

The Samtec logo is located in the top right corner. It consists of the word "samtec" in a bold, lowercase, sans-serif font. The letters "a", "m", and "e" have horizontal lines extending from their top and bottom edges, respectively. The background of the slide features a light gray grid with a central bright white circle and various geometric patterns of squares and lines.

# SAMTEC COMPANY OVERVIEW

# AGENDA

9.00am Samtec Company Overview

9h15 Samtec Interconnect:

Flyover Cables

Backplane & Arrays

High Speed and Rugged

10h45 Samtec Optical Group:

Overview of FireFly and roadmap.

FireFly used in a FPGA application: examples

PCIe over FireFly

Introduction to COBO (Consortium for On-Board Optic)

11h15 Samtec Microelectronics:

Micro Interposers

Micro-Electronics Capabilities

Case Studies

Glass Core packaging (GCP)

11h45 Samtec Signal Integrity Support:

12h05 Questions

# PROFILE



Samtec was founded in 1976 in New Albany, Indiana USA.

Samtec is privately held and debt free with sales over \$625M in 2015.

Samtec has 5A1 Dun & Bradstreet Rating – the highest rating for current and future business health.

Samtec has been awarded the annual honor of #1 Connector Manufacturing 15 times by Bishop and Associates.



# TOP 20

2015 Interconnect manufacturers in an industry with over 1,000 competitors

1.	TE Connectivity	\$14,154	11.	Harting	\$692
2.	Amphenol	\$4,832	<b>12.</b>	<b>Samtec</b>	<b>\$625</b>
3.	Molex	\$4,356	13.	FCI	\$598
4.	Delphi DCS	\$2,607	14.	Furukawa	\$548
5.	Hon Hai/Foxconn	\$2,443	15.	Glenair	\$543
6.	JST	\$1,556	16.	Fujikura	\$534
7.	JAE	\$1,449	17.	Foxlink	\$479
8.	Hirose	\$1,121	18.	Hosiden	\$478
9.	Huber+Suhner	\$858	19.	Volex	\$472
10.	Rosenberger	\$855	20.	ITT Cannon	\$463

\* Competitor numbers based on 2015 sales

# WORLDWIDE LOCATIONS



33 locations and over 4,000 associates

# TECH CENTERS

To meet the interconnect challenges of tomorrow and beyond, we have developed technology centers to help optimize your entire signal transmission path... from the IC to the panel and all points in between.

ADVANCED  
INTERCONNECT  
DESIGN

SIGNAL  
INTEGRITY  
GROUP

HIGH SPEED  
CABLE PLANT

OPTICAL  
GROUP

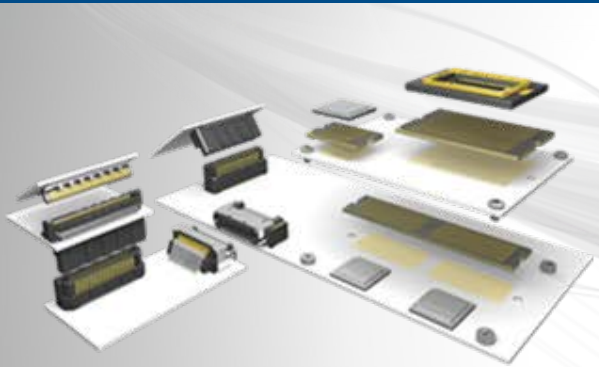
IC  
PACKAGING

TERASPEED®  
CONSULTING



# SAMTEC PRODUCT SOLUTION BLOCKS

IC-TO-BOARD



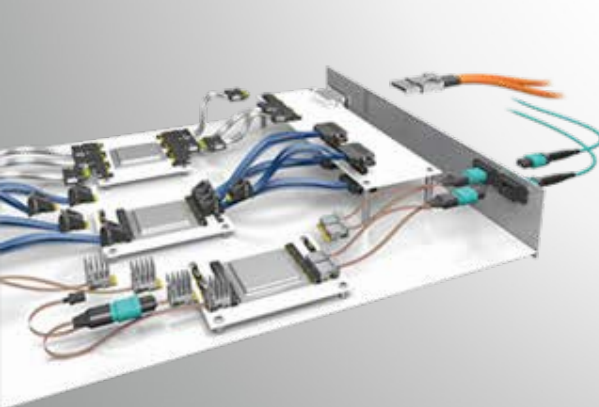
HIGH SPEED BOARD-TO-BOARD



HIGH SPEED CABLES



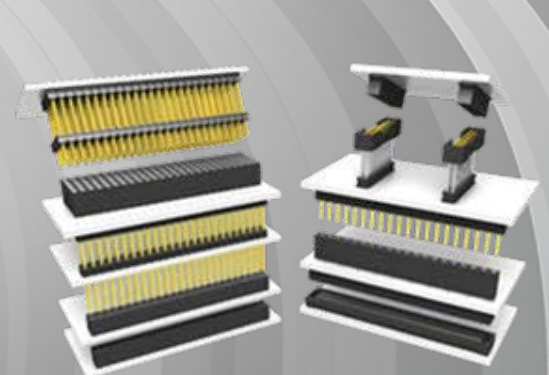
OPTICS



MICRO RUGGED



FLEXIBLE STACKING



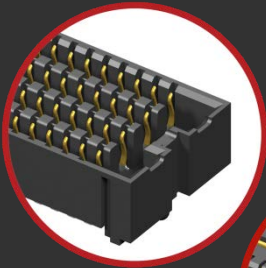
# TECH CENTERS

## Advanced Interconnect Design Group

High precision stamping, plating, molding, and automated assembly for fine pitch and array interconnects used for board-to-board, interposers, micro backplane, and high speed/high density cable assemblies.

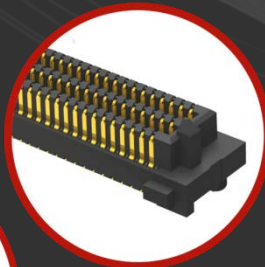
### SEARAY™ 1,27 mm

28 Gbps Open Pin Field Arrays  
40-500 Positions



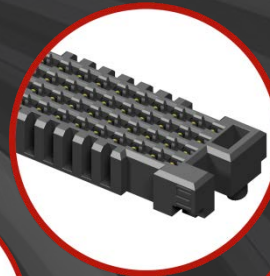
### SEARAY™ 0,80 mm

28 Gbps  
Highest Density Arrays  
up to 720 Positions



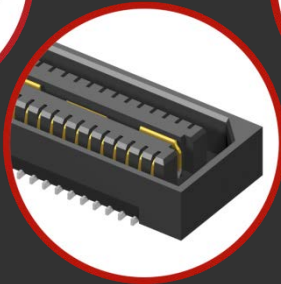
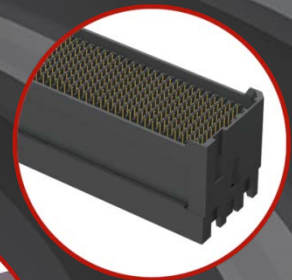
### SEARAY™ LP

34 Gbps Low Profile Arrays  
down to 4 mm



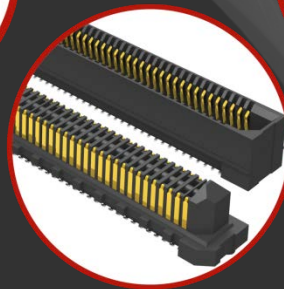
### SkyRay™

28 Gbps  
Elevated Arrays



### Q Strip®

28 Gbps Low Profile  
Ground Plane Connectors



### Edge Rate™

28 Gbps Rugged Connectors



### High Speed Backplane

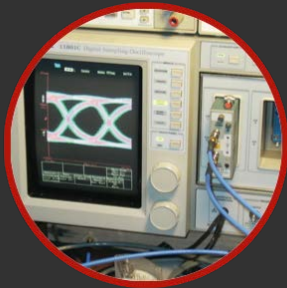
25 to 56 Gbps Solutions



# TECH CENTERS

## Signal Integrity Group

High speed characterization reports, simulations up to 40 GHz, advanced breakout regions using technologies such as Differential Vias™ and routing recommendations using Tri-Planar™ trace technology. Live EE support is available worldwide 24/7.



**Live EE Support**  
24/7 Access to  
Signal Integrity Support



**Differential Vias™**  
High Speed Array  
Breakout Region Technology



**Simulator™**  
Simulate in a Minute™ Performance Verification  
for Mated Connector Sets and Cables

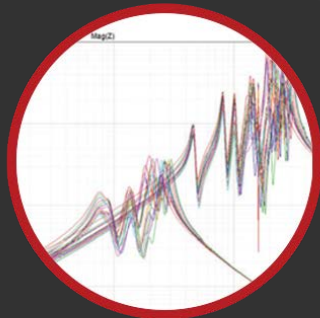


**Final Inch®**  
Performance Certified  
Break Out Regions

# TECH CENTERS

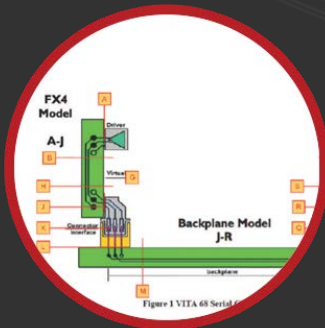
## Teraspeed Consulting

Signal Integrity Services team providing complete system design, full channel signal integrity analysis, and SI optimized advanced IC packaging for 28 Gbps and beyond.



### Signal and Power Integrity

*Analysis, Design, Engineering, and Verification*

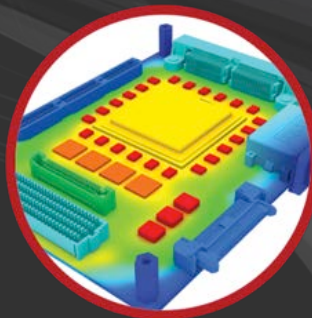


### System Engineering

*Full system solutions from silicon-to-silicon*

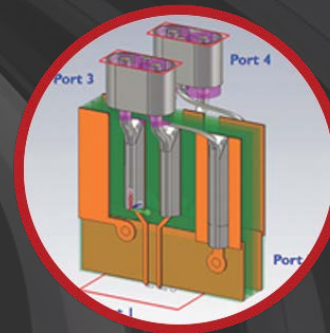
### Thermal Management

*Solutions for high density / high power systems*



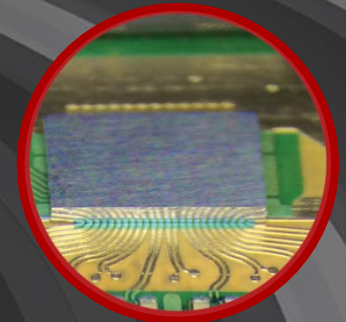
### IC Packaging

*Optimized Modeling, Simulation, and Measurements up to 56 Gbps*



### Electromagnetic Modeling

*Modeling, Simulations, Testing and Measurements*



# TECH CENTERS

## High Speed Cable Plant

R&D and manufacturing of precision extruded micro coax and TwinAx cable used for high speed/high density cable assemblies. Capabilities include 26-38 AWG center conductors, 50/75/85/100  $\Omega$  impedance, and assemblies rated at 28 Gbps.



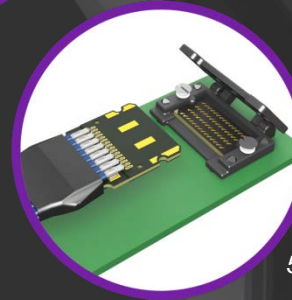
**Eye Speed®**  
High Performance/  
Dynamic Applications



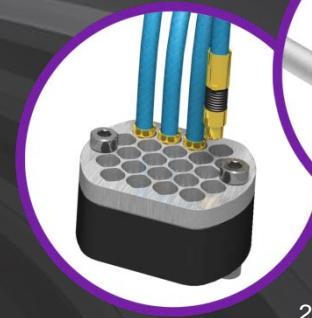
**Equalized**  
Passive or Active for 25-40%  
Increased Performance



**AcceleRate™**  
High Performance/Lowest Cost



**Z-Ray®**  
High Speed  
Low Profile Interposer  
56 Gbps down to 0.30 mm  
up to 1,000 Pins



**Bull's Eye®**  
20+ GHz Test Point System



# TECH CENTERS

## Optics Group

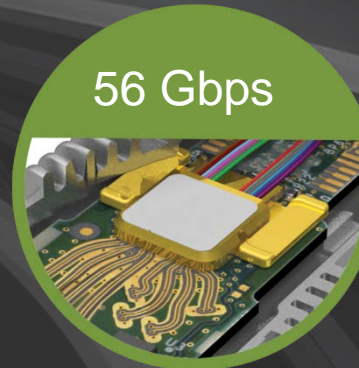
Engineering team dedicated to the design, development, and application support of high performance micro optical engines, active optical assemblies, and high density ganged passive optical panel solutions. Capable of 14 Gbps, 28 Gbps, and soon 56 Gbps. Samtec's FireFly™ micro on-board optical engines occupy the smallest overall footprint, consume the least amount of power, and enable fast, easy and low cost fiber termination.



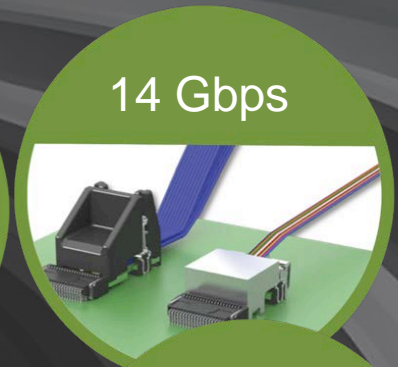
**QSFP+ 14 Gbps**  
InfiniBand™ QDR  
up to 100 m



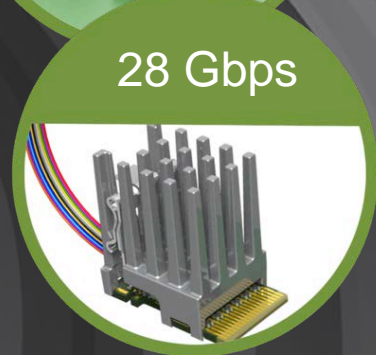
**PCIe® Optic**  
Supports Gen 3 PCIe® up to 100 m



**56 Gbps**  
**FireFly™**  
14 Gbps | 28 Gbps | 56 Gbps  
Micro Flyover  
Future-proof Copper or Optical  
Highest Bandwidth Density Available



**14 Gbps**

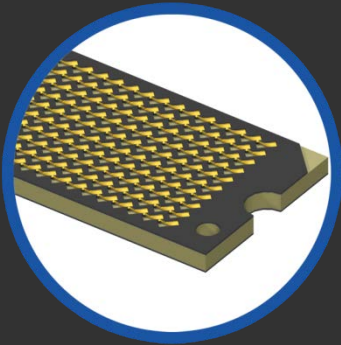


**28 Gbps**

# TECH CENTERS

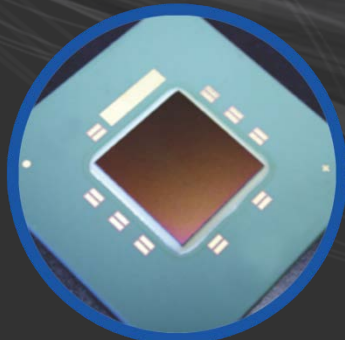
## IC Packaging Group

Advanced IC packaging with precision die attach, fine pitch/low profile wire bonding, flip chip/underfill, and dam/encapsulation capabilities. Complete "IC-to-Board" design, application support and manufacturing for custom IC packaging, substrates, and micro high density interposers. Advanced IC packaging services include layouts for signal integrity and power optimization, package/materials characterization and structural analysis. Also, manufacturing of Samtec's micro optical engines.



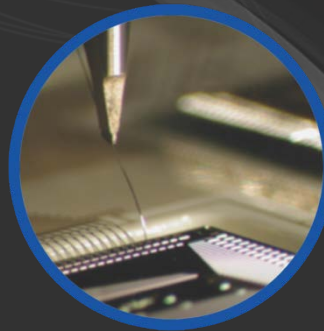
### Z-Ray®

High Speed  
Low Profile Interposer  
28 Gbps down to 0.30 mm  
up to 1,000 Pins



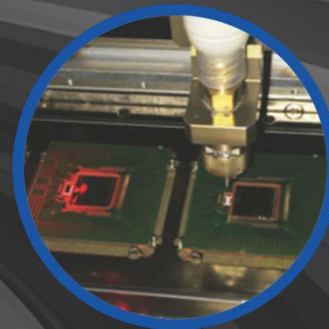
### Flip Chip

Accuracy to  
 $\pm 3 \mu\text{m}$



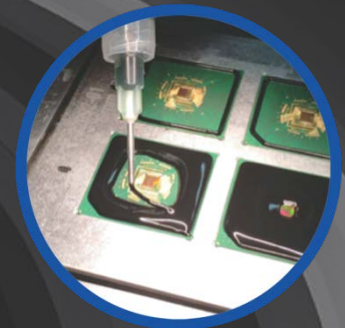
### Wire Bond

Diameters Starting at 0.0007" (19  $\mu\text{m}$ )



### Die Attach

Accuracy to  
 $\pm 3 \mu\text{m}$



### Dam & Encapsulate

Automated or Manual Encapsulation



# SAMTEC INTERCONNECT

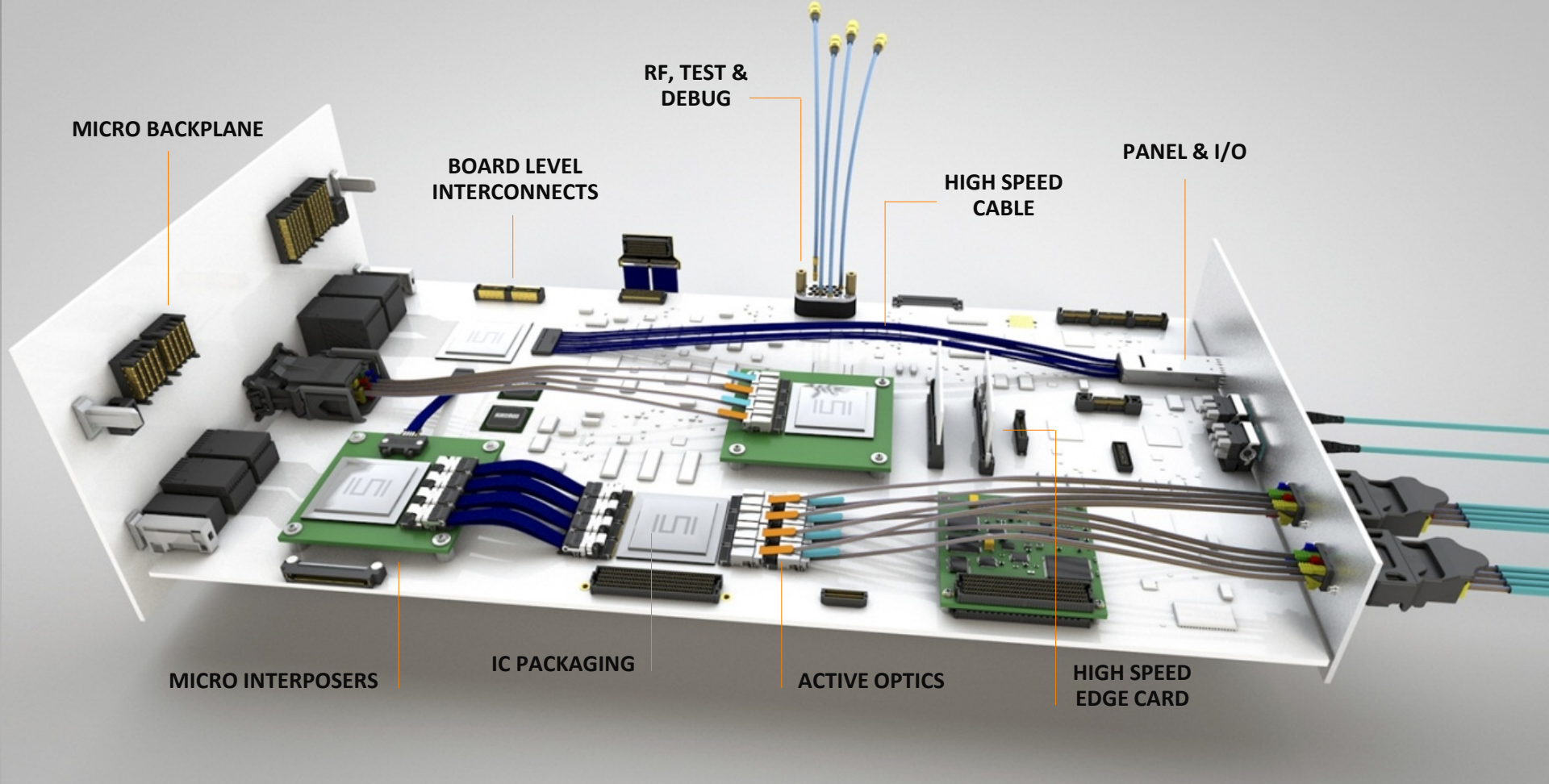
Flyover Cables

Backplane

Arrays

High Speed

Rugged

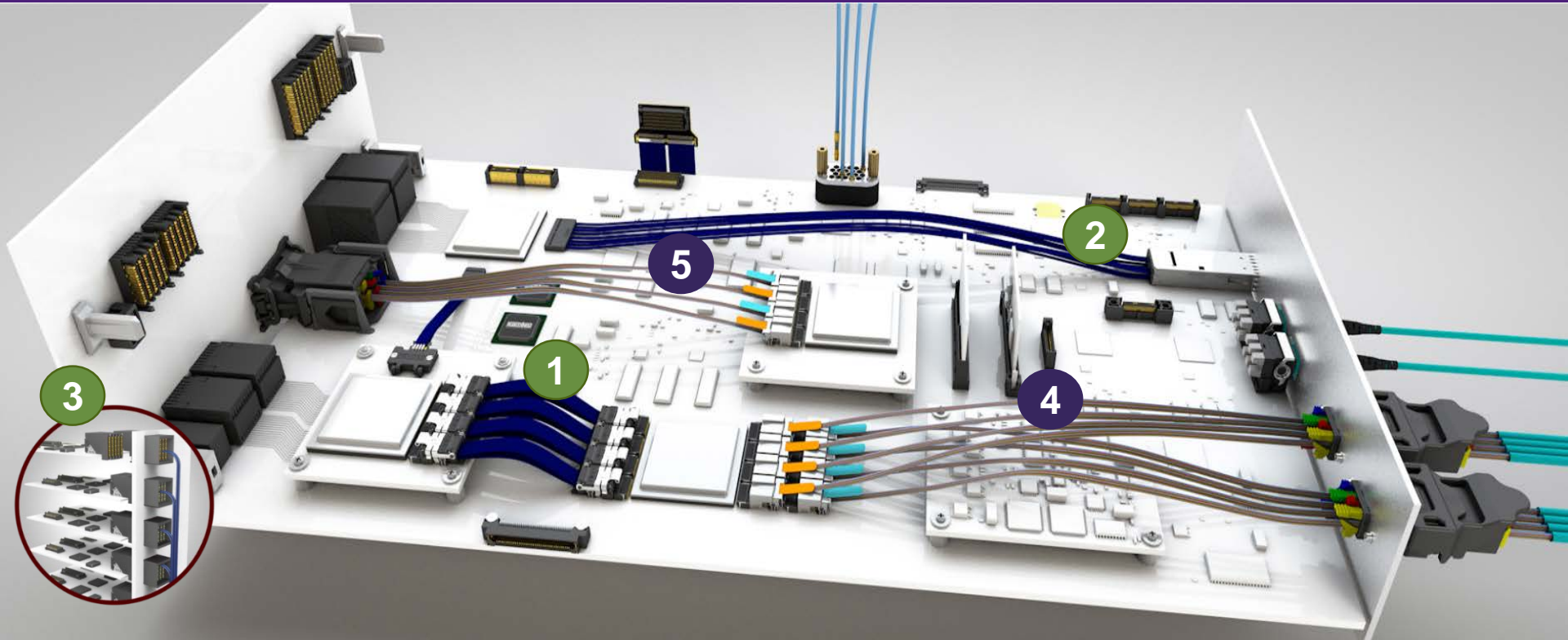


# Full Signal Channel Solutions

We're the only company focusing on the entire signal channel, from the silicon to the panel, because we know SI is a full channel challenge.

You can expect faster speeds and smaller footprints across solutions that span the entire signal channel transmission path.

# MICRO FLYOVER SYSTEMS™

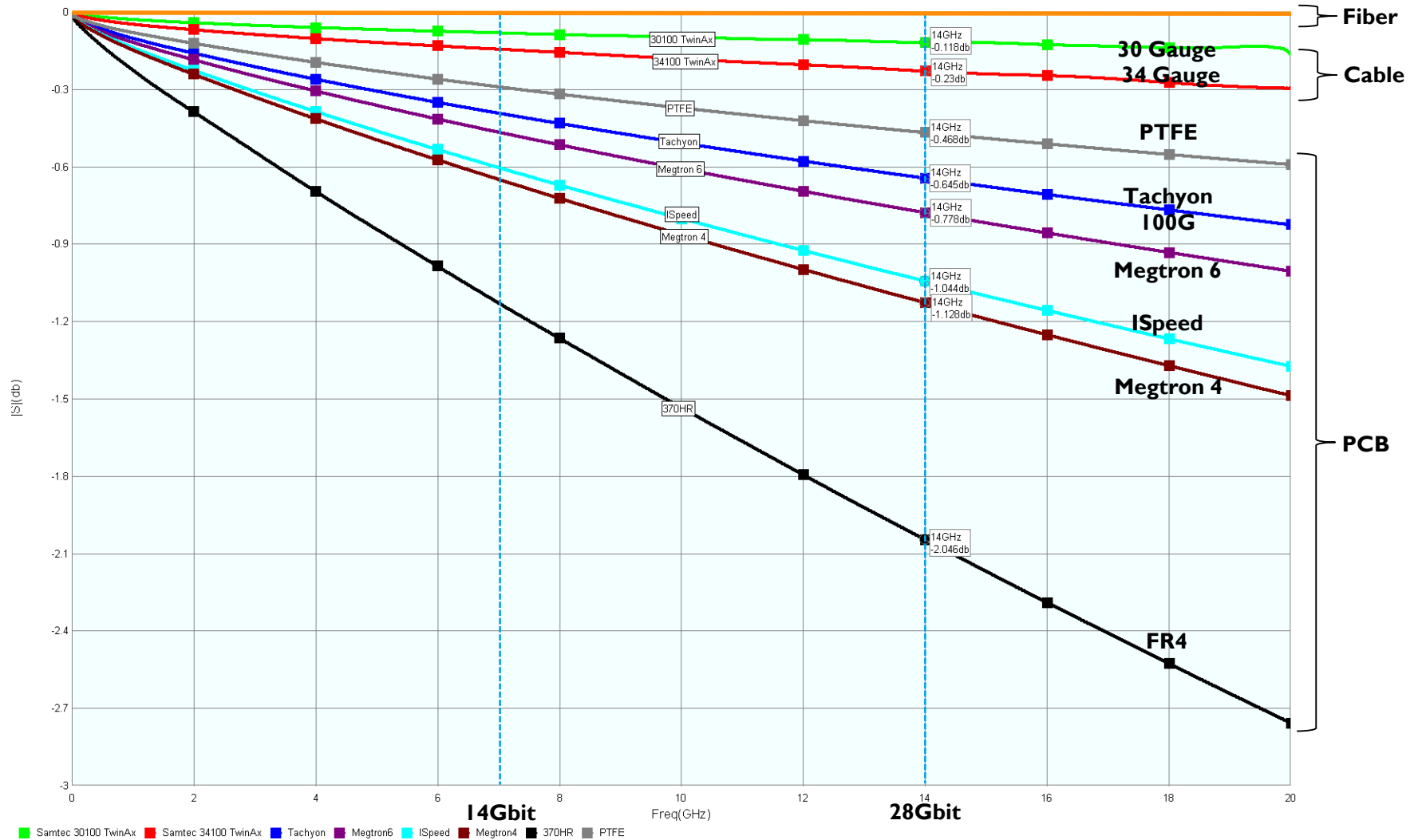


	CHIP-TO-CHIP	CHIP-TO PANEL	BACKPLANE
COPPER	(1) FireFly™ copper	(2) FQSP Flyover	(3) ExaMAX™ Fly-under
OPTICS	N/A	(4) FireFly™ + GMPO I/O	(5) FireFly™ + GMPO BP

# THESE ARE SOME OF THE REASONS FOR FLYOVER

Bandwidth\ Materials\ Reach	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"	<5"	10"+

# LOSS IN dB PER INCH FOR 28 GBPS DESIGNS





# TWINAX FLYOVER SOLUTIONS

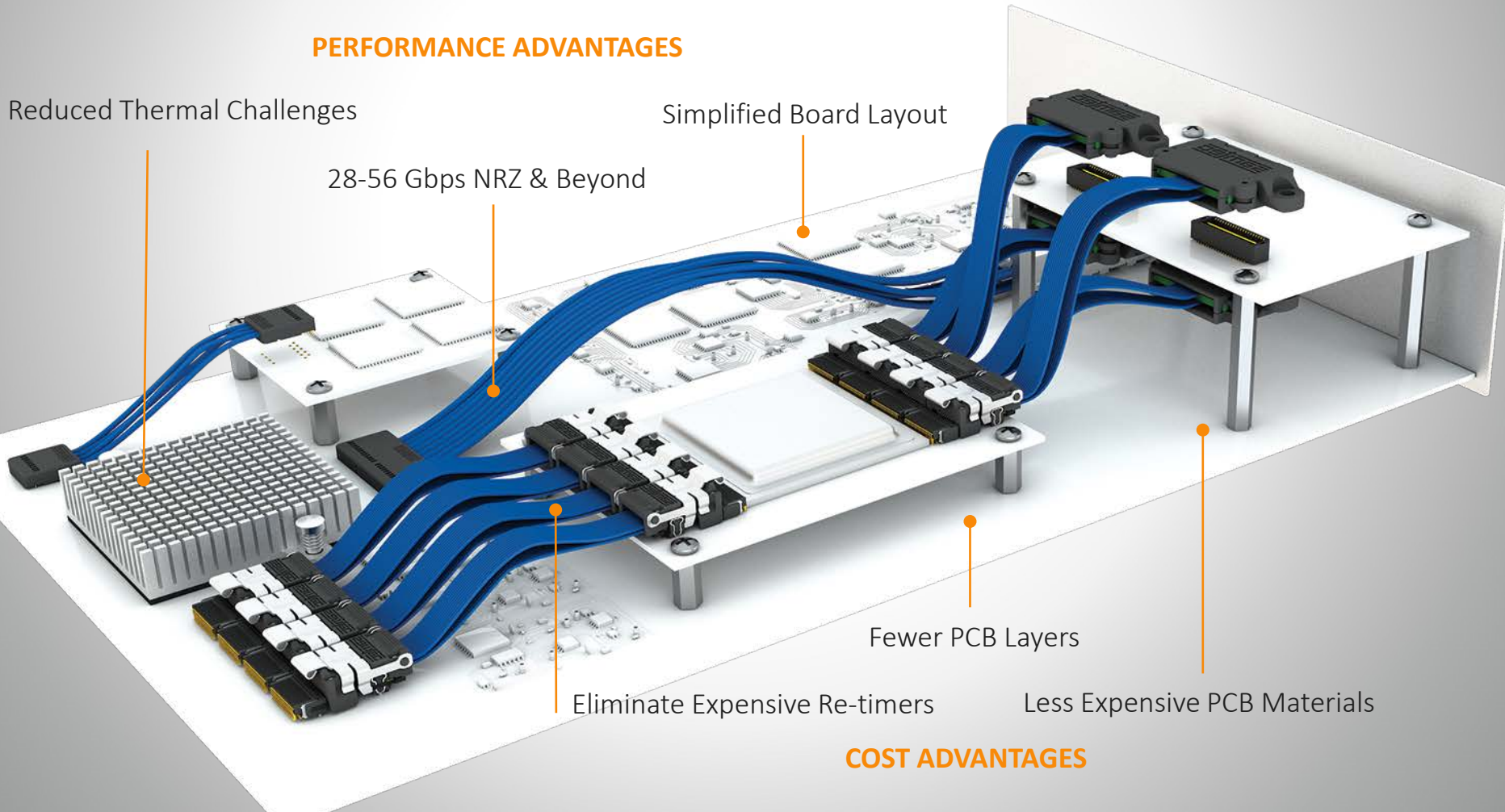
Next generation performance without added cost

## PERFORMANCE ADVANTAGES

Reduced Thermal Challenges

28-56 Gbps NRZ & Beyond

Simplified Board Layout



Fewer PCB Layers

Eliminate Expensive Re-timers

Less Expensive PCB Materials

## COST ADVANTAGES

# INTERCONNECT TECHNOLOGY

## FireFly™ Micro Flyover System™

### Highest Performance / Highest Density / Rugged / Future-Proof Design

- x12 systems on 36 AWG TwinAx ribbon cable
- x4 (34 AWG) and x12 (36 AWG) duplex systems
- x4 (4 pair Tx, 4 pair Rx) with 100  $\Omega$  34 AWG cable provides
- Active and Passive Equalisation options
  - Performance boost or allow longer cable lengths
- Variety of end two termination options
- Future-proof design: pin compatible with optical FireFly™
- UEC5 0.5mm High speed edge card interface and UCC8 mechanical support

**FIREFLY™**

**28**  
G b p s

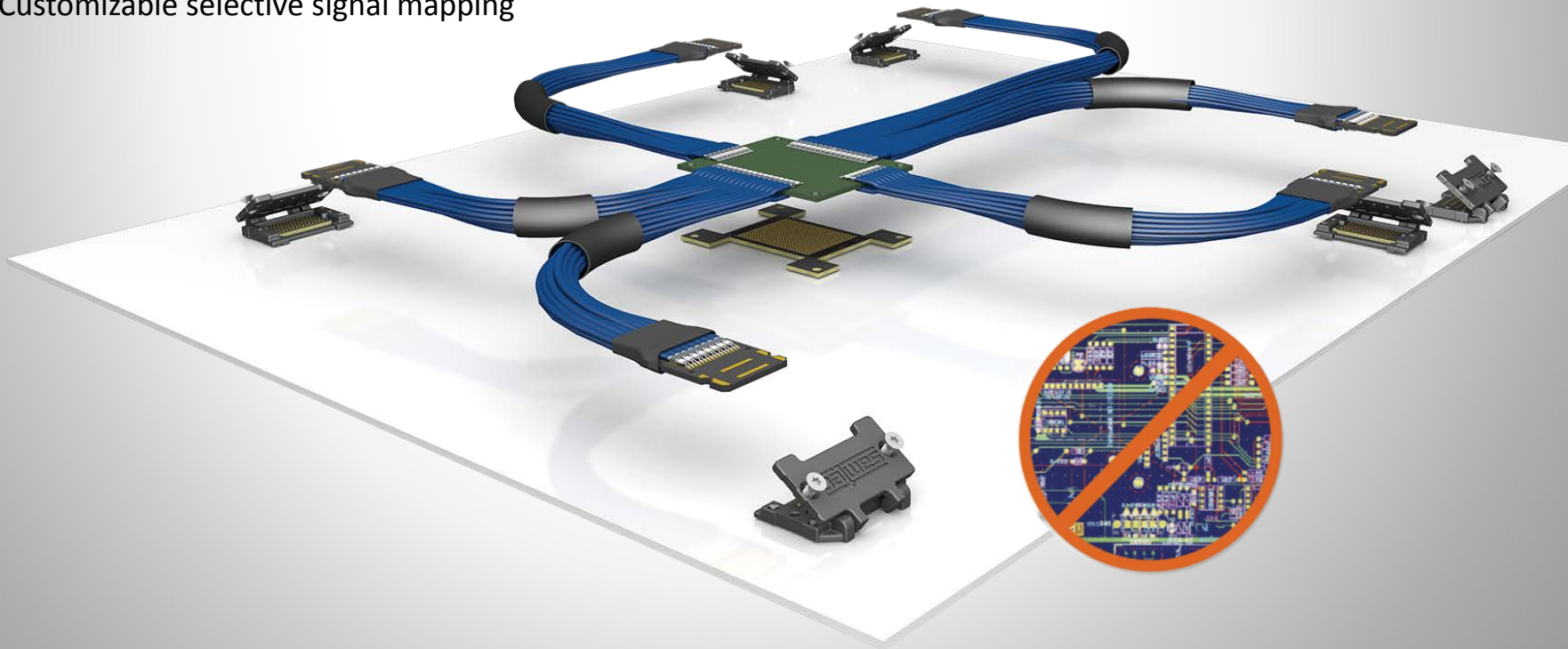


# FLYOVER APPLICATIONS

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 interposer plus Eye Speed® ultra low skew TwinAx cable
- BGA-to-BGA high-speed signal “flyover”
- Customizable selective signal mapping

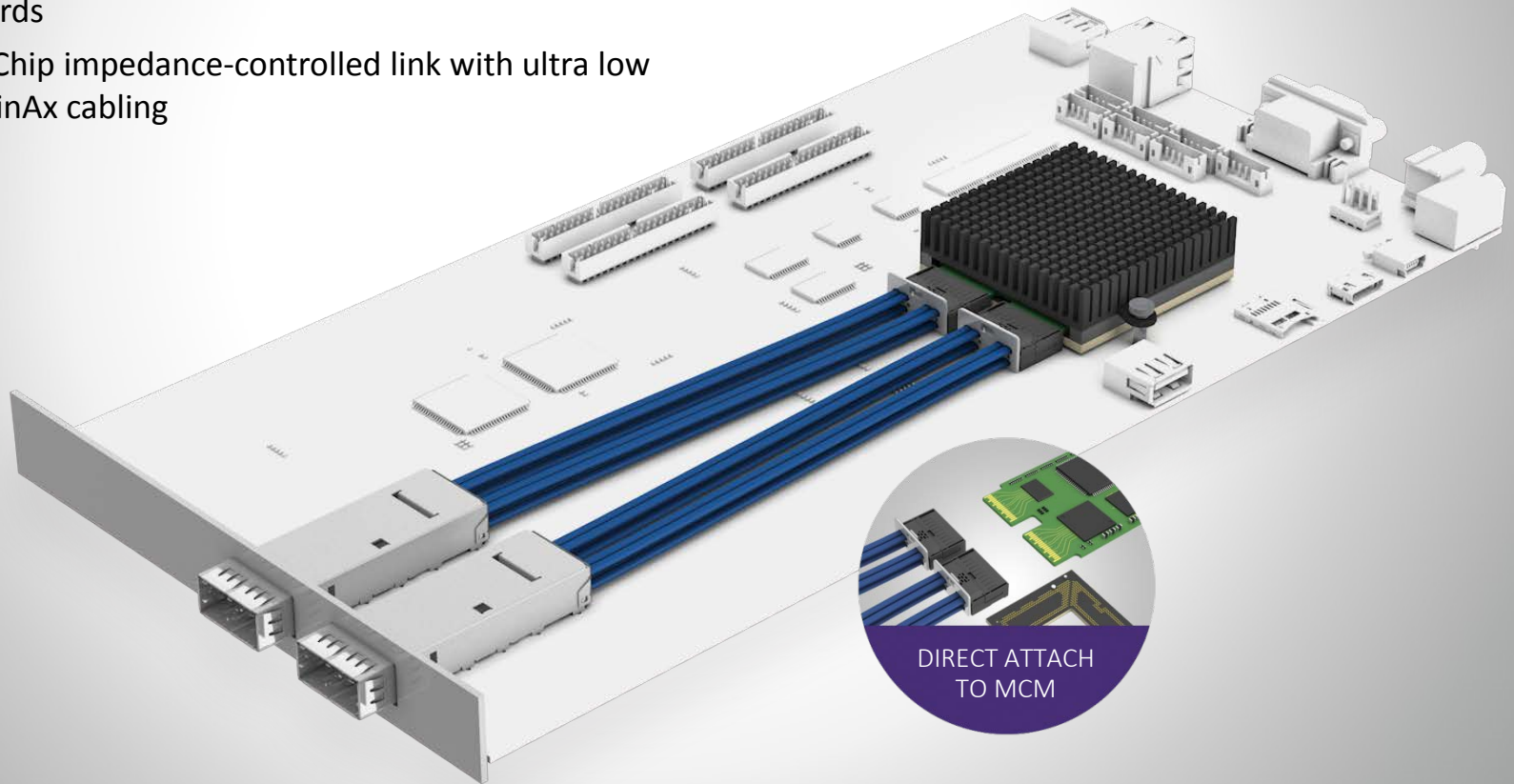


# FLYOVER APPLICATIONS - FQSFP

Direct Attach to Multi-Chip Module

## Bypass Signal Traffic & Loss / Controlled Impedance

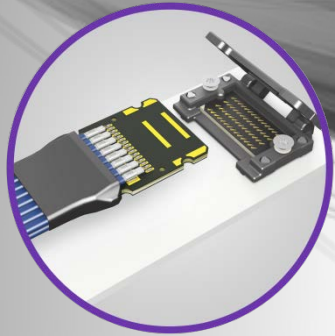
- Ultra low skew Eye Speed® TwinAx direct-to-MCM solution
- Design bypasses BGA signal traffic and loss associated with host boards
- Chip-to-Chip impedance-controlled link with ultra low skew TwinAx cabling





# “END 2” OPTIONS

## HIGH SPEED CABLE-TO-BOARD



**Z-RAY®**  
Ultra Low Profile

**28+ Gbps**

Up to 16 signal  
pairs on  
0.80 mm pitch



**FireFly®**  
Future Proof  
System

**28+ Gbps**

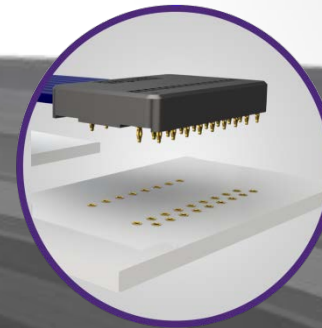
High density  
“futureproof” system  
for copper today and  
equalized or active  
optical tomorrow



**28G Right Angle  
Edge Card**

**28+ Gbps**

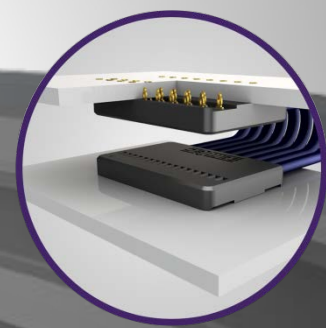
Ultra Micro + Low  
Costs



**DCC**  
2.0

**28+ Gbps**

Meets SAS-4, PCIe®  
Gen 4 and beyond  
  
Lowest Cost HS  
Cable-to-Board



**DCC**  
3.0

**34+ Gbps**  
(Targeting up to 56  
Gbps NRZ)

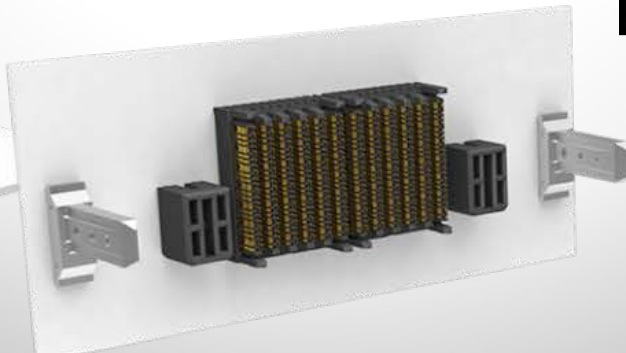
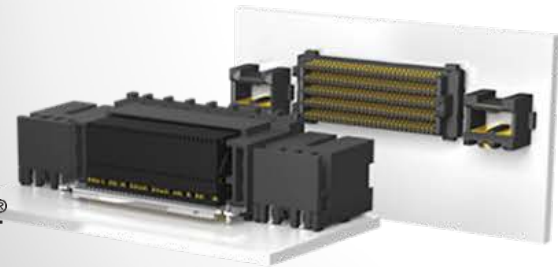
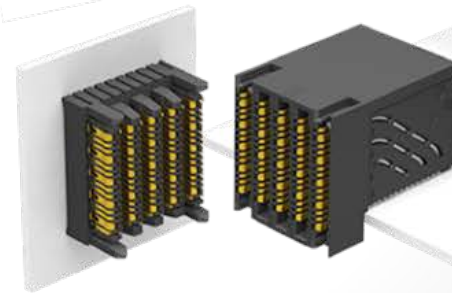
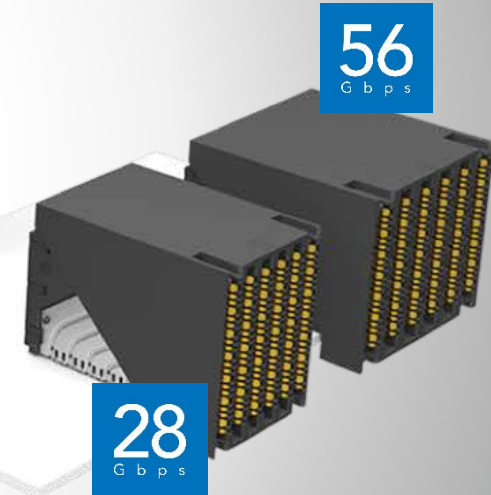
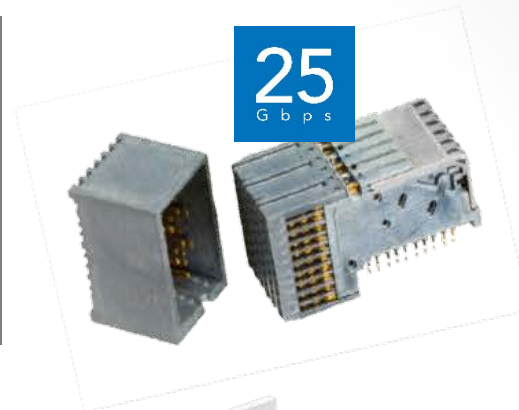
Designed for  
chip-to-chip high  
speed signal traffic

*\* Data Rate based on Channel Operating Margin and/or OIF specifications*



# BACKPLANE / MICRO BACKPLANE

- High Speed Systems to 56 Gbps
- Xcede<sup>®</sup> HD
  - 8-32 Gbps PAM4
- ExaMAX<sup>®</sup>
  - 28-56 Gbps NRZ

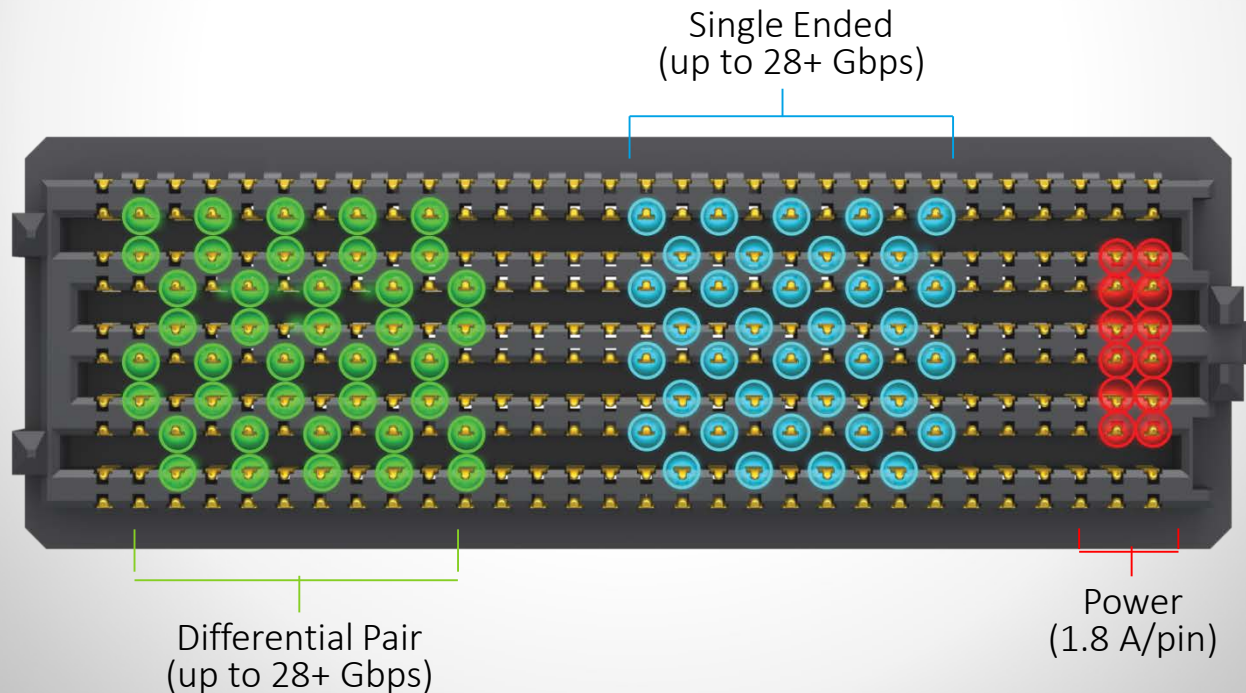


ExaMAX<sup>®</sup>



# SEARAY™ OPEN PIN FIELD ARRAYS

Customer-designated pin assignments of SE, DP and Power possible within the same interconnect.

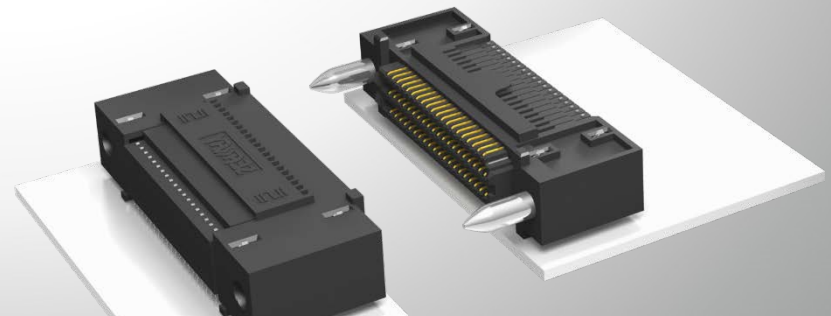
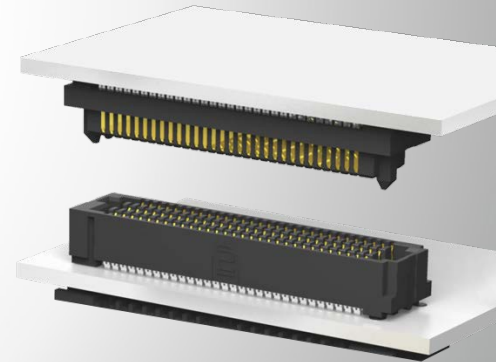


# SEARAY™ OPEN PIN FIELD ARRAYS

- Three product types, *all with 28+ Gbps performance*
  - SEARAY 1.27mm with IPC-A-610F Class 3 solder joint
  - SEARAY 0.80 mm for highest density
  - SEARAY LP for lowest profile
- Lower insertion/extraction forces vs. typical array products
- Open pin field for maximum grounding and routing flexibility
- Differential Vias™ for optimized PCB routing in DP applications

**SEARAY™**

**28+**  
G b p s



# SEAF8-RA/SEAM-EW

SEAF8-RA: RELEASED  
SEAM8-EW: Q4 2016

## SEAF8-RA

- Right-angle open-pin-field SEAF8
- 8 and 10 rows: Released
- 20, 30, 40, 50 positions per row
- 2X the density of SEAF-RA
- SEAM-GP also released



**SEARAY**<sup>TM</sup>.8mm

## SEAM8-EW (EXTENDED WIPE)

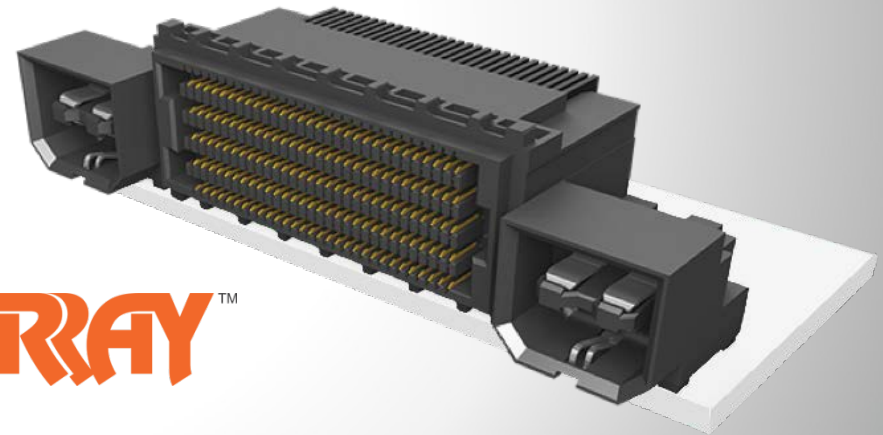
- Allows for **2 mm of wipe** when combined with SEAF8-RA
- 2 mm is the magic number for backplane connectors

28  
Gbps

## UBPS/UBPT – SEARAY™ Power Modules

- 20 A per module (4 contacts x 5 Amps)
- Designed for SEARAY and SEARAY .8 mm
- Phase 1: DV-RA, Phase 2: DV-DV
- Staging between ground and power
- 3 stages when combined with SEAXX
- Press-fit termination only

28  
Gbps



SEARAY™

SEARAY™.8mm

samtec



# SEARAY™ LOW PROFILE

# SEARAY™ LP

## SEARAY™ LP for lowest profile

28+  
Gbps

- Stack height: 4 mm, 4.5 mm or 5 mm
- Pitch: 1.27 mm
- Positions: 40 to 320
- Termination: solder crimp
- Dual beam contact system
  - Two points of contact for higher reliability
- Orientation: parallel

**Series:** LPAM, LPAF

Stack height  
As low as  
**4mm**



samtec

# ExaMAX<sup>®</sup>

The high-speed, cost-effective backplane system capable of **25+ Gbps today** and **56+ Gbps in the future**.



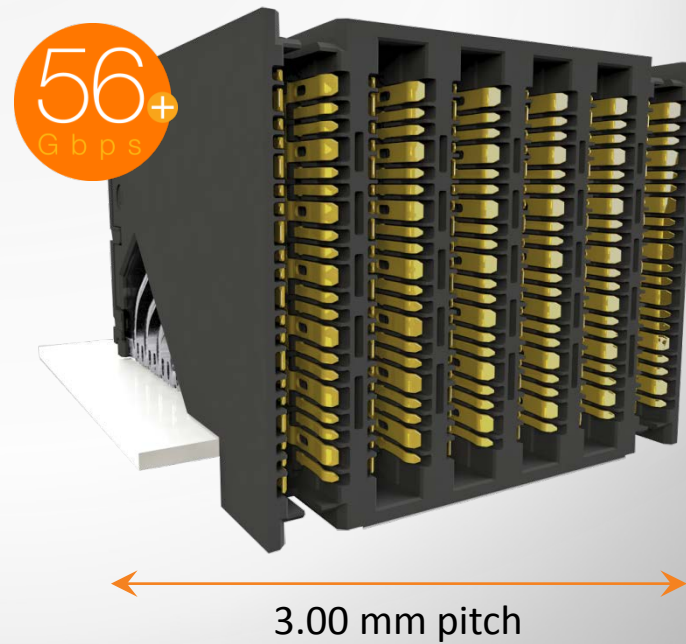
# HIGH DENSITY & HIGH SPEED

ExaMAX<sup>®</sup> is available in various column pitches allowing designers to optimize density or minimize board layer count for high-speed designs.

## High Density 25+ Gbps



## High Speed 56+ Gbps

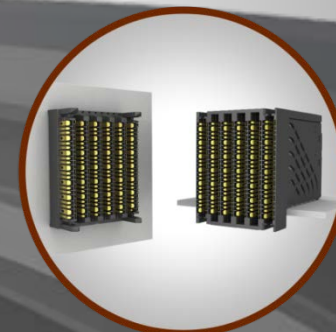
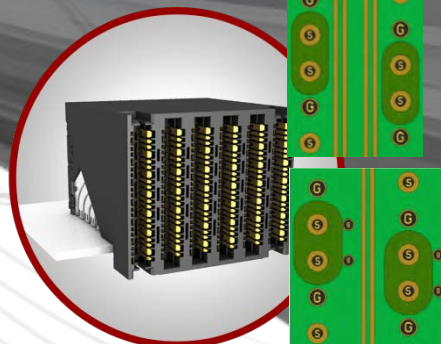
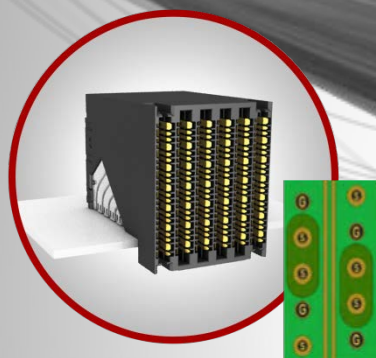


# FUTURE BACKPLANE POSSIBILITIES

AirMax®	XCede® HD	ExaMAX®	Paladin™
			
<b>6 – 10 Gbps NRZ</b>	<b>10 – 25 Gbps</b>	<b>25 – 56 Gbps</b>	<b>56 – 112 Gbps</b>

# ROADMAP

## ExaMAX<sup>®</sup> Traditional BACKPLANE SYSTEM



### ExaMAX<sup>®</sup> 2 mm

### ExaMAX<sup>®</sup> 3 mm

### ExaMAX<sup>®</sup> Plus

### New System

28 Gbps NRZ

56 Gbps NRZ

56 Gbps PAM4

56 Gbps NRZ/  
112 Gbps PAM4

Up to 8 pair/col,  
2 mm column pitch

Up to 8 pair/col,  
3 mm column pitch

Same or better density  
than ExaMAX 2 mm

Better density than  
ExaMAX 3 mm

Most Dense

Double track routing

Most Dense

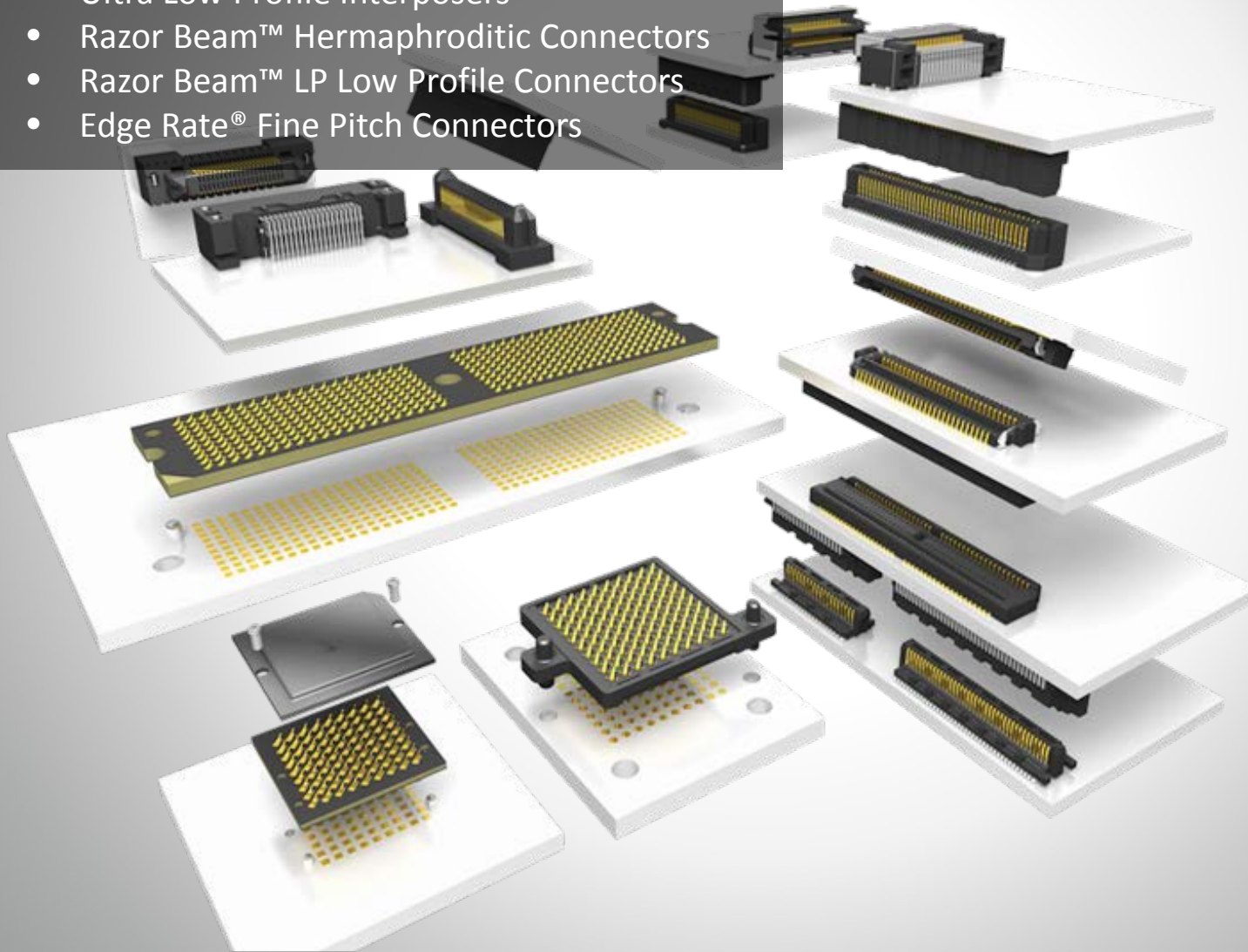
Blazing fast and dense

*\* Data Rate based on Channel Operating Margin and/or OIF specifications*

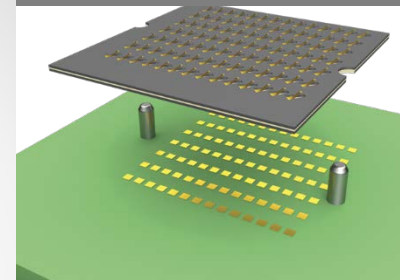


# ULTRA MICRO INTERCONNECTS

- Ultra Low Profile Interposers
- Razor Beam™ Hermaphroditic Connectors
- Razor Beam™ LP Low Profile Connectors
- Edge Rate® Fine Pitch Connectors



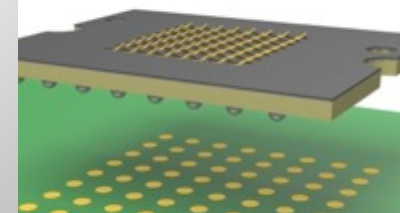
## ROADMAP



56 to 100 Gbps Z-Ray®



Ultra Micro Cables



Z-Ray®  
Multilayer System

# Z-ray<sup>®</sup> low profile interposer

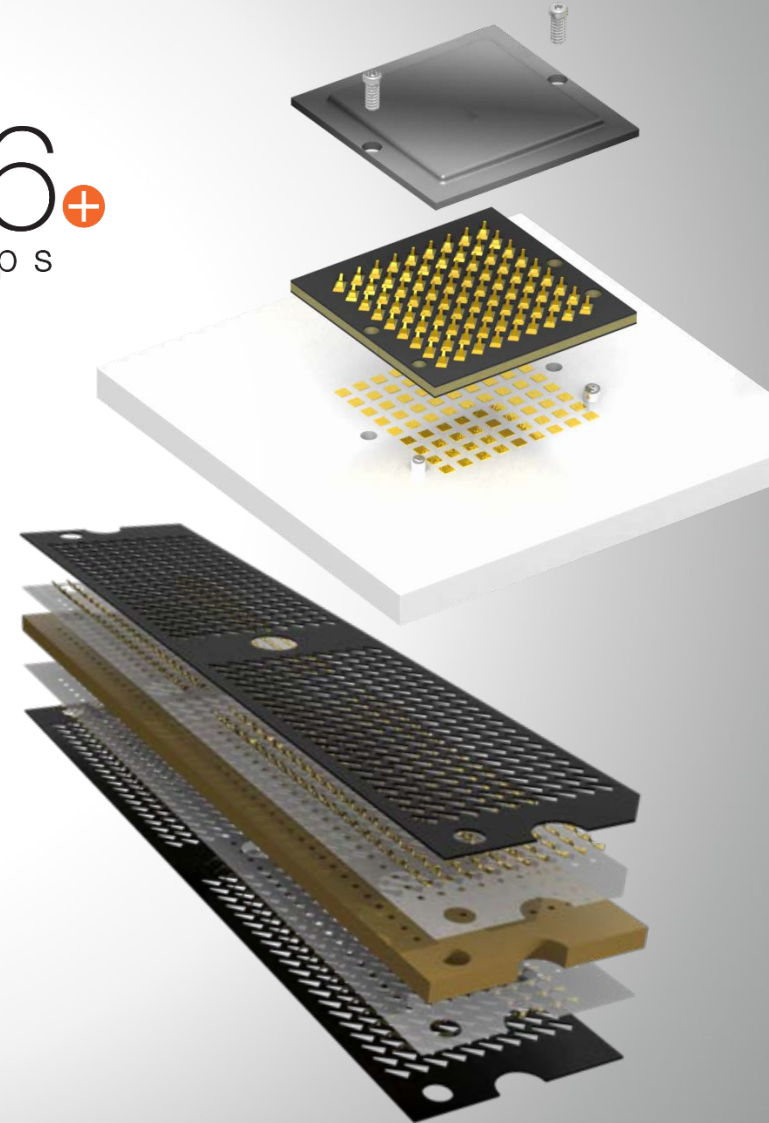


## Specifications

- 56+ Gbps
- 4,000 cycles
- Stack height: 0.30 mm to 4 mm (1 mm standard)
- .008" contact deflection
- 500 mA per line
- 25 grams per line of normal force
- Differential Vias<sup>™</sup> PCB routing available

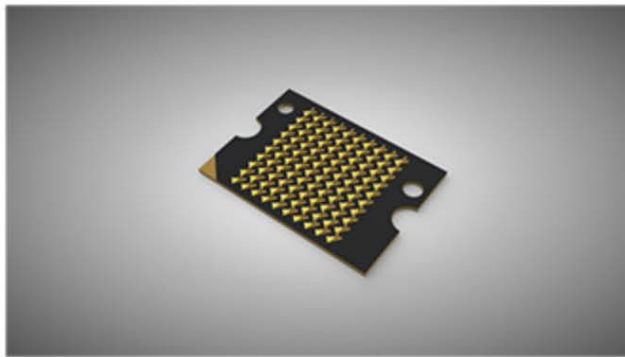
56+  
G b p s

Stack height  
as low as  
**0.30 mm**

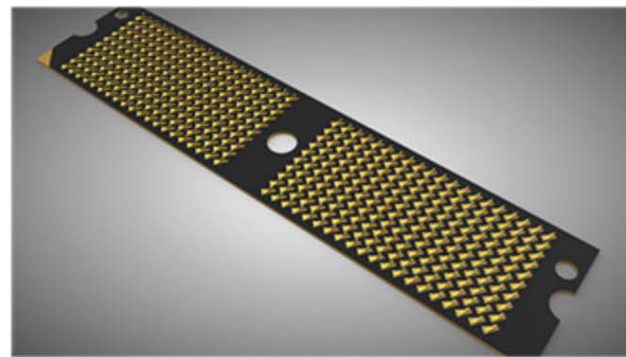


# CUSTOM CAPABILITIES

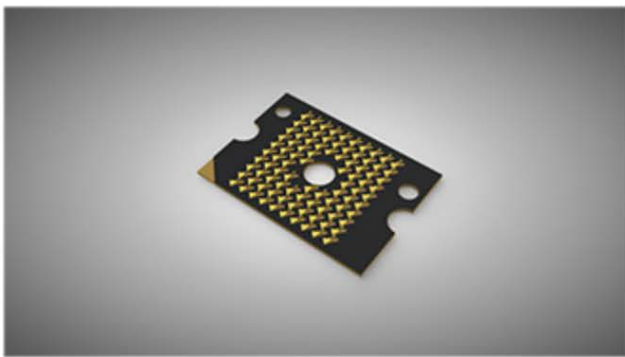
Customizable in X-Y-Z axes for ultra micro applications



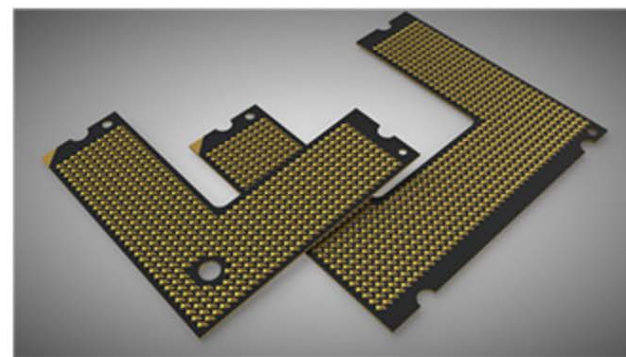
SQUARE



RECTANGLE



ALIGNMENT & SCREW  
HOLE OPTIONS

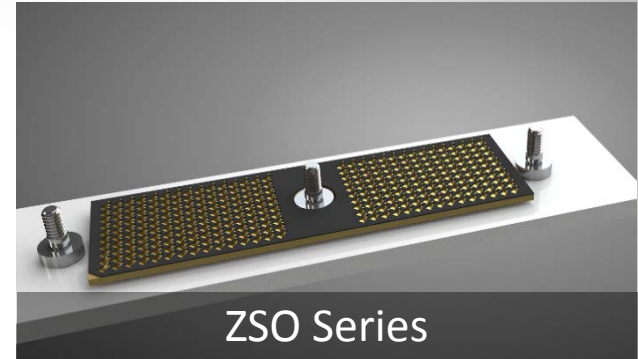


CUSTOMER-SPECIFIC  
SHAPES

# Z-RAY® HARDWARE SYSTEMS

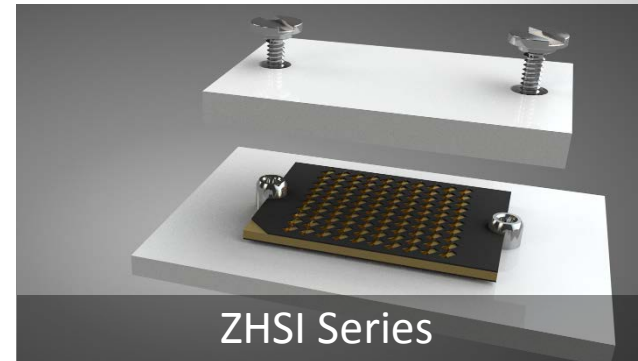
## ZSO Series

Used with single-compression Z-Ray® products that have beams that fully compress on one side and solder balls on the other.



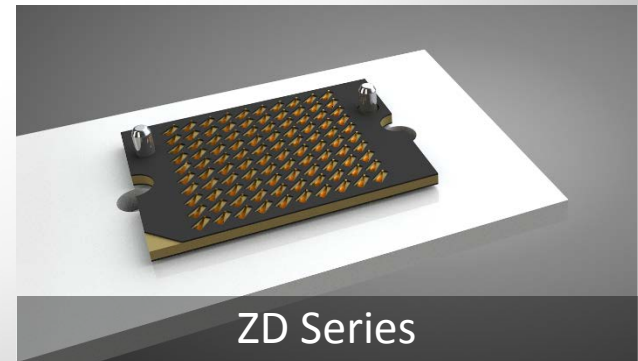
## ZHSI Series

Used with dual-compression Z-Ray® products that have beams that fully compress on both sides of the connector.

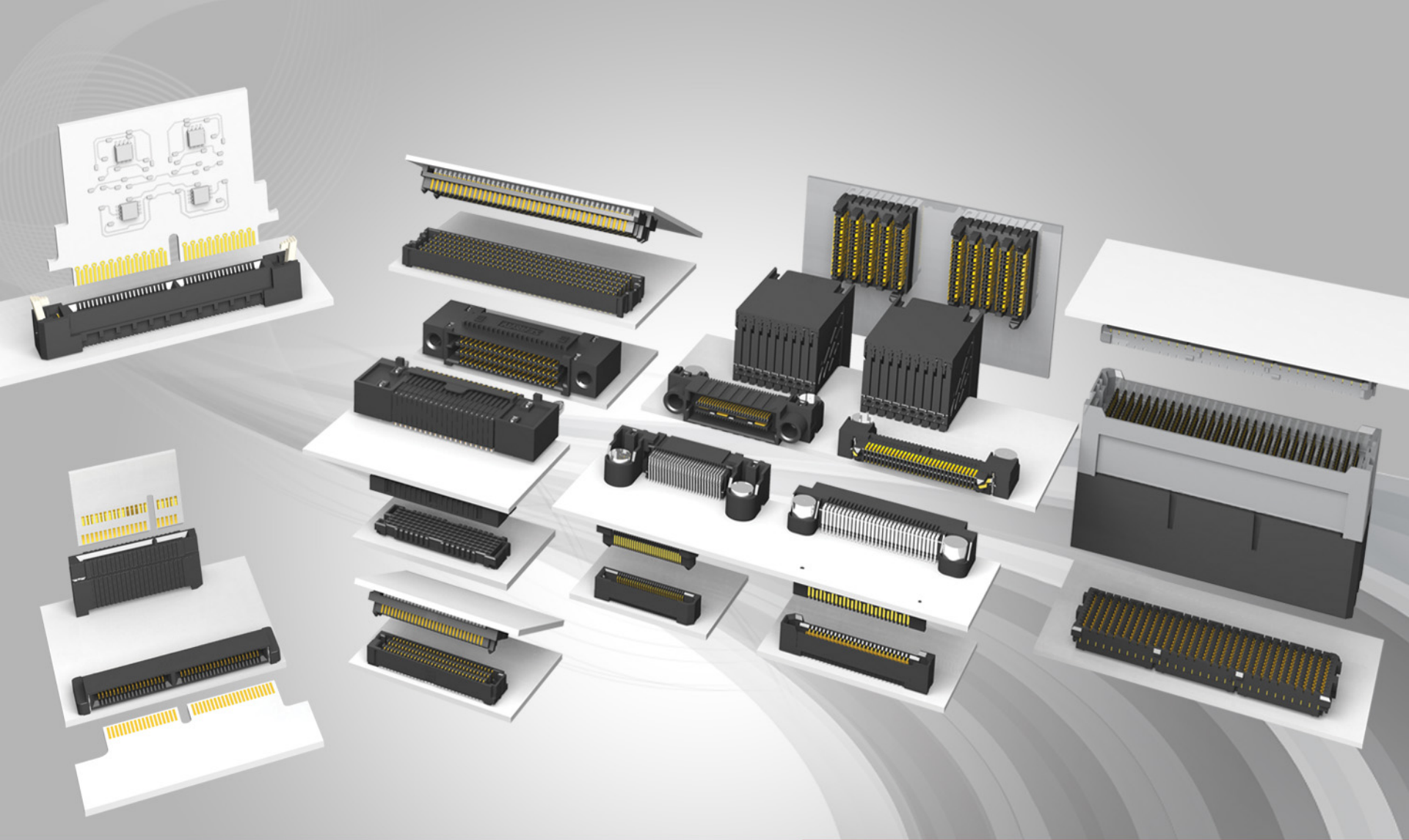


## ZD Series

Used alongside off-the-shelf retention hardware to provide alignment for dual-compression Z-Ray® products.







# HIGH SPEED BOARD-TO-BOARD

Ultra High Density Arrays  
Low Profile Arrays  
Edge Card Systems  
Backplane Systems  
Ground Plane Connectors

# HIGH SPEED EDGE CARD

## High performance edge card, HSEC8 Series

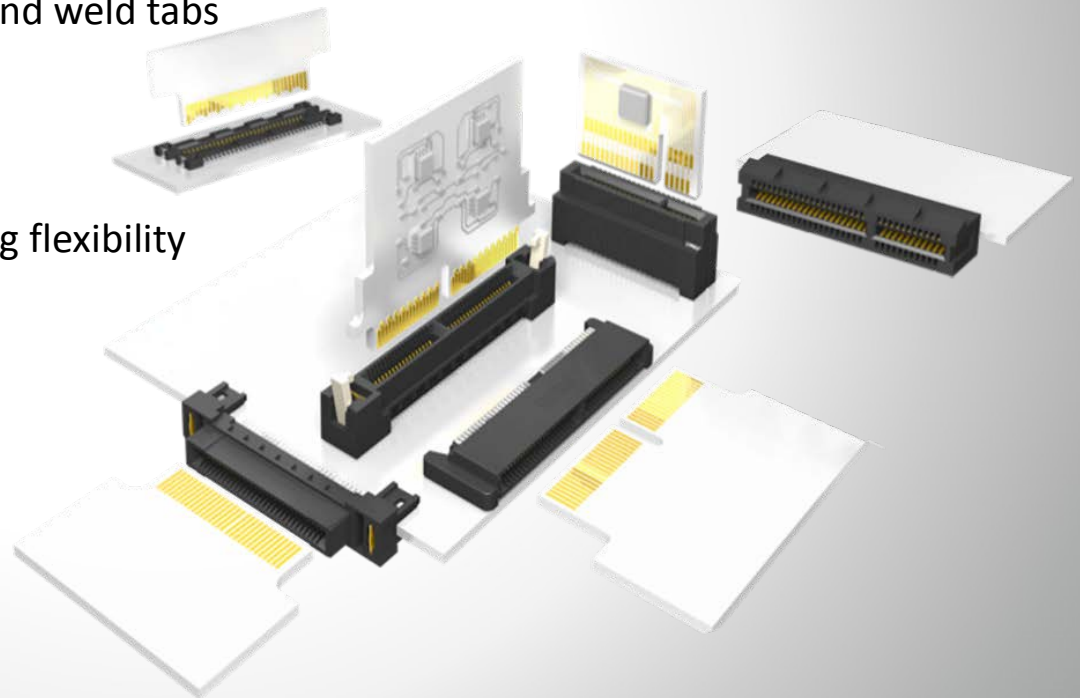
- Up to 37 Gbps, 0.80 mm pitch
- Pass-through or signal/power combination available
- Vertical, right angle, and edge mount
- Rugged Edge Rate® contacts optimized for signal integrity performance
- Optional board locks, cable latching, and weld tabs

## Serial ATA, SAL1 Series

- SATALink™ compatible, 1 mm pitch
- Low profile, board stacking and routing flexibility

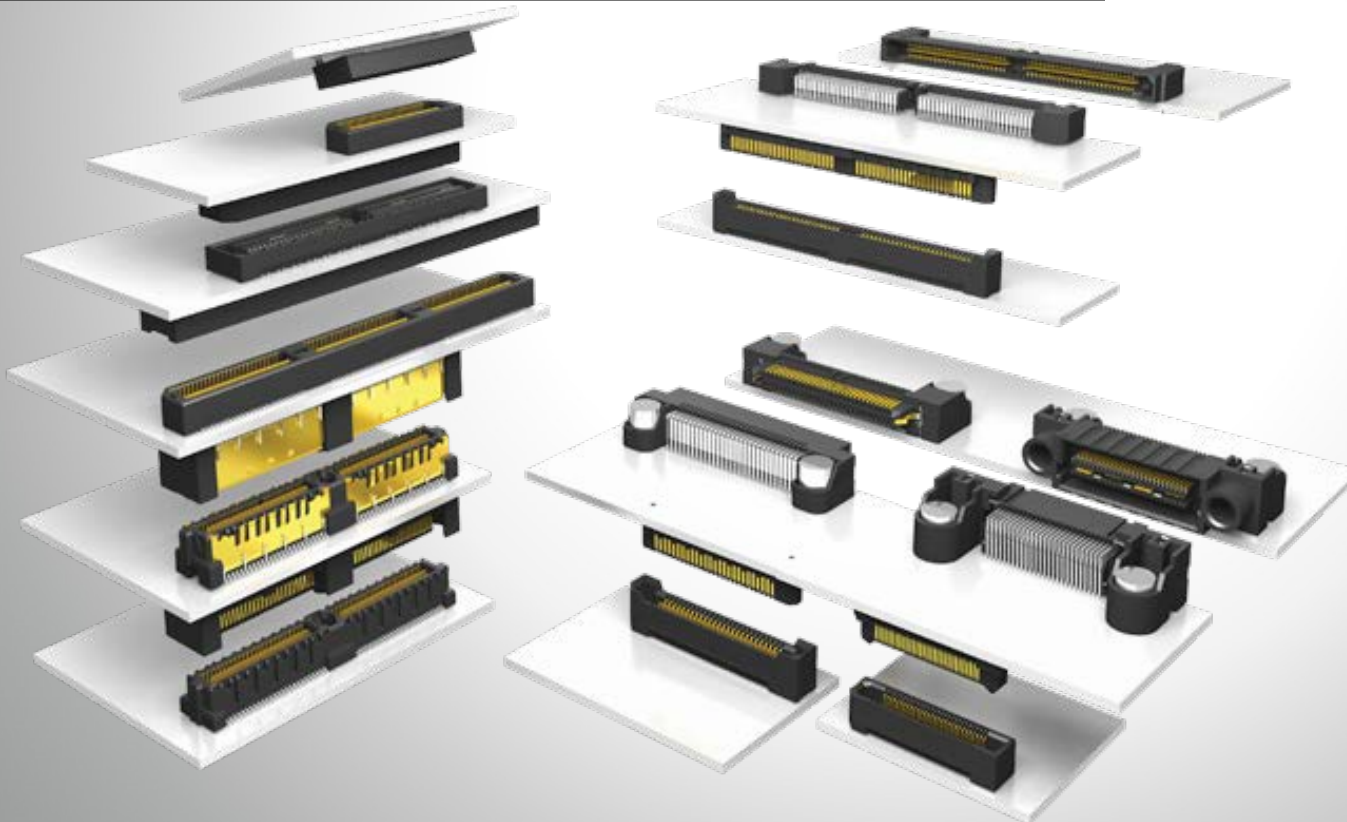
## PCI Express® socket, PCIE Series

- PCIe® compatible, 1 mm pitch
- Vertical, right angle, and edge mount

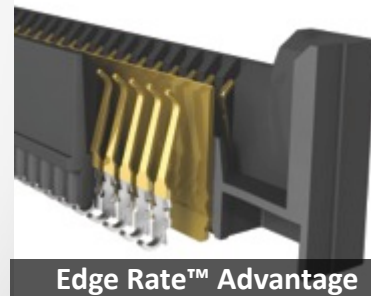
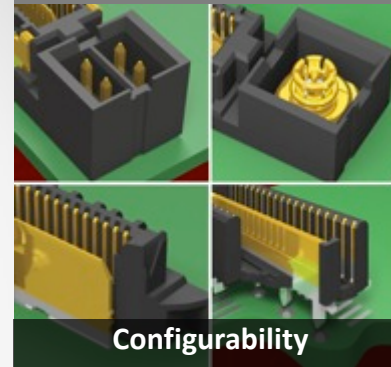


# HIGH SPEED BOARD-TO-BOARD SYSTEMS

- Ground Plane connectors
  - Q Strip® 28+ Gbps Low Profile Connectors
  - Q Rate® 28+ Gbps Slim Connectors
  - Q2™ 28+ Gbps Rugged Connectors
- Edge Rate
  - 28+ Gbps Rugged Connectors



## FLEXIBILITY



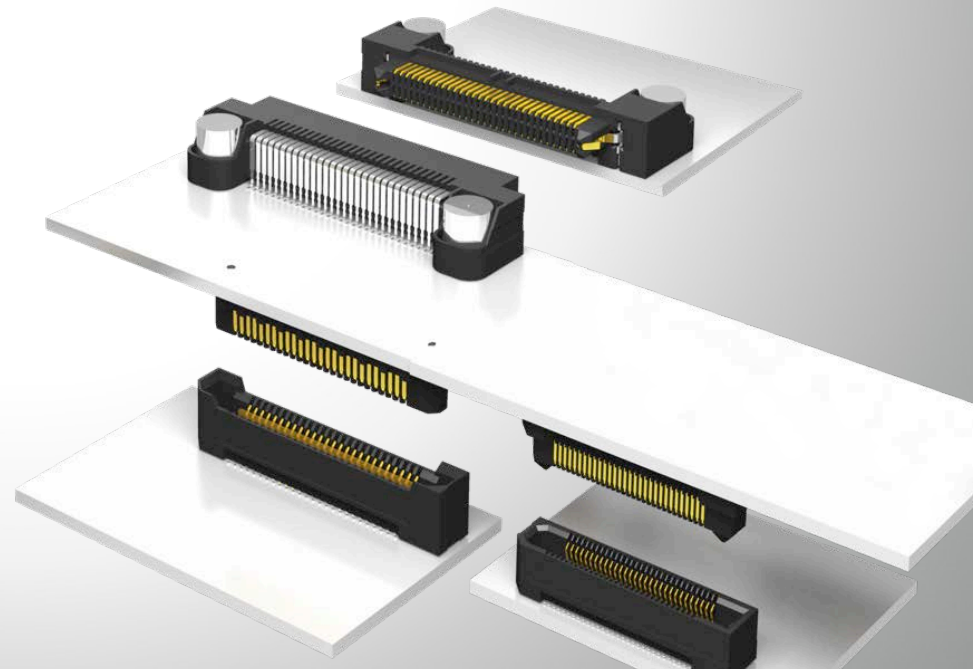
# EDGE RATE®

## Edge Rate® Rugged Connectors

- Edge Rate® contacts optimized for Signal Integrity performance
- Robust when “zippered” during unmating
- 1.5 mm contact wipe on 0.80 mm pitch
- 1.00 mm contact wipe on 0.50 mm pitch
- Up to 40% PCB space savings with 0.50 mm system
- Stack heights from 7 mm to 16 mm
- Right angle and edge mount
- Metal friction latches available



28+  
G b p s







# MICRO/RUGGED

Power Interconnects  
Flexible Sealed Circulars  
Tiger Eye™ Systems  
Discrete Wire Systems

# CONTACT FLEXIBILITY

## Tiger Eye™ System

High reliability  
High mating cycles  
IDC cable assemblies  
Discrete wire

- Multi-finger contact
- Board-to-board



## Tiger Buy™

High retention  
Cost effective  
Tuning fork contact



## Tiger Claw™

Pass-through  
Ultra low profile  
Dual wipe contact



## Tiger Beam™

- Best cost
- Reliable performance
- Post and beam contact



## Blade & Beam

- Micro pitch
- Mating/alignment “friendly”
- Cost effective



## Edge Rate™

- Designed for Signal Integrity
- Reduced broadside coupling
- Rugged contact system
- Smooth broad milled surface for high cycles



## Razor Beam™

Rugged retention notch  
Ultra-fine pitch  
High speed  
Low profile to elevated designs



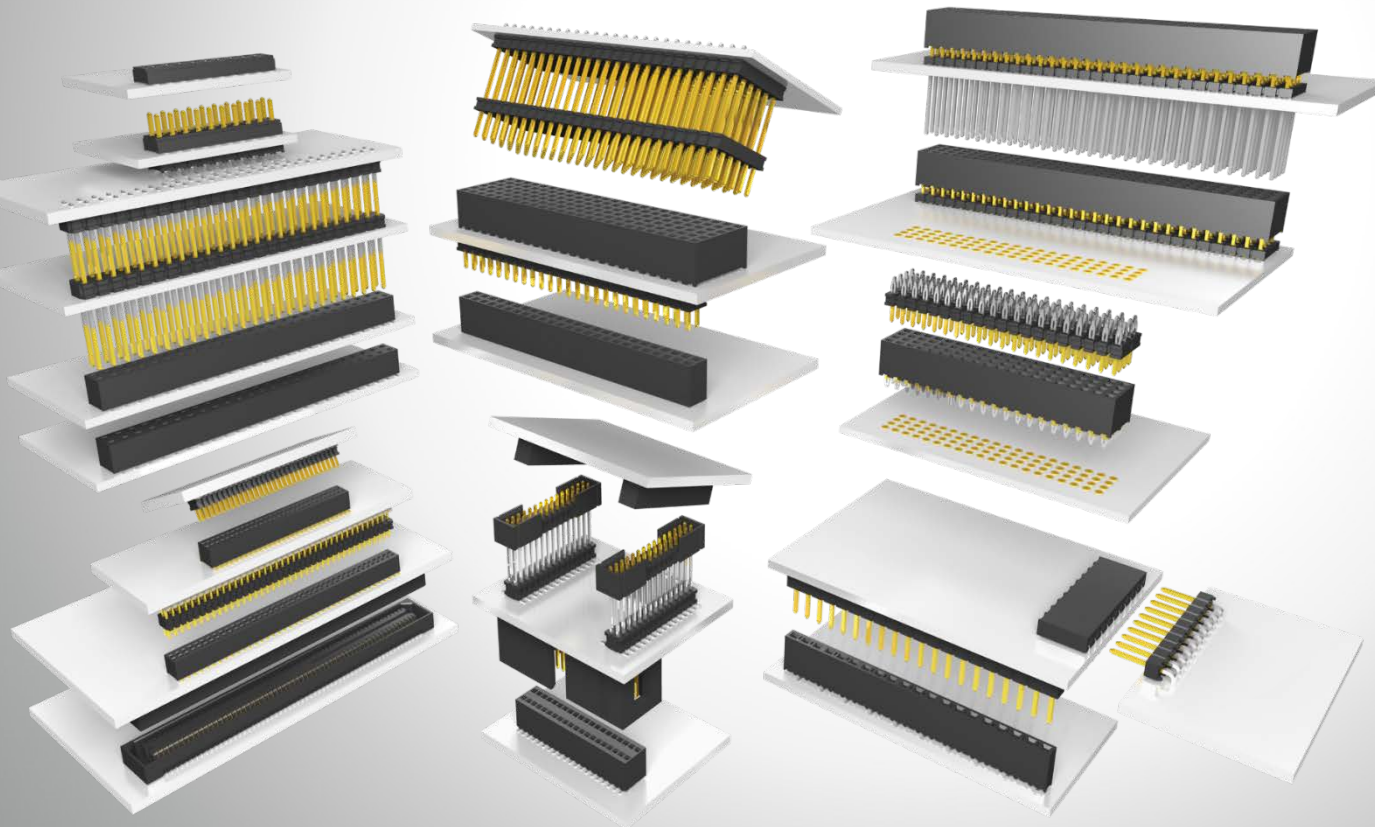
## Machined

- Multi-finger BeCu contact
- Precision machined shell



# FLEXIBLE STACKING

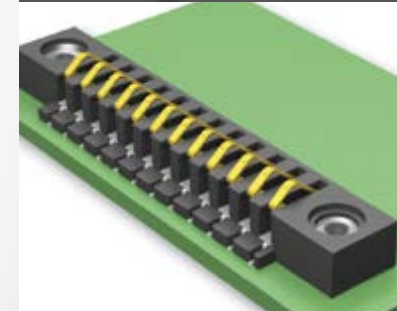
- Flexible Board Stackers
- One Piece
- Micro Blade-and-Beam



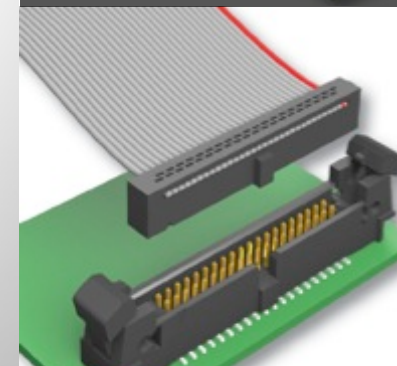
## FLEXIBILITY



Contact Flexibility



One Piece Interfaces

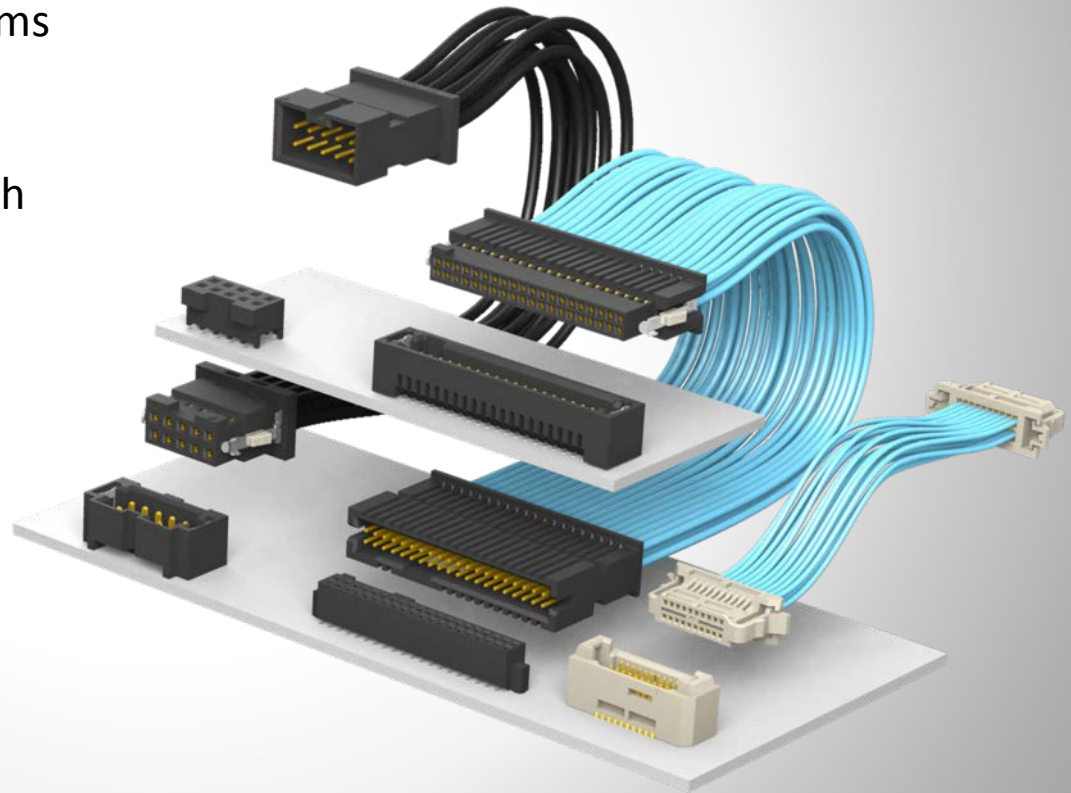


Cable and Header Mates



# TIGER EYE™ DISCRETE WIRE

- High reliability
- Multi-Finger contacts
- Metal and plastic latching systems
- Screw down options
- PVC or \*Teflon® cable
- 0.8 mm, 1.27 mm, or 2 mm pitch



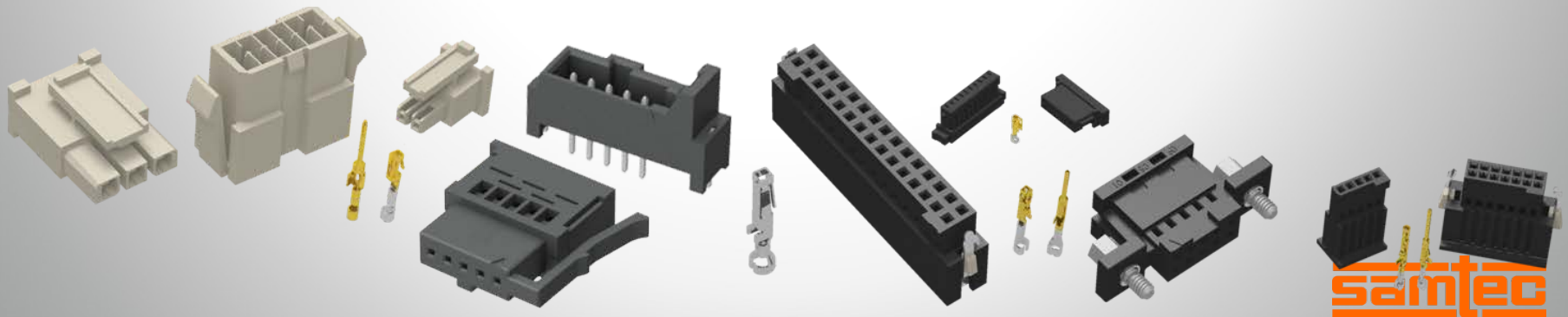
\*DuPont™ Teflon® is a registered trademark of the E.I. du Pont de Nemours and Company or its affiliates.

**samtec**

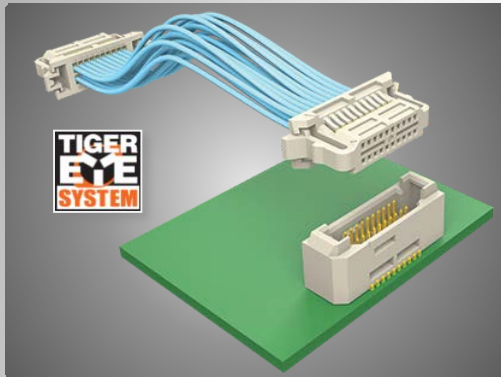


# DISCRETE WIRE & IDC CABLE COMPONENTS

- A broad selection of housings and contacts for build-it-yourself design and application flexibility
- High reliability BeCu Tiger Eye™ contacts on 0.80 mm, 1.27 mm and 2.00 mm pitches, 32 - 24 AWG wire, housings, screw downs, plastic and metal latches
- 1,00 mm dual leaf contacts, 30 - 28 AWG wire, housings and latches
- 2.00 mm IDC components, 24 AWG wire and latches
- Mini Mate® and Power Mate® housings, contacts, 30 - 16 AWG wire, plastic and metal latches



# SESDT/S1SD/S1SS



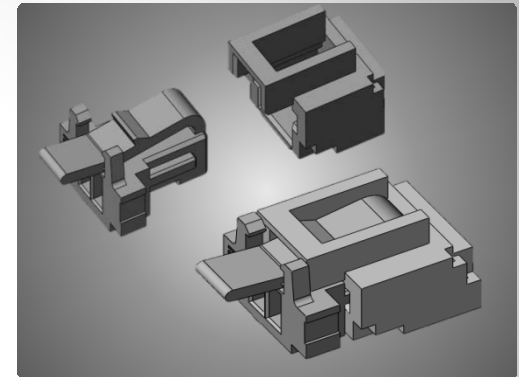
## SESDT (RELEASED)

- Samtec's smallest pitch: .8 mm
- Components and tooling available for field termination
- Tiger Eye™ contact system
- Double row crimp and poke
- Rugged end latches
- Mates with new DV TEM
- 32 AWG Teflon wire
- Current rating ~1.0 A per contact
- 5, 10, 15 & 20 position per row



## S1SD (RELEASED)

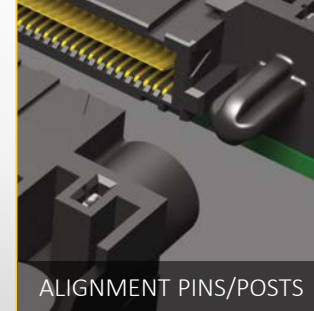
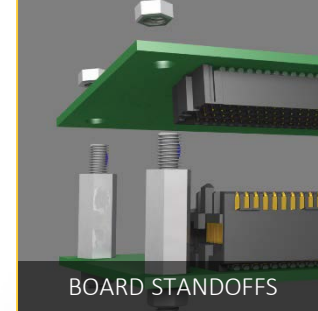
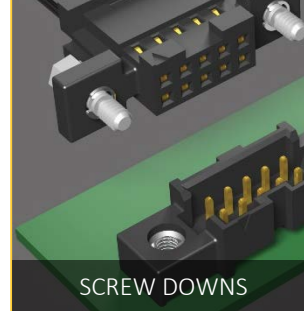
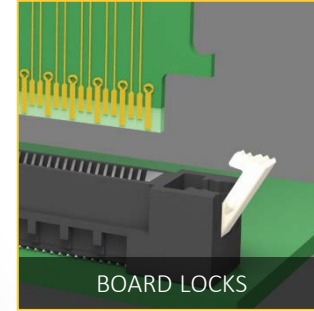
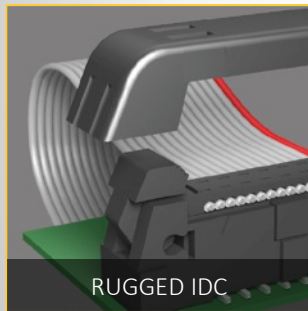
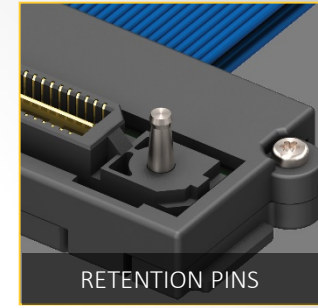
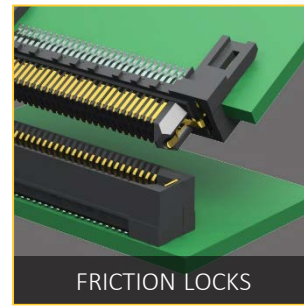
- 1 mm pitch
- Dual row
- Standard rugged end latches
- 28 and 30 AWG
- Mates with new DV & RA T1M
- 2-10 positions per row



## S1SS-L (RELEASED)

- Mates with new DV & RA T1M
- Available in all current S1SS positions
- Compatible with current footprint
- *2-5 Released*
- 6-20 in late Q1

# RUGGED FEATURES AND OPTIONS





**THANK YOU**