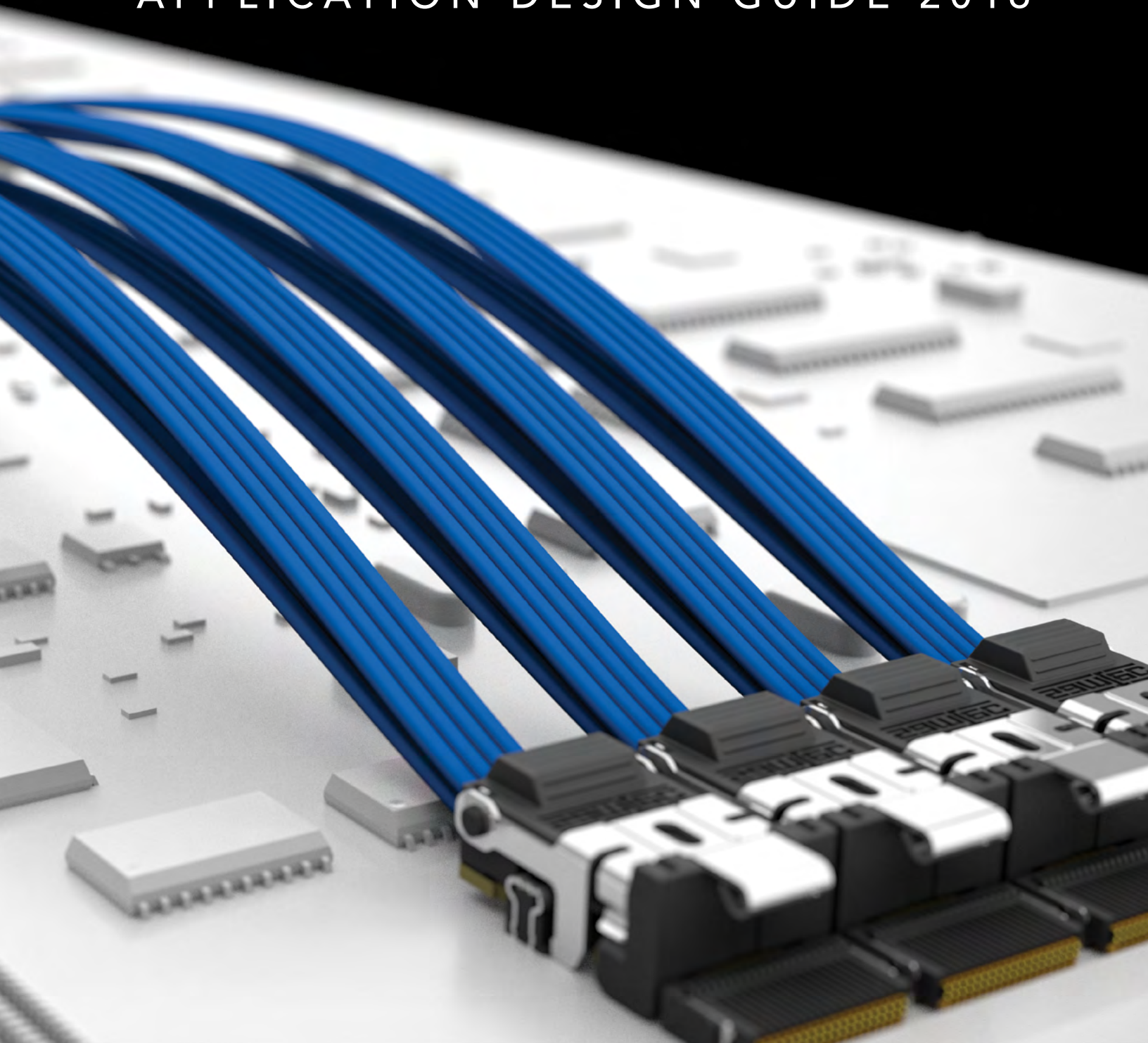
TWINAX FLYOVER

APPLICATION DESIGN GUIDE 2016

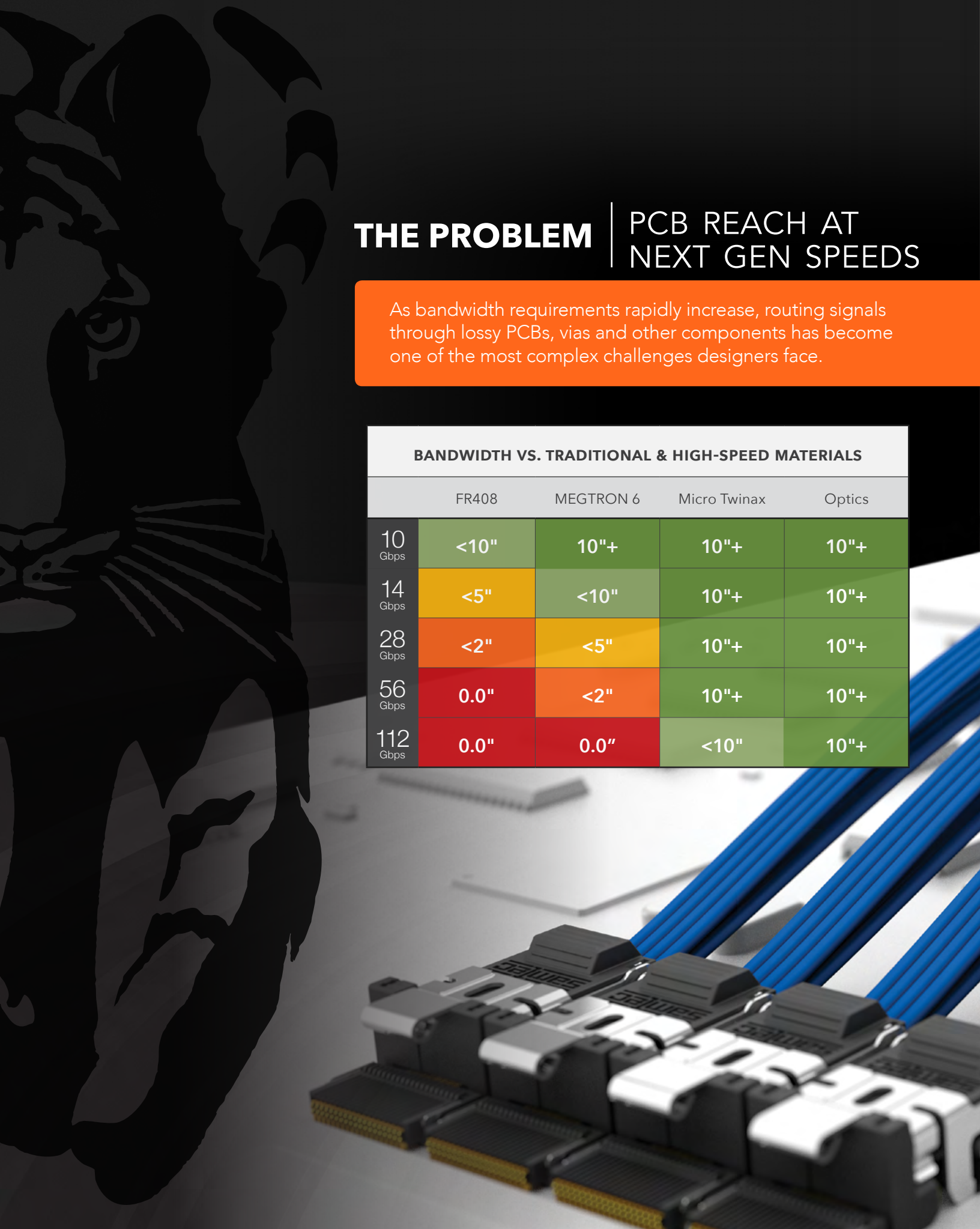


THE PROBLEM | PCB REACH AT NEXT GEN SPEEDS

As bandwidth requirements rapidly increase, routing signals through lossy PCBs, vias and other components has become one of the most complex challenges designers face.

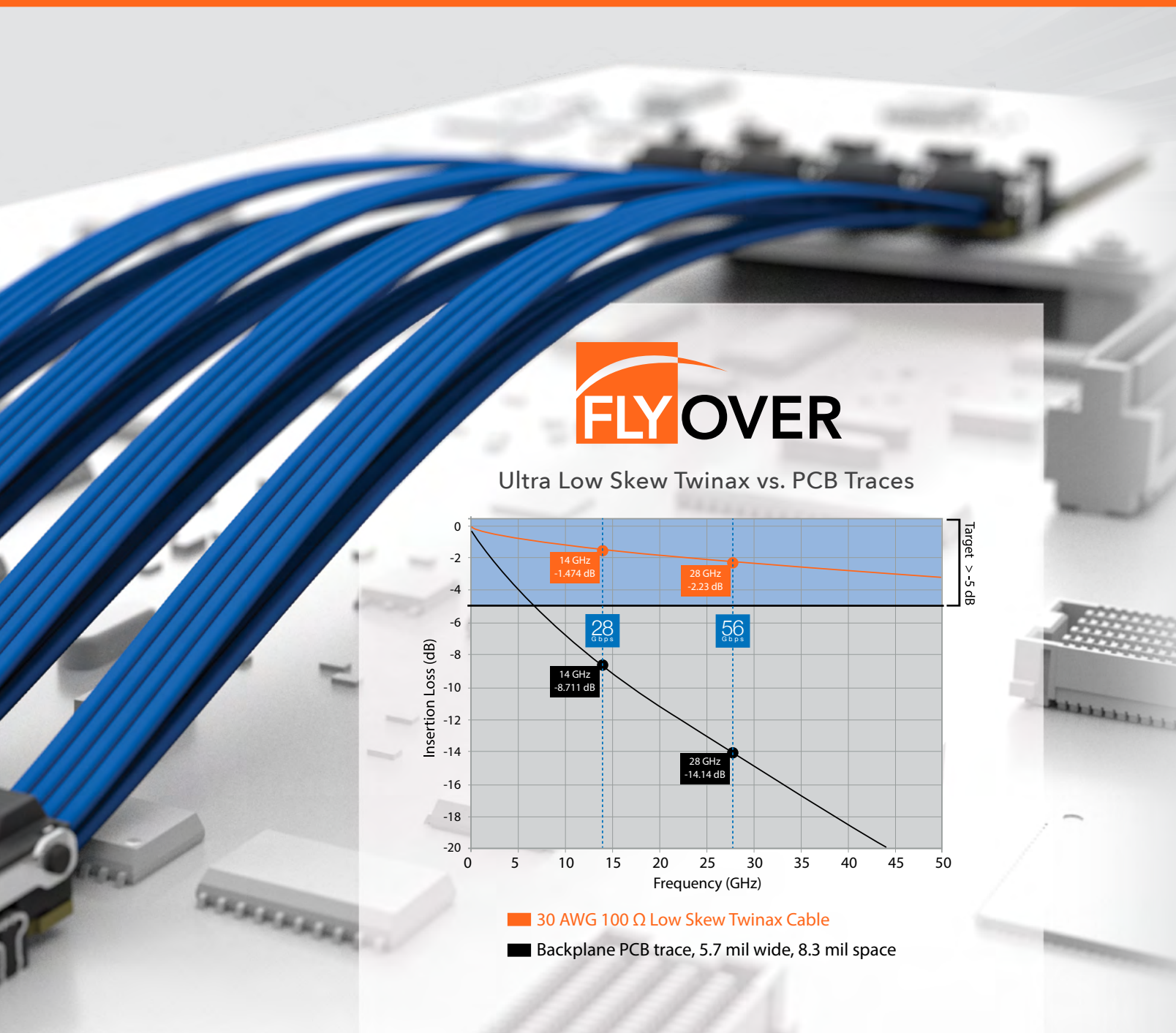
BANDWIDTH VS. TRADITIONAL & HIGH-SPEED MATERIALS

	FR408	MEGTRON 6	Micro Twinax	Optics
10 Gbps	<10"	10"+	10"+	10"+
14 Gbps	<5"	<10"	10"+	10"+
28 Gbps	<2"	<5"	10"+	10"+
56 Gbps	0.0"	<2"	10"+	10"+
112 Gbps	0.0"	0.0″	<10"	10"+



THE SOLUTION | SAMTEC FLYOVER™ SYSTEMS

Samtec's "Flyover" design approach breaks the constraints of traditional signaling substrate and hardware offerings, resulting in a cost-effective, high-performance answer to the challenges of 28 Gbps bandwidths and beyond.



FLYOVER

Ultra Low Skew Twinax vs. PCB Traces

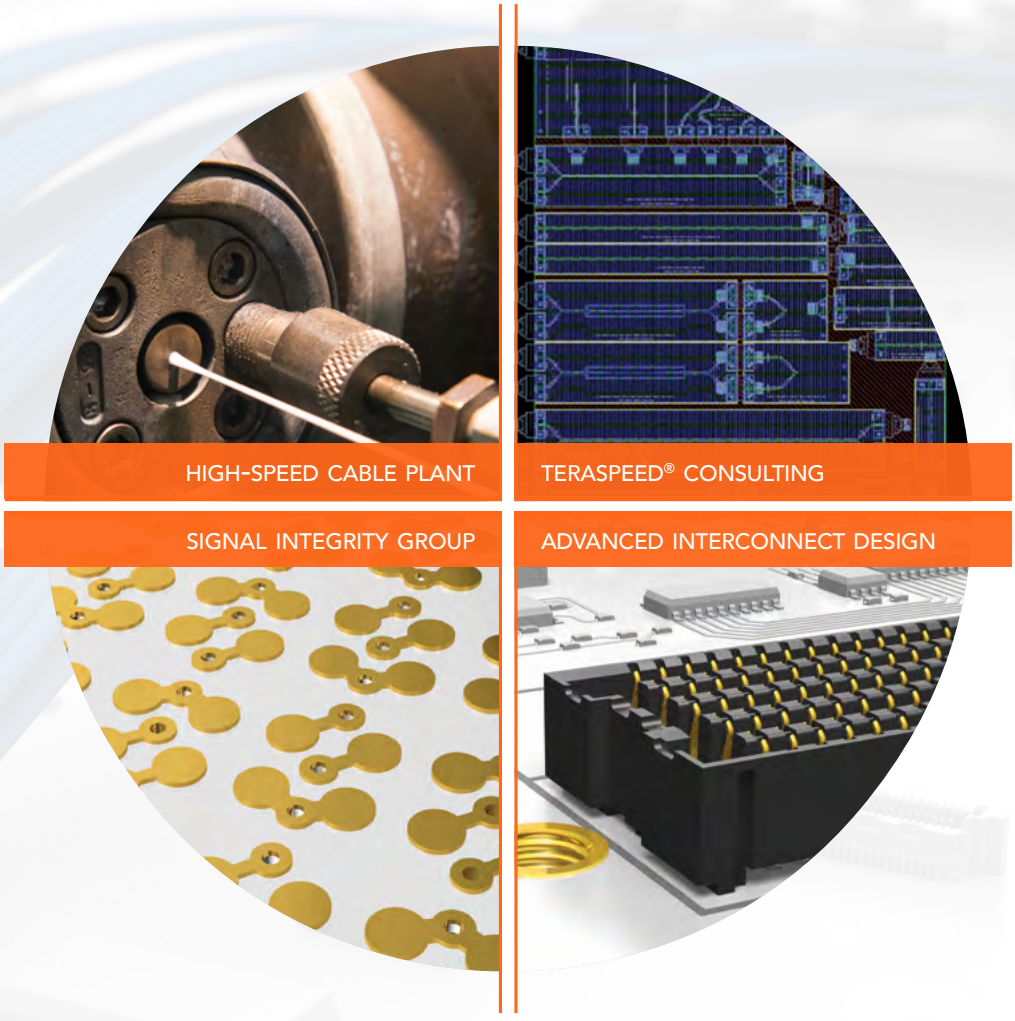
30 AWG 100 Ω Low Skew Twinax Cable

Backplane PCB trace, 5.7 mil wide, 8.3 mil space

THE SOLUTION | SUPPORT FOR NEXT GEN CHALLENGES

Samtec has developed the industry's only collection of fully integrated, complementary, and cross-functional Technology Centers designed to ensure full system interconnect performance and cost optimization - from Silicon-to-Silicon™.

SAMTEC TECHNOLOGY CENTERS | INTEGRATION = INNOVATION



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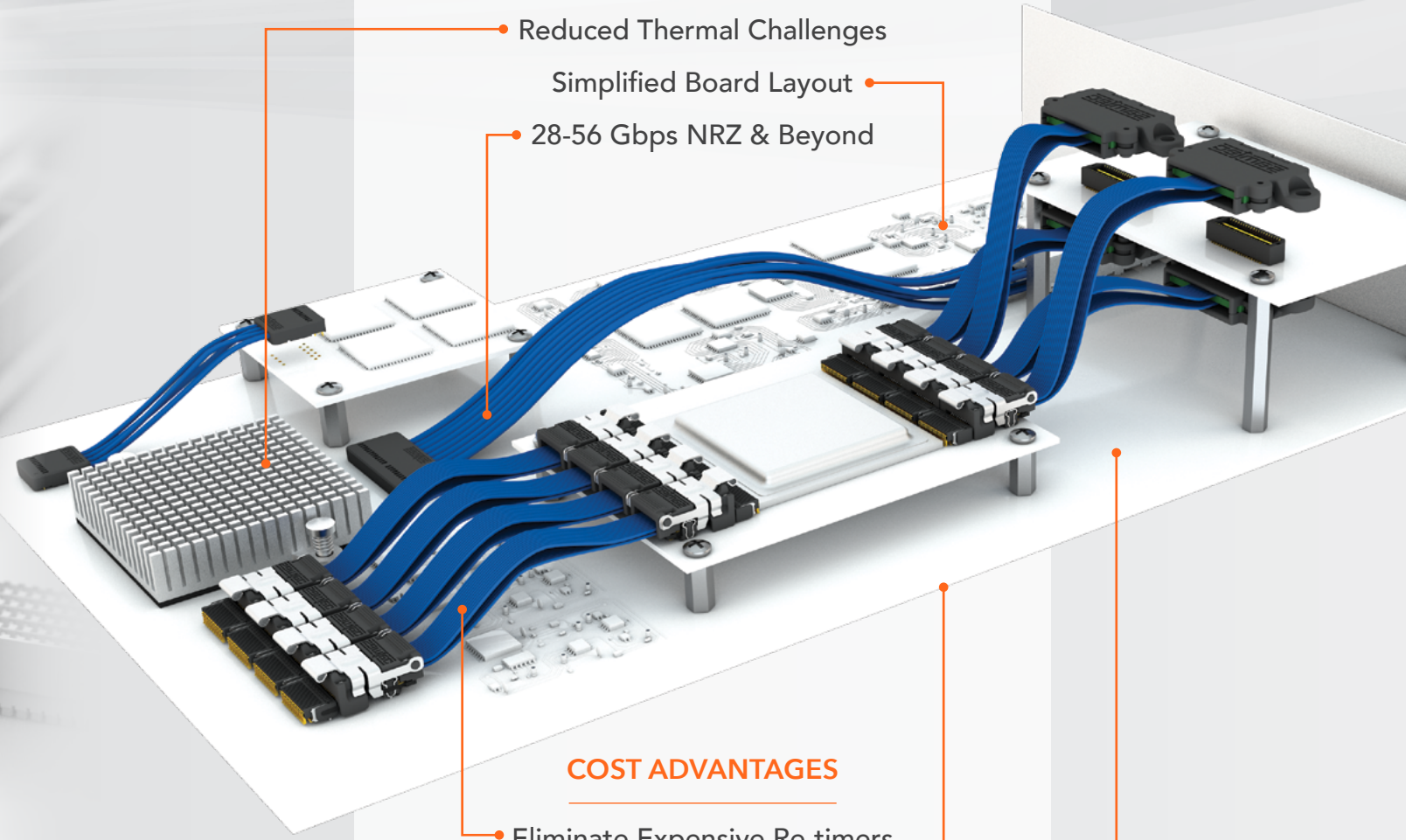
NEXT GEN PERFORMANCE | *WITHOUT* ADDED COST

Samtec's high-performance, low loss twinax cable systems support 28 Gbps and beyond while providing for extended signal reach and system architecture design flexibility - without adding cost to the overall system.

PERFORMANCE ADVANTAGES

- Reduced Thermal Challenges
- Simplified Board Layout
- 28-56 Gbps NRZ & Beyond



COST ADVANTAGES

- Eliminate Expensive Re-timers
- Fewer PCB Layers
- Less Expensive PCB Materials

28+ Gbps INTERCONNECT TECHNOLOGY

FIREFLY™ MICRO FLYOVER™ SYSTEMS

Highest Performance | Highest Density | Rugged | Future-Proof Design

- x12 systems on 36 AWG ultra low skew twinax ribbon cable
- x4 (34 AWG) and x12 (36 AWG) bidirectional systems with passive equalization provide a performance boost or allow longer cable lengths
- x4 (4 pair Tx, 4 pair Rx) active equalized system with 100 Ω 34 AWG cable provides even greater performance boost or longer cable lengths (currently in development)
- Variety of end two termination options
- Future-proof design: pin compatible with optical FireFly™

HIGH-SPEED EDGE CARD CONNECTORS

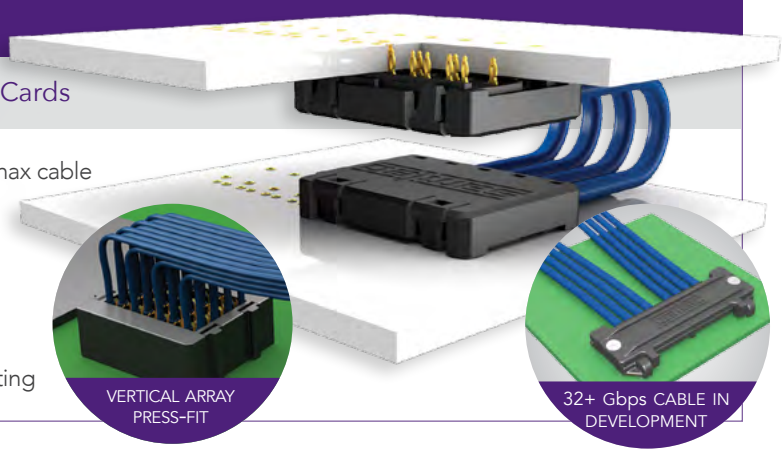
Low-Cost | Pluggable | Design Flexibility

- 0.80 mm pitch Edge Rate® sockets; 0.60 mm design in development
- Cost-efficient 28+ Gbps interconnect solutions
- Rugged Edge Rate® contacts optimized for signal integrity
- Vertical and right-angle orientations
- Single-ended or differential pair
- Card slot: .062" (1.60 mm)
- Optional board locks, cable latching features, and weld tab / solder tabs for mechanical strength

DIRECT CONNECT™ SYSTEMS

Lowest Cost | Connectorless Design | No Transition Cards

- Eye Speed® 85 Ω, 92 Ω and 100 Ω 30 AWG ultra low skew twinax cable
- High-retention press-fit termination directly to PCB
- 28 - 56 Gbps NRZ and beyond
- Multiple pair counts available from 4 to 72
- Right-angle press-fit & vertical array press-fit designs
- Stitched ground pins for improved signal integrity & easy routing



ULTRA LOW SKEW CABLE TECHNOLOGY

EYE SPEED® ULTRA LOW SKEW TWINAX CABLE

Ultra Low Skew Twinax | Micro Cellular Dielectric | Manufacturing Technology Innovation

Samtec's co-extruded twinax cable technology eliminates the performance limitations and inconsistencies of individually extruded dielectric twinax cabling, improving signal integrity, bandwidth and reach for high-performance system architectures.

Ultra Low Skew Twinax

- Tight coupling between signal conductors
- Improved bandwidth and reach
- Improved signal integrity and eye pattern opening
- Low skew over extended lengths

Micro Cellular Dielectric Extrusion

- Critical dimensions measured at every dielectric spool
- Inline laser and CAPAC devices for capacitance monitoring and diameter control
- In-process stats summary sheet for Cpk acceptance

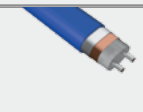
Manufacturing Technology Innovation

- World class in-house expertise, R&D and test & measurement
- Real-time closed-loop control to adjust process parameters
- Internally developed proprietary processes

Contact Samtec's High-Speed Cable Group at DR@samtec.com.

High-Speed Cable Technology Center, Wilsonville, Oregon

NOMINAL PERFORMANCE SPECIFICATIONS

Eye Speed® Ultra Low Skew Twinax Cable			28 AWG	30 AWG	32 AWG	34 AWG	36 AWG
							
14 GHz (28 Gbps)	0.25 m	IL (dB)	-1.0	-1.2	-1.5	-1.8	-2.2
	1.00 m		-3.9	-4.7	-5.9	-7.2	-8.7
28 GHz (56 Gbps)	0.25 m		-1.5	-1.8	-2.2	-2.6	-3.2
	1.00 m		-6.0	-7.0	-8.7	-10.6	-12.7
Density / Flexibility			Good	Good	Better	Best	Best

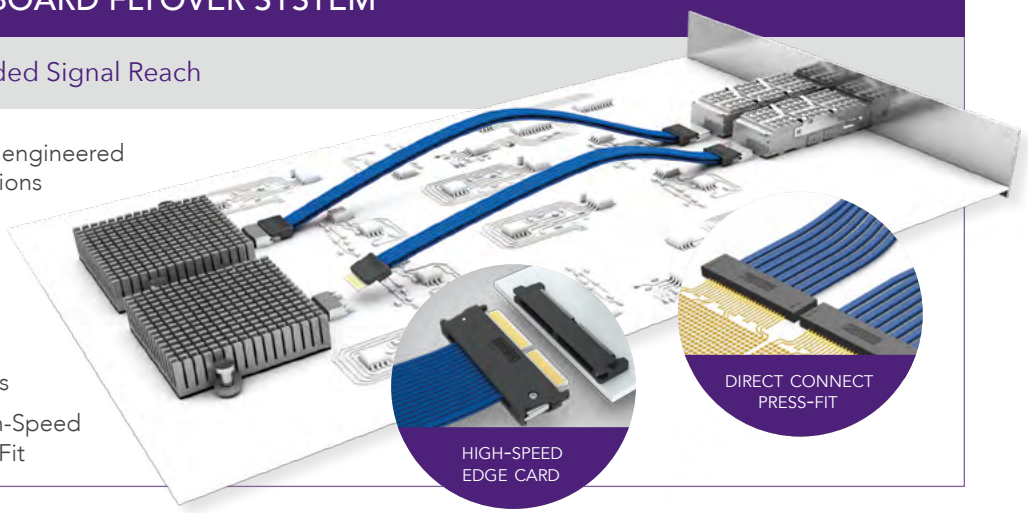
Eye Speed® Ultra Low Skew Twinax Cable is available in engineered impedance configurations of 85 Ω, 92 Ω and 100 Ω.

FLYOVER PRACTICAL APPLICATIONS

ULTRA HIGH-DENSITY MID-BOARD FLYOVER SYSTEM

Chip Placement Flexibility | Extended Signal Reach

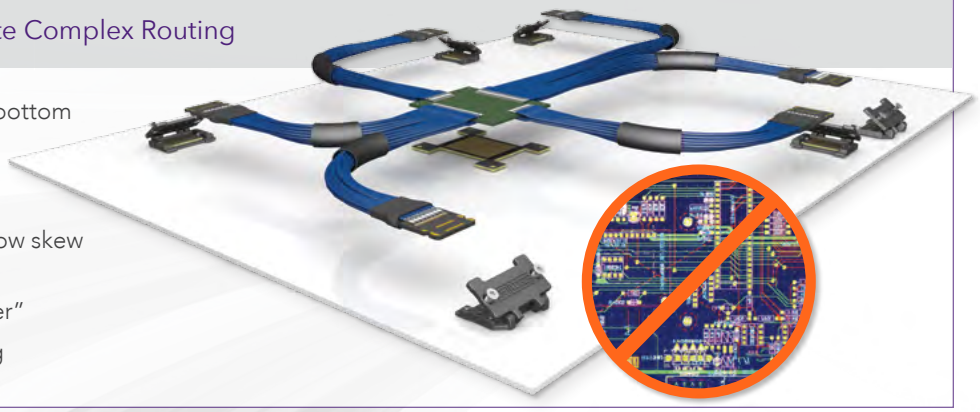
- Ultra high-density, 28+ Gbps solution engineered for on-board and embedded applications
- Allows drivers to be remotely located for design flexibility and control over thermal cooling
- Use of Eye Speed® ultra low skew twinax cable eliminates the need for expensive PCB materials and re-timers
- Choice of terminations including High-Speed Edge Card and Direct Connect Press-Fit



BACKSIDE INTERCONNECT ULTRA HIGH-SPEED LOW SKEW TWINAX FABRIC

Save Valuable Real Estate | Eliminate Complex Routing

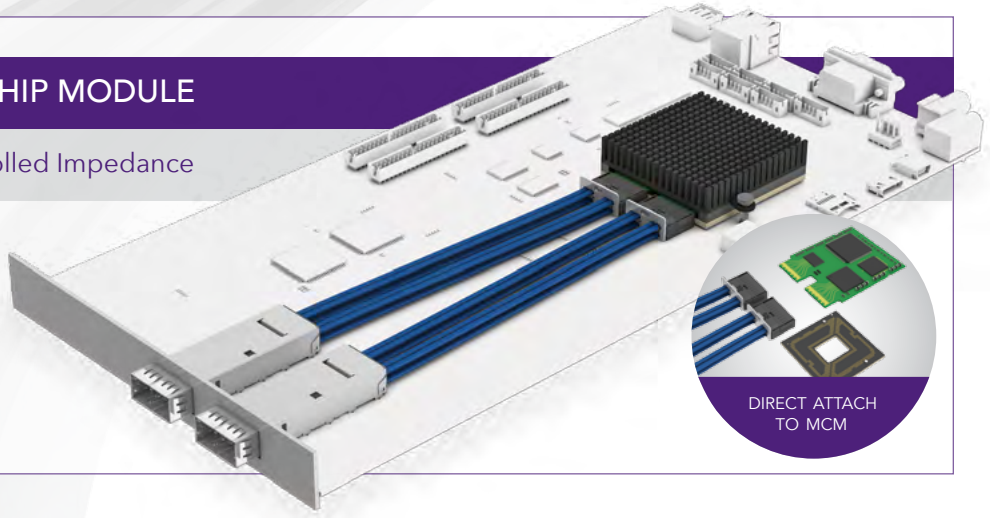
- Takes advantage of real estate on the bottom side of the PCB to distribute critical data to multiple locations
- Z-Ray® high-density, ultra low profile micro interposers + Eye Speed® ultra low skew twinax cable
- BGA-to-BGA high-speed signal "flyover"
- Customizable selective signal mapping



DIRECT ATTACH TO MULTI-CHIP MODULE

Bypass Signal Traffic & Loss | Controlled Impedance

- Eye Speed® ultra low skew twinax direct-to-MCM solution
- Design bypasses BGA signal traffic and loss associated with host boards
- Chip-to-Chip impedance-controlled link with ultra low skew twinax cabling



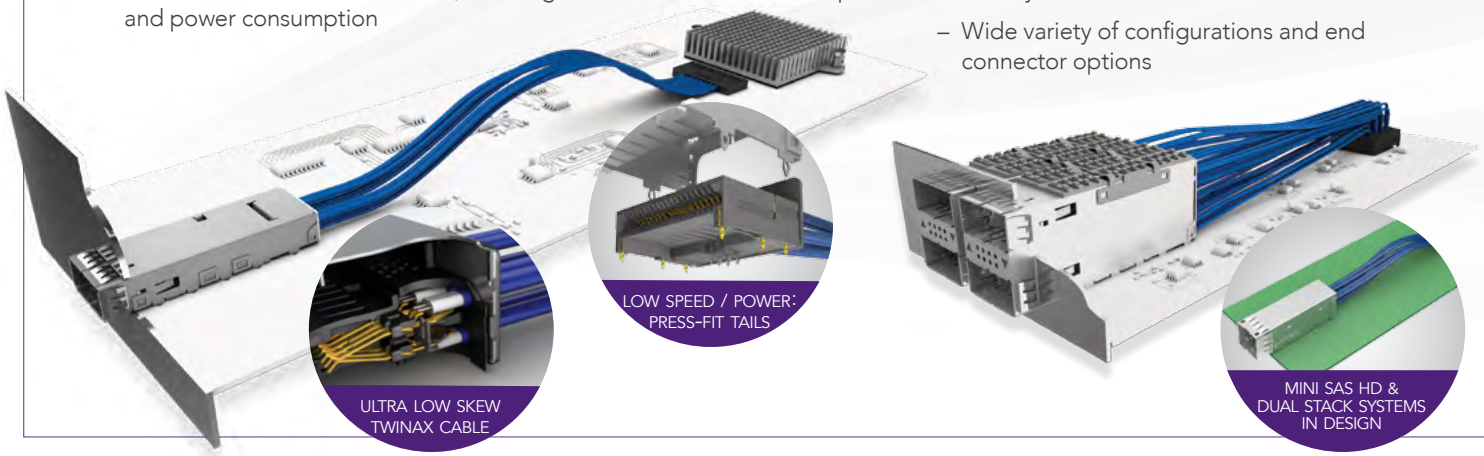
56+ Gbps DIRECT ATTACH TECHNOLOGY

Samtec's Direct Attach Technology enables ultra high-performance 56 Gbps and beyond for Chip-to-Backplane and Chip-to-I/O applications.

QSFP DIRECT ATTACH FLYOVER SYSTEMS

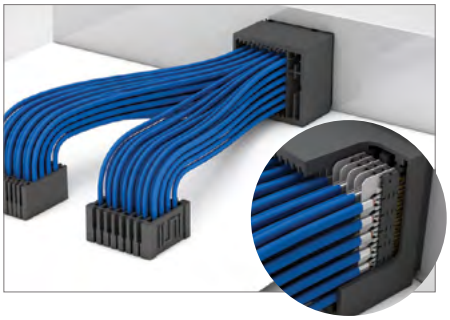
Chip Placement Flexibility | No Re-timers Required | Ultra High-Performance

- Allows drivers to be remotely located, enabling flexibility in system architecture and more control over thermal cooling
- Need for re-timers is eliminated, resulting in reduced costs and power consumption
- Backward compatible with all QSFP cable assemblies
- Eye Speed® 30 AWG 100 Ω ultra low skew twinax cable provides inherently lower attenuation
- Wide variety of configurations and end connector options



HIGH-SPEED BACKPLANE FLYOVER SYSTEMS

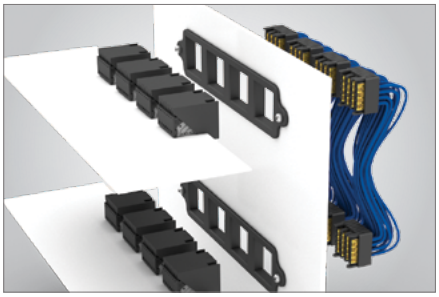
Cable-to-Board Press-Fit | Cable-to-ExaMAX® Right-Angle & Vertical | Cable-to-Cable



28+ Gbps Direct Connect™ system

Flyover Backplane applications or adjacent to the chip on a host board

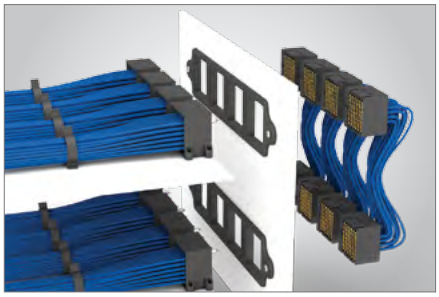
Intermateable with ExaMAX® Press-fit



28 - 56 Gbps NRZ performance

Pluggable Flyover Backplane applications

Mates to existing ExaMAX® right-angle and vertical connectors

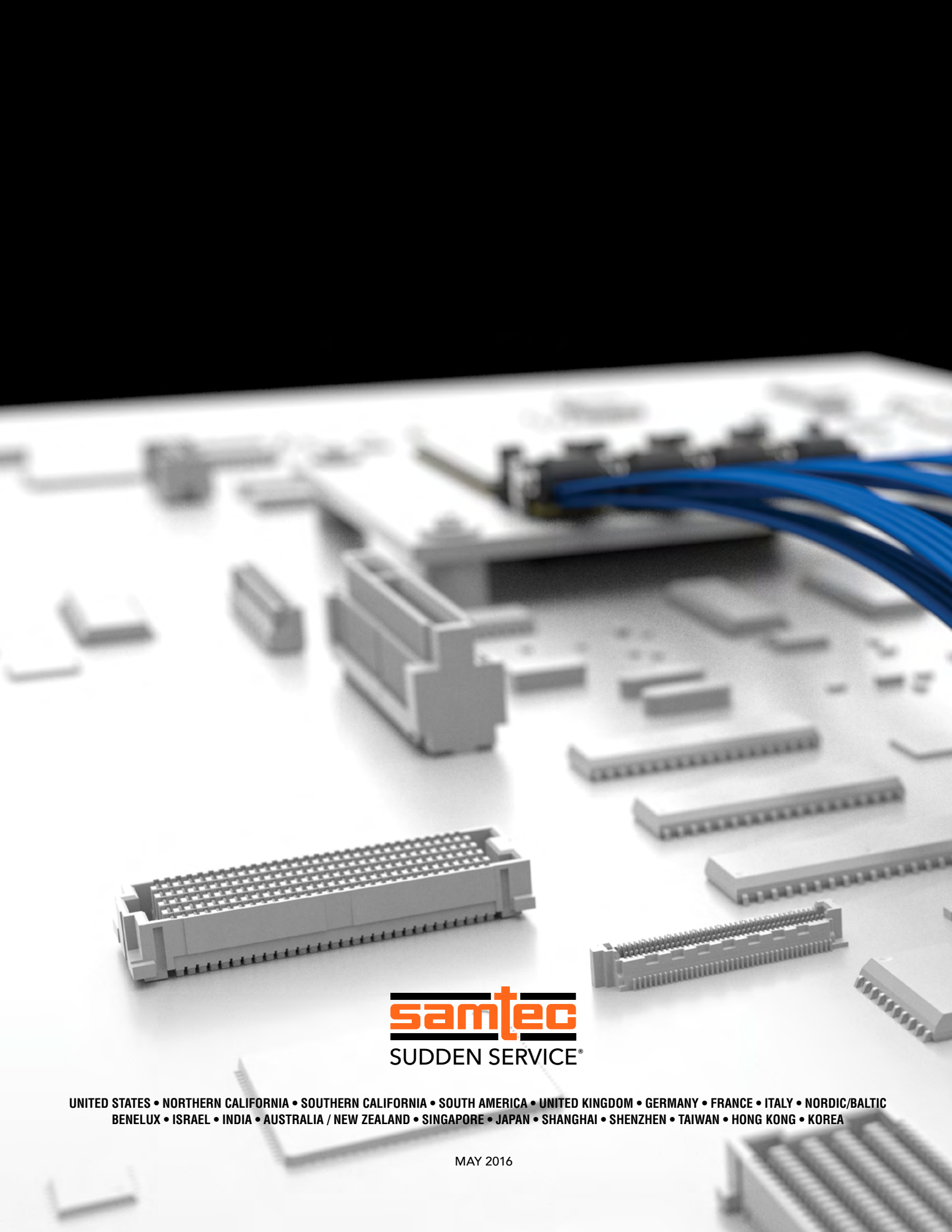


56+Gbps NRZ performance

Move high-speed signals off the backplane and the line card

"Flyunder" Backplane applications

*ExaMAX® is a trademark of FCI



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