common connector is used to plug in modules that handle a dozen serial links via copper or fiber micro-ribbon cable. The protocol-agnostic system can handle Ethernet, InfiniBand, FibreChannel, and PCI Express. Key to its design is the implementation of a vertical-cavity surface-emitting laser (VCSEL) array.



1. Samtec's Firefly family addresses high-speed serial connections between chips, boards, and systems.

For instance, there's TE Connectivity's Coolbit, which delivers 25-Gb/s optical connections. The company's Lightray MPX system can handle 24 fibers on 250- $\mu$ m centers.

A standards-based solution comes by way of Pentek. Its 5973 3U VPX FMC carrier board supports the VITA 66.4 standard and uses a dozen fiber connections on the backplane connector via Samtec's Firefly (Fig. 2). The Pentek 5973 board contains a field-programmable-gate-array mezzanine card (FMC) socket and a Virtex-7 FPGA on-board. The optional VITA 66.4 support connects directly to the FPGA's multi-gigabit serial interfaces.

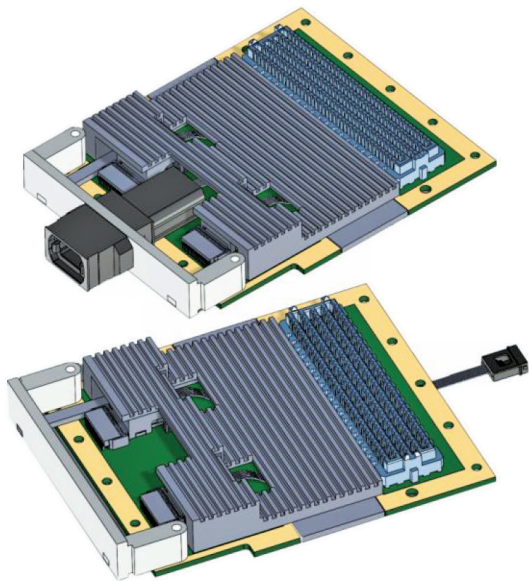


2. Pentek's 5973 3U VPX FMC carrier board supports the VITA 66.4 standard with a dozen fiber connections via Samtec's Firefly.

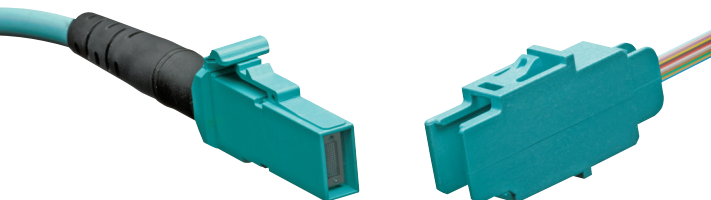
The Pentek 5973 board is able to handle a majority of FMC cards on the market today. These normally provide a front-end interface often incorporating analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). Sometimes the FMC cards feature high-speed serial interfaces. Such is the case with Techway's TigerFMC—it's a VITA 57.1 card that also takes advantage of Sam-

tec's FireFly optical connection (Fig. 3).

Different versions of the TigerFMC expose the optical interface on the front panel or via a cable for connection to the carrier board, a rear transition module (RTM), or backplane. The system can handle up to 14 Gb/s per channel. A 28-Gb/s per channel system is in the works.



3. Techway's TigerFMC uses Samtec's FireFly for high-speed optical input in this VITA 57.1 FMC card.



4. Molex's MXC connectors come with up to 64 fiber connections (four rows of 16 fibers).

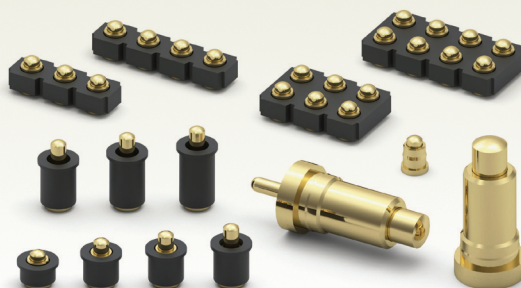
Intel's Silicon Photonics remains a work in progress. As the enterprise arena moves to 100-Gb/s Ethernet and beyond, this technology was designed to link servers and switches using fiber connections. The system employs special micro-coaxial (MXC) connectors like those available from TE and Molex (Fig. 4). These connections can be used with Molex's 12-fiber VersaBeam parallel optical device (POD) module.

The high-density MXC connector is designed to handle up to 64 fibers, while other connector technologies top out at around 24 fibers. A single-mode fiber can support distances up to 4 km. Transfer rates of 25 Gb/s translate to 1.6 Tb/s for a 64-fiber bundle—that kind of bandwidth will be essential to handle the growing data center and cloud requirements.

MXC employs expanded-beam lens technology, which can help reduce the impact of debris in the connection. It also requires less spring force for mating thanks to the greater tolerances enabled by this technology.

Copper continues to push the envelope, but it's getting harder and harder to meet the performance characteristics of fiber. When it comes to long-distance connections, there's simply no comparison. **ed**

# MAXIMUM OPTIONS IN SPRING-LOADED CONTACTS



## CONSISTENT AND RELIABLE ELECTRICAL CONTINUITY

Uneven mating surfaces, floating height requirements, and exposure to extreme vibration all challenge the integrity of electrical connections. Field proven for performance and reliability in harsh environments, Mill-Max spring-loaded contacts ensure continuity across a wide variety of length and stroke configurations, including new low and ultra-low pin profiles.

**Don't see what you need? Rapid prototyping and custom designs are our specialty.**



[www.mill-max.com](http://www.mill-max.com)



MillMaxMfg



Mill-Max Mfg. Corp.