

# Recent Developments in Interconnection Technology

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Connectors, cables and cable assemblies continue to receive plenty of attention in research laboratories. As new applications are developed, the need for the right types of electrical performance and physical characteristics keeps changing. This report looks at some of the performance issues that are currently being addressed, along with some companies' new product offerings that address these issues.

## RF/Microwave Interconnections

Among the recent areas of new development in wireless communication, laboratory testing and production testing are the following:

*Phase-matched cable assemblies*—Phase-matched cables are not new, but there has been a recent increase in the need for this type of performance. In both testing and deployment, consistent performance over temperature is required for multiple antenna systems such as MIMO (multiple input/multiple output), and smart antennas.

*High-performance test cables*—The specifications for electrical and mechanical performance of production test cables have become much more demanding as wireless, optical, and other high frequency systems have become more complex, with operation at higher frequencies. The performance required to test these products in a production environment is nearly the same as in a laboratory environment.

*Higher performance for military and aerospace*—Precision connectors and cables with exactly the right combination of characteristics has always been required for hi-rel systems, but the specifications continue to get more stringent. One area where requirements have become tighter is in munitions, which now include more electronics than ever. These guidance and fuzing functions must be interconnected with the highest reliability, while maintaining the necessary electrical performance.

Mating/unmating cycle performance is another area of recently increased performance specs. Today's military platforms have more critical performance specs than ever, yet they must be maintainable and replaceable, using cables and connectors with unprecedented electrical performance over many cycles of routine removal, testing and replacement.

*Low cost, low profile connectors*—Wireless devices have driven development efforts in very small connectors for interconnections in portions of the product that are modular, or that require access to test connections after assembly.

*Multi-cable assemblies*—New applications have recently been developed that require solutions that pro-

vide power, signal, and control wiring in a single cable assembly. For example, MIMO and smart antenna technologies are best implemented with tower-top electronics. Instead of a single coaxial cable carrying power to the antenna and signals to the receiver, there may be multiple transmit and receive baseband or IF signals carried via coax or fiber optic cable. In addition, the cables must carry power to operate the equipment and control wiring to switch and/or monitor various operating functions.

## High-Speed Digital Interconnections

The area of digital electronics known as *signal integrity* has become as high-profile as the latest microprocessor core, FPGA or digital signal processor IC. Getting the digital signals from one device to another, routed between p.c. boards, and connected to external devices, is a very hot topic. Among the specific areas of work are:

*Impedance-controlled connectors*—Whether using pin- or finger-style contacts, high density digital connectors have received much attention over the past few years. In particular, the soldered interface where the connector is mounted to the PCB has been analyzed to the point where some manufacturers provide a layout reference design to ensure that the transition between connector and board maintains the performance of the connector itself.

*Multiple cable assemblies*—At today's ultra high clock speeds, monitoring and troubleshooting digital equipment has become more difficult. Although powerful test equipment has been developed for these systems, the most difficult task is connecting the instrument to the digital bus without loss of performance. Much effort has been given to the development of cable assemblies that use the best technology for impedance-controlled connections, along with innovative methods for constructing cables with many transmission lines.

*Consumer electronics*—High definition television (HDTV), streaming audio and video and, more recently, Internet-enabled equipment have created high demand for high-speed data connections. HDMI and FireWire are well established for these applications. For high-speed data transfer among computing devices (including the above list), USB 3.0 is a recently introduced standard that is receiving significant attention in the design of high performance connectors and cable assemblies that will maintain the 5 Gbps data rate when handled by unskilled users.

With high activity in all areas of interconnection technology, there are many new products being developed to meet the performance requirements noted above, as well as many others. This report continues with news releases for some of these products.

### Connector Market Report

Bishop and Associates, Inc. ([www.bishopinc.com](http://www.bishopinc.com)) has just released a 23 chapter report providing a detailed analysis of Connector Types and Technologies Poised for Growth. This new report addresses a list of 19 specific connector types that are expected to experience greater than average growth in either volume or sales based on the rapid expansion of markets for existing and new products that utilize these interfaces. New technologies already driving the market as well as emerging technologies that are poised to influence connector design and/or application are reviewed. A discussion of market trends that are changing the way electronic connectors are used is included.

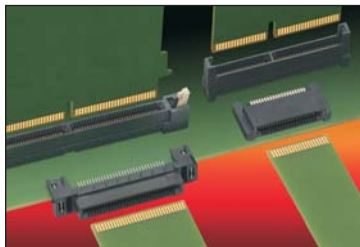
Many of the selected interfaces have existed in the market for several years, but emerging applications will propel their growth well beyond that of the general connector market. Some legacy connector types, for instance, are being adapted to high-speed differential signaling, which will allow implementation in next-generation equipment. In other cases, entirely new interfaces will show logarithmic percentage growth from near zero as they are implemented in new high-volume applications. The cost for the complete report is \$3,500 (paper copy); \$3,850 with a single-user license CD.

### 75 Ohm BNC HDTV Connector

Radiall USA, Inc. ([www.radiall.com](http://www.radiall.com)) introduces its new "True" BNC 75 ohm HDTV Coaxial Connector Series, which can handle data rates up to 3 Gbps or higher while supporting the broadcast industry's SMPTE 292M and 424M standards. These connectors feature gold plated center and outer contacts, which provide outstanding electrical performance with a frequency range of up to 6 GHz, optimized at 3 GHz. In addition, they are interchangeable with standard 50 and 75 ohm BNC products, offer better mechanical performance and durability with 1000 mating cycles guaranteed. Connectors are also easily field installable on most coaxial cables using hand-crimping tools and have colored cable boots available for easy coding of video signals. For more information and a white paper on High Performance 75 ohm HDTV interface visit the company web site.

### Sockets Optimized for High Speed Backplanes

Samtec's ([www.samtec.com](http://www.samtec.com)) Edge Card Sockets with signal integrity optimized Edge Rate™ contacts are available to fill many high speed micro board-to-board and micro backplane applications. The 0.8 mm (.0315") pitch High Speed Edge Card sockets (HSEC8 Series) are available in vertical, edge mount, and



right angle designs for perpendicular and coplanar applications with up to 60 contacts per row. The system draws on the exceptional electrical performance of its Edge Rate™ contacts, which are optimized for signal integrity performance and reduced crosstalk to achieve perfor-

mance ratings to 8 GHz (SE) and 10.5 GHz (DP) at -3 dB insertion loss. The sockets accept standard .062" (1.60 mm) PCB cards and also mate with Samtec's High Speed 100 ohm Twinax Edge Card Cable Assembly (EEDP Series) and High Speed Flex Data Links (HSF8 Series). Optional rugged board locks and cable latches as well as application specific guide rails are also available. Pricing begins at \$ .05 per line in production quantities.

### ZIF Connectors for Medical Equipment

ITT Interconnect Solutions ([www.ittcannon.com](http://www.ittcannon.com)) offers a comprehensive range of zero insertion force (ZIF) connectors for medical diagnostic and imaging equipment. Utilizing a landed contact system, there is no connector engagement force, and the only wear on the con-



tacts occurs as they are pressed together and lightly wiped past each other during the camming and locking operation. ITT's ZIF plug and receptacle devices include the DL Series and DLD Series ther-

moplastic connectors; DLM Series, DL4 Series and DLP136-272 Series aluminum connectors; DLP 408 Series zinc alloy connector; and QLC zinc connector. Available in contact arrangements ranging from 60 to 2496, the connectors feature gold-plated copper alloy contact material. Typical pricing ranges from \$6.00 to \$1500.00 each in minimum order quantities of 5 pieces.

### 25 Gbps Card Edge Connectors

Molex Incorporated ([www.molex.com](http://www.molex.com)) offers the new EdgeLine CoEdge Connector, a one-piece, 25 Gbps connector that is configured to meet an industry standard pitch of 0.80 mm (.031"). The connectors support high-speed signal transmissions and have the capability to optimally manage slower speed single-ended and power circuits, with a low profile off of the PCB to aid in airflow for system cooling. They also deliver a single-piece solution for high-speed and high-power telecom, computing and storage applications with 30.0 A power per blade.

This low-profile, dual-sided, edgcard connector supports sixteen PCB thickness variations with multiple circuit sizes for high-speed, industry-standard, edgcard applications. CoEdge connectors ensure PCBs are aligned at the centerline to allow for a uniform signal path across the length of the connector. Keying and locking features are provided to secure the connector to the PCB and improve board alignment during mating. Application tooling is not needed, allowing for easy board installation.

### Summary

Interconnections remain an essential part of high frequency/high speed product design, enabling transfer of signals at the device, board, module and enclosure levels. New performance requirements for applications in RF, microwave, optical, high speed analog and high speed digital are driving new developments for improving both mechanical and electrical performance.