



TEST CONNECTIVITY SOLUTIONS GUIDE

INTERCONNECT SOLUTIONS FOR NEXT GENERATION TEST EQUIPMENT



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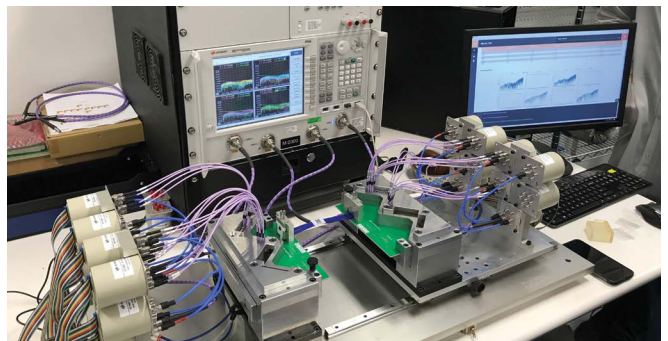
TEST CONNECTIVITY

INTERCONNECT SOLUTIONS & CAPABILITIES

5G Networking, HPC/AI and Automotive 2.0 are driving unprecedented industry growth, along with **massive increases in bandwidth, frequency and density requirements**. The complexities of the resulting system architectures have intensified demand for **advanced production test systems for semiconductors, module hardware, connectors and cables**. Samtec offers a broad range of high-performance connectivity solutions, as well as industry-leading signal integrity support for these next gen test platforms.

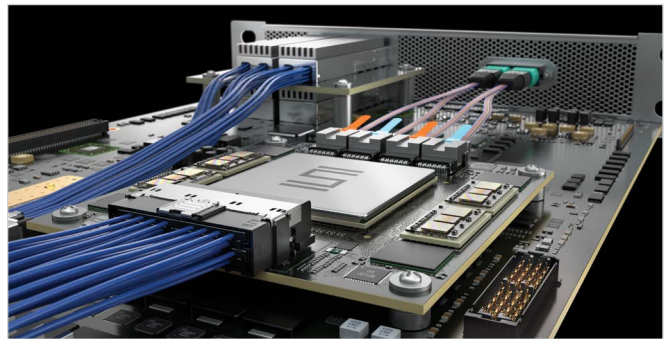
TEST & DEVELOPMENT EXPERTISE

Rapidly increasing signal integrity requirements have driven Samtec to internally develop hardware for high-level testing of our interconnect solutions, resulting in a unique understanding of the demands and challenges of advanced test instrumentation connectivity.



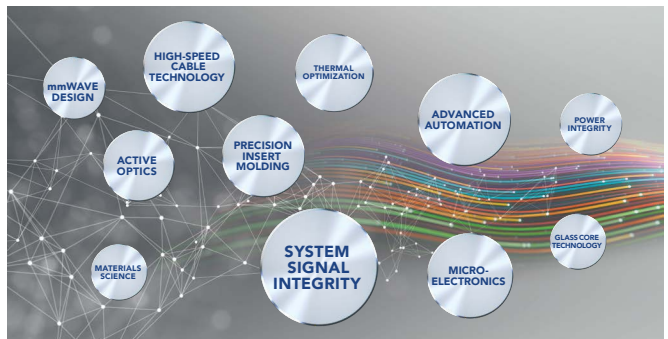
HIGH-PERFORMANCE INTERCONNECT SOLUTIONS

Samtec offers a broad line of cost-effective, high pin count, extreme performance / density, and high mating cycle interconnect solutions, ideal for a wide range of high-performance test platforms.



FULL SYSTEM SUPPORT

Samtec's fully integrated business model enables true collaboration, which results in innovative products and technologies, along with industry-leading expertise that allows us to offer effective strategies and support for optimizing the entire high-performance signal channel.



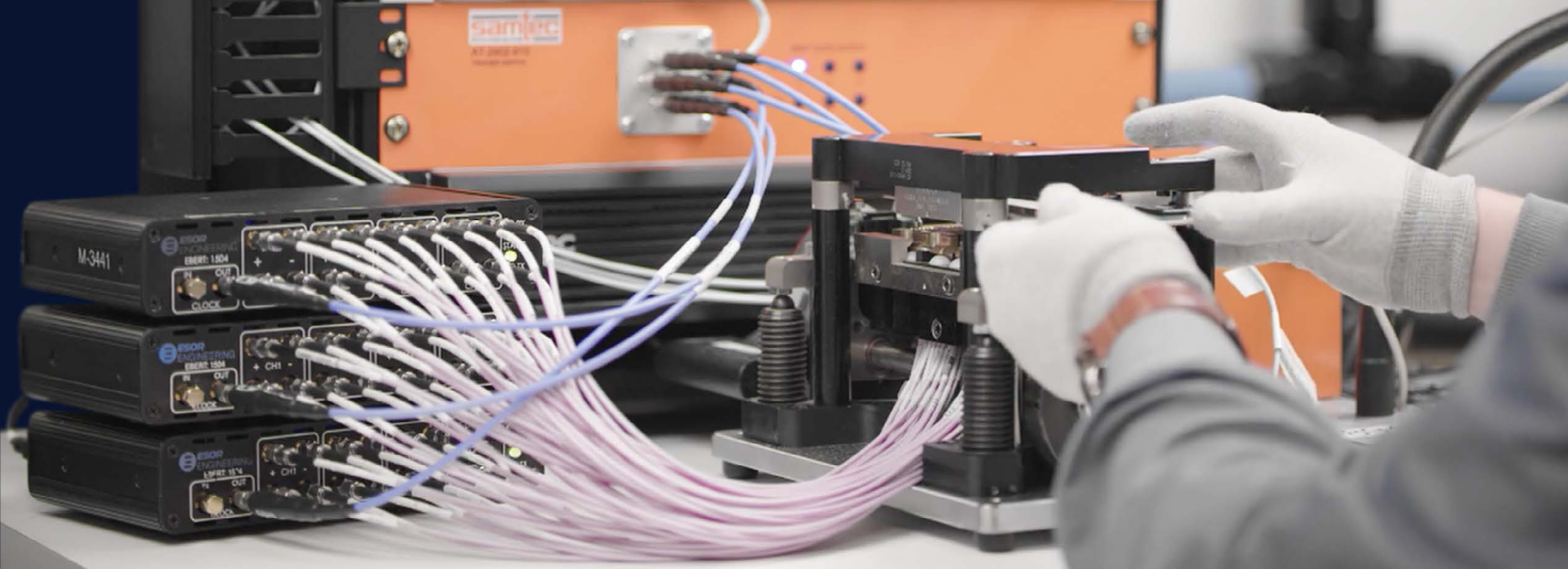


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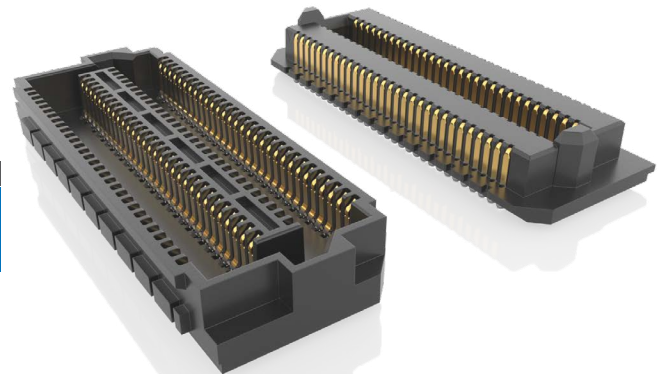
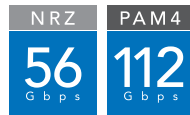
Integration Leads to Innovation
 Signal Integrity Services & Support
 Testing Capabilities
 Design & Development Tools



HIGH-DENSITY ARRAYS

ACCELERATE® HP HIGH-PERFORMANCE ARRAYS

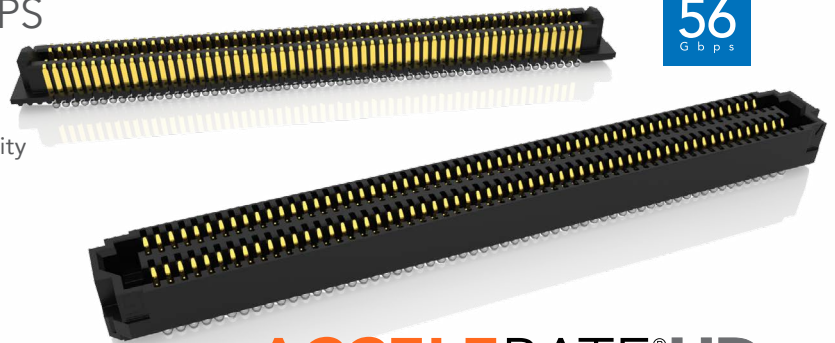
- Flexible open-pin-field
- Cost optimized, extreme performance solution
- Four row design with up to 400 total pins; roadmap to 1,000+ pins
- Low-profile 5 mm stack height and up to 10 mm
- 0.635 mm pitch
- Data rate capable with PCIe® 5.0 and 100 GbE
- Cable assembly in development (see page 8)



ACCELERATE® HP

ACCELERATE® HD ULTRA-DENSE, MULTI-ROW STRIPS

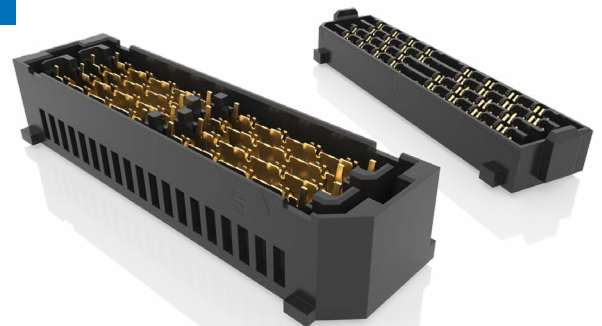
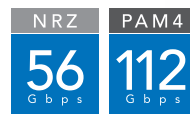
- Up to 400 I/Os in a 4-row design
- Open-pin-field design for grounding and routing flexibility
- 0.635 mm pitch Edge Rate® contacts
- Low profile 5 mm stack height and slim 5 mm width
- Right-angle and other stack heights in development



ACCELERATE® HD

NOVARAY® EXTREME DENSITY & PERFORMANCE ARRAYS

- 4.0 Tbps aggregate data rate - 9 IEEE 400G channels
- Two points of contact ensure a more reliable connection
- Fully shielded differential pair design
- Extremely low crosstalk (to 40 GHz) and incredibly tight impedance control
- Minimal variance in data rate as stack height increases
- Utilizes 40% less space with the same data throughput as compared to traditional arrays
- Terminal with latching available to mate with NovaRay® cable (NVAM-C Series; see page 9)

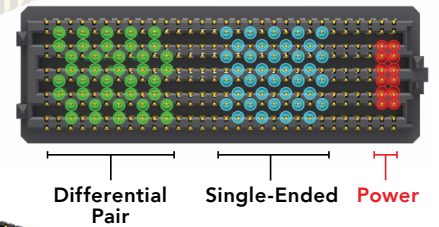
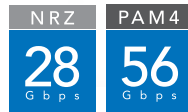
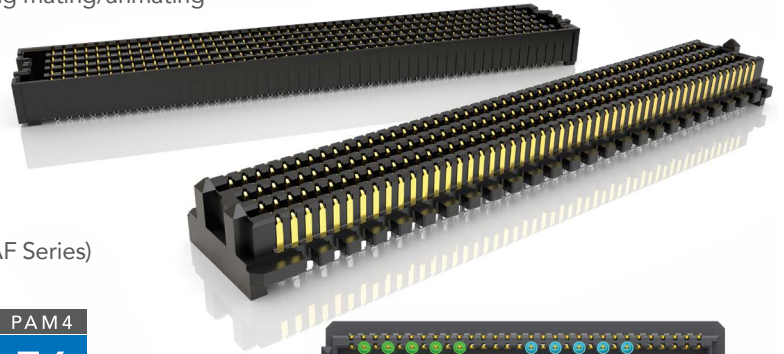


NOVARAY®

SEARAY™ HIGH-DENSITY OPEN-PIN-FIELD ARRAYS

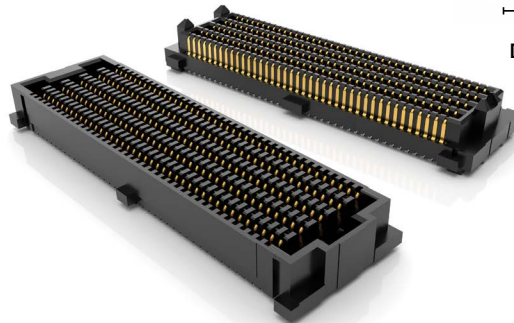


- Open-Pin-Field Arrays offer maximum routing and grounding flexibility
- Rugged Edge Rate® contact system can be “zippered” during mating/unmating
- Lower insertion/extraction forces
- Solder charge terminations for ease of processing
- Meets Extended Life Product™ (E.L.P.™) standards
- SEARAY™ 1.27 mm Pitch Open-Pin-Field-Arrays (SEAM/SEAF Series)



- Up to 560 I/Os; 7 – 40 mm stack heights
- Vertical, right-angle and press-fit designs
- Performance to 28 Gbps NRZ/56 Gbps PAM4 (up to 32 Gbps NRZ at certain stack heights; contact sig@samtec.com for details)
- VITA 57, VITA 74, Pismo 2 certified

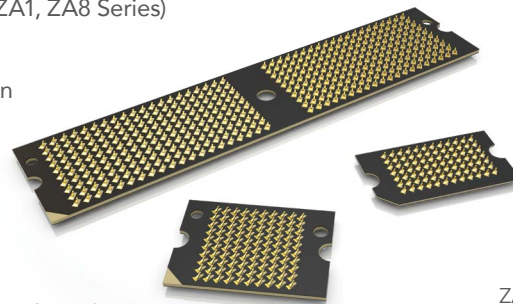
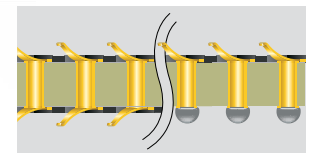
- SEARAY™ 0.80 mm Pitch Ultra High-Density Arrays (SEAM8/SEAF8 Series)
- Up to 720 I/Os & 7 or 10 mm stack heights
- Right-angle or vertical design
- 56 Gbps PAM4 performance
- IPC Class 3 qualification in process



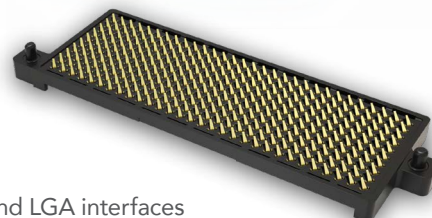
HIGH-SPEED COMPRESSION INTERPOSERS



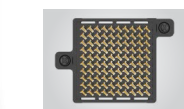
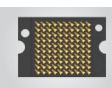
- Z-Ray® High-Speed, Ultra Low Profile Interposers (ZA1, ZA8 Series)
- 0.33 mm & 1 mm standard body heights
- Dual compression contacts or single compression with solder ball
- Performance up to 56 Gbps NRZ
- 0.80 mm (ZA8) or 1.00 mm (ZA1) pitch standard
- Highly customizable system



- High-Speed, Low Profile One-Piece Interposers (GMI Series)
- 1.27 mm standard body height
- 1.00 mm pitch with 100 – 300 total pins
- Dual compression contacts
- Minimizes thermal expansion issues
- Ideal for low cost board stacking, module-to-board and LGA interfaces



ZA8 Series; 100 pins (actual size shown)



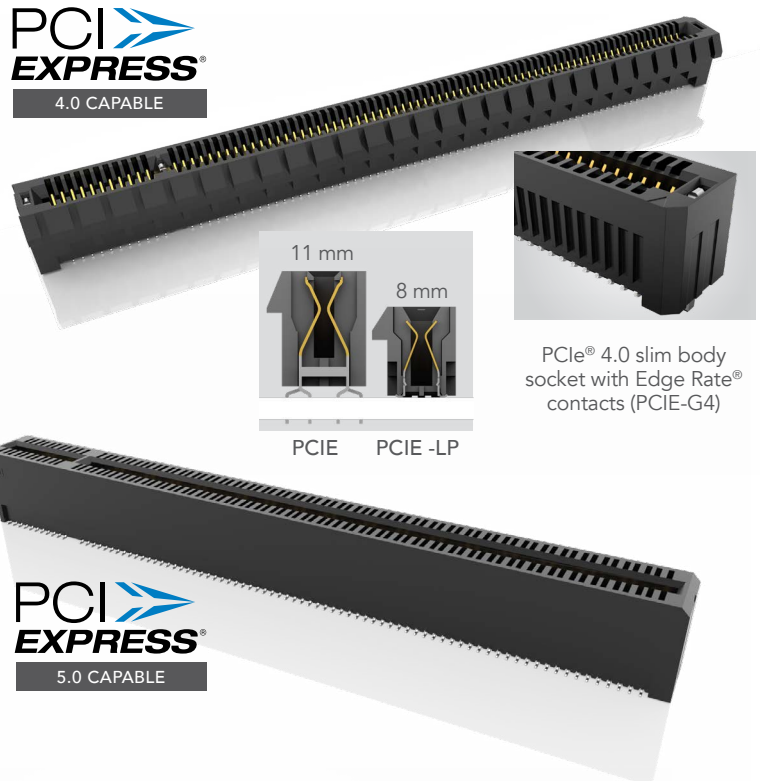
GMI Series; 100 pins (actual size shown)



HIGH-SPEED BOARD-TO-BOARD

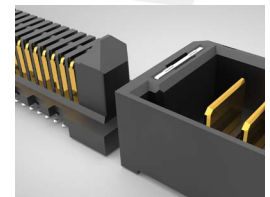
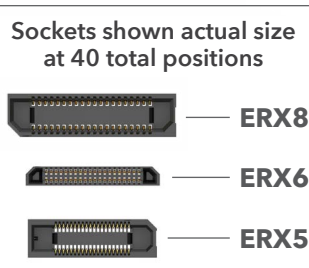
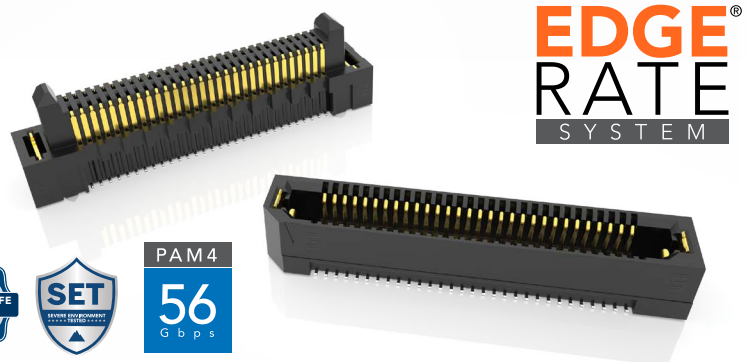
PCI EXPRESS® 4.0 & 5.0 SOCKETS

- PCIe® 4.0 Capable (PCIe-LP)
 - 1.00 mm pitch in x1 (36P), x4 (64P), x8 (98P) and x16 (164P) configurations
 - Low profile version for space savings; through-hole tails in development
 - PCI Express® Jumpers available
 - Mates with .062" (1.60 mm) thick cards
- PCIe® 5.0 Currently in Development
 - Differential pair system
 - 1.00 mm pitch
 - Design-in today for future-proof data rates
 - Mates with standard PCIe® expansion cards
 - 1, 4, 8 and 16 PCI Express® 5.0 link options



EDGE RATE® RUGGED HIGH-SPEED STRIPS

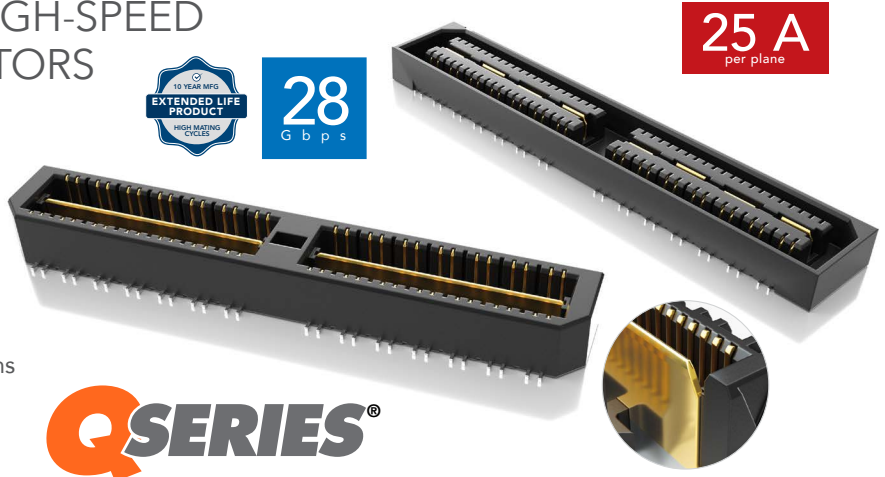
- Rugged Edge Rate® contacts optimized for signal integrity performance
- 1.5 mm contact wipe
- Robust when “zippered” during unmating
- Up to 56 Gbps PAM4 performance
- 0.50 mm, 0.635 mm or 0.80 mm pitch systems
- Stack heights from 5 mm to 18 mm
- Extremely slim 2.5 mm body width on 0.635 mm pitch system
- 0.50 mm pitch system for up to 40% PCB space savings vs 0.80 mm pitch system



Compatible with mPOWER™ (UMPT/UMPS Series) for Power/Signal Flexibility

Q SERIES® LOW PROFILE, HIGH-SPEED GROUND PLANE CONNECTORS

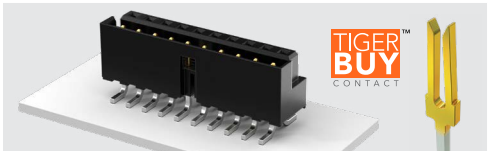
- 0.50 mm, 0.635 mm and 0.80 mm pitch
- Performance up to 14.0 GHz/28 Gbps
- Integral ground/power plane
- Connector to connector retention options
- Vertical, perpendicular, and coplanar applications
- Up to 180 I/Os
- 5 mm to 25 mm stack heights
- 38 AWG micro coax and 30 AWG twinax cable assemblies rated to 14 Gbps (see page 11)
- Compatible with mPOWER™ (UMPT/UMPS) for power/signal flexibility
- Differential pairs and edge mount options available



Mating Coax & Twinax Cables (see page 10)

ALSO AVAILABLE: MICRO-RUGGED BOARD-TO-BOARD SOLUTIONS

- Standard board stacking interconnects for low profile, elevated, pass-through, and rugged applications on .100" (2.54 mm) and 2.00 mm pitch
- Variety of ruggedizing options and features including high-reliability contact systems, polarization, locking clips, alignment pins, etc.
- Visit samtec.com/connectors/standard-board-to-board to learn more



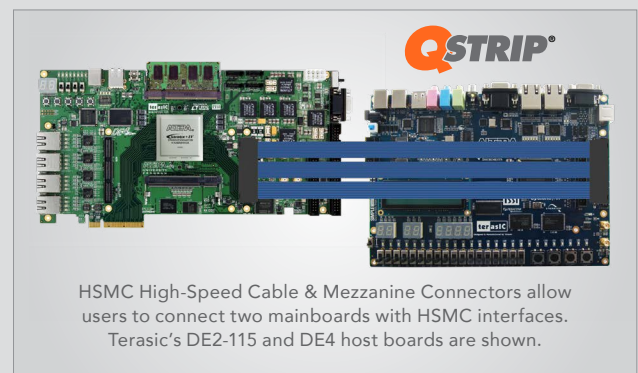
Locking, shrouded, polarized self-mating system for rugged applications (LS2 Series)

APPLICATION: INTEL HIGH SPEED MEZZANINE CARD (HSMC) SPECIFICATION

The Intel High Speed Mezzanine Card (HSMC) specification allows for a flexible design approach to interoperable motherboards and mezzanine cards of various manufacturers.

By defining both the electrical and mechanical properties of the adapter, HSMC brings a standardized approach to a modular architecture.

HSMC Cable Assemblies can connect two carrier cards together for debugging, or extend the reach between a carrier card and daughter card for application-specific test environments.



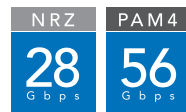
HSMC High-Speed Cable & Mezzanine Connectors allow users to connect two mainboards with HSMC interfaces. Terasic's DE2-115 and DE4 host boards are shown.

The HSMC interconnect is based on Samtec's High-Speed Q Strip® Mezzanine Connectors and Cable Assemblies. The marriage of the 0.50 mm pitch Connector with a 30 AWG Twinax Cable for longer reaches, or with a 38 AWG Micro Coax Cable for high position count single-ended systems, provides a **high density advantage** ideal for Intel's HSMC specification.

HIGH-DENSITY CABLE ASSEMBLIES

ACCELERATE® SLIM BODY CABLE SYSTEM

- Incredibly slim 7.6 mm width, high-density 2-row design
- 8 & 16 differential pair configurations (24 pair in development)
- 34 AWG, 100 Ω Eye Speed® ultra-low skew twinax cable
- Mating surface mount connector (ARF6 Series) features standard rugged weld tabs for increased stability on the PCB
- Rugged metal latching and shielding
- Supports 56 Gbps PAM4 (28 Gbps NRZ) applications
- Flyover® systems simplify board layout & extend signal reach
- High pin count, high data rate ganged solutions in development

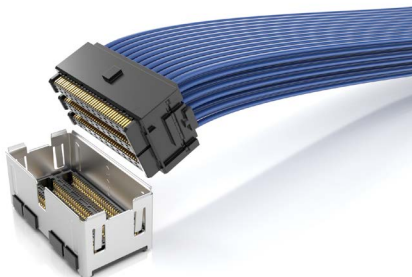


ARC6 Series
Slim Cable Assembly

ACCELERATE®

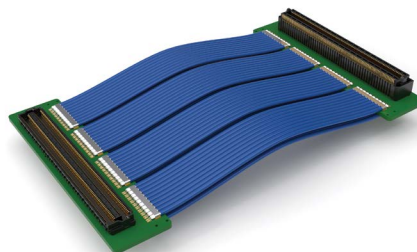
Product Roadmap

Differential Pair, Ganged AcceleRate® Cable-to-AcceleRate® HP Vertical



Direct Attach • 56 to 112 Gbps PAM4
Highest Aggregate Data Rate in the Industry

AcceleRate® HP High Data Rate / High Pin Count Cable System



Transition Card • 400 to 800 Pin Counts

Ganged AcceleRate® Cable-to-AcceleRate® HP Right-Angle



Mixed DP/SE/Power • 32/64 Gbps PAM4
Blind Mate/High Pin Count

APPLICATION: STORAGE DRIVE TESTING SOLUTIONS

In test, individual storage drives attach to single-board computers (SBCs) connected to a test server. Connections between the SBCs and test servers utilize the latest high-performance protocols in a small area.

Samtec's AcceleRate® Slim Body Cable System combines **56 Gbps PAM4 performance with high pin counts** in a high-density, 2 row design. Ganged interconnect options provide high aggregate throughput from the test server to SBCs.

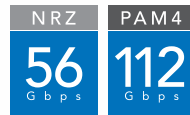


ACCELERATE®

NOVARAY® EXTREME HIGH-SPEED, HIGH-DENSITY CABLE SYSTEM

- Industry leading aggregate data rate density – 2x the data rate in 60% of the space
- Proprietary pin-to-ground configuration enables very low crosstalk (to 40 GHz) and very tight impedance control
- 8 to 32 signal pairs with two reliable points of contact guaranteed; 72 pairs in development
- BGA attach for density and optimized trace breakout region

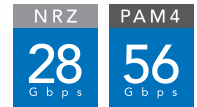
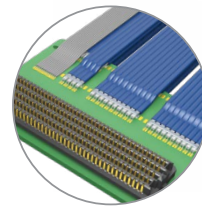
NOVARAY®



SEARAY™ HIGH-DENSITY CABLE SYSTEMS

- 1.27 mm (SEAC) and 0.80 mm pitch (ESCA)
- 34 or 36 AWG coax; 32 AWG twinax
- 1.27 mm pitch offers up to 560 single-ended I/Os or 140 differential pairs
- Open-Pin-Field Array enables maximum routing and grounding flexibility
- 16 Gbps PCIe® 4.0 data rate
- Wide variety of options and design flexibility: mix-and-match any SEARAY™ connector on transition cards, multiple design options including right-angle & vertical
- Mates with SEARAY™ and SEARAY™ 0.80 mm arrays (see page 5)
- Optional rugged latching

SEARAY™



APPLICATION: SEMICONDUCTOR TEST SOLUTIONS



Semiconductor components continue to grow in complexity, shrink in size and increase in performance. Testing ICs at the system level requires dense, high-speed modular test fixtures.

SEARAY™ High-Density Arrays and Cable Assemblies are ideally suited for such applications. **Large I/O counts, ease of routing, 56 Gbps PAM4 performance and mix-and-match configurations** simplify the design of modular test fixtures.

MICRO COAX & TWINAX CABLE ASSEMBLIES

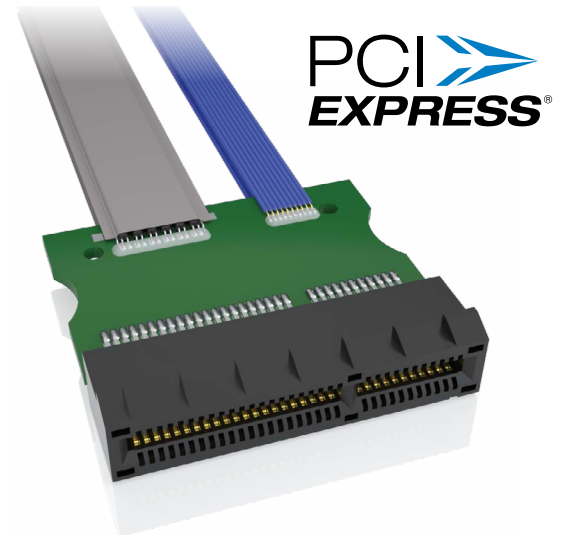
Q SERIES® HIGH-SPEED CABLE ASSEMBLIES

- Integral power/ground plane
- 38 AWG coax & 30 AWG twinax
- 0.50 mm (HQCD & HQDP Series) & 0.80 mm pitch (EQCD & EQDP Series)
- Performance up to 14 Gbps
- Surface mount, edge mount or panel mount terminations
- Mates with Q Series® connectors (see page 7)



HIGH-SPEED CABLE ASSEMBLIES

- 0.80 mm pitch Edge Rate® coax and twinax assemblies (ERCD, ERDP)
- PCI Express® twinax assemblies support 1, 4, 8 and 16 links (PCIEC)
- Ultra-micro hermaphroditic Razor Beam™ coax assemblies with rugged shielding (HLCD)
- 34 or 38 AWG coax and 30 AWG twinax assemblies
- IDC cable assemblies with high reliability Tiger Eye™ contacts on 1.27 mm & 2.00 mm pitch, and dual beam contacts on 2.54 mm pitch



HIGH-SPEED EDGE CARD ASSEMBLIES

- 14 Gbps (ECDP) and 16 Gbps (FEDP) performance
- 30 AWG twinax (ECDP); mates with 0.80 mm pitch edge cards (HSEC8)
- 34 AWG ultra low skew twinax (FEDP); mates with 0.50 mm pitch edge card (FCDP)



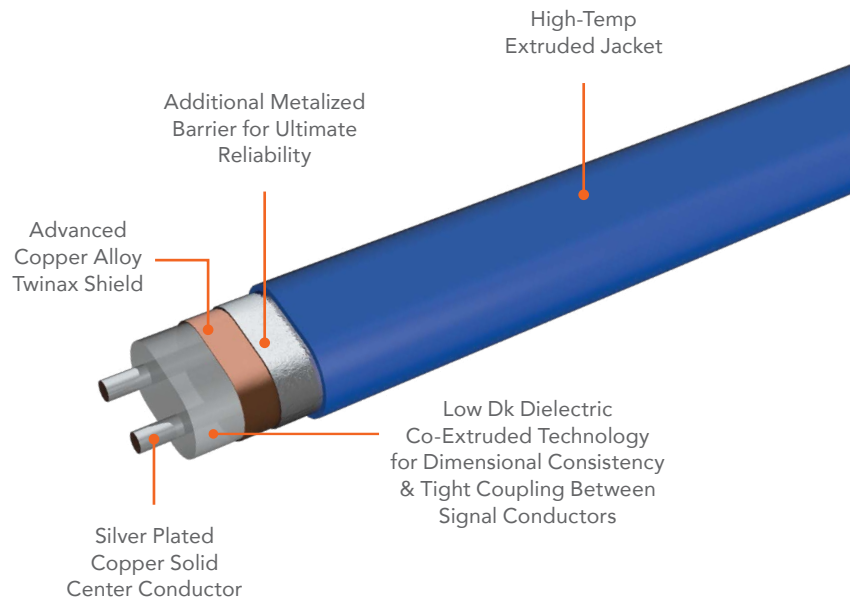
EYE SPEED[®] CABLE TECHNOLOGY

ULTRA LOW SKEW TWINAX

Samtec's proprietary Eye Speed[®] 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.

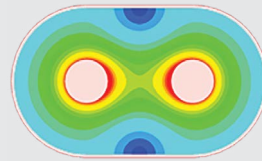


- Tight coupling between signal conductors
- Improved bandwidth (28 – 112+ Gbps) and reach
- Improved signal integrity and eye pattern opening
- Low skew (< 3.5 ps/meter) over extended lengths
- Supports Samtec Flyover™ technology

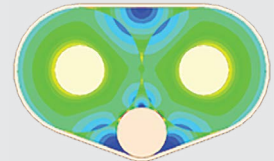


Micro Cellular Dielectric Extrusion

- 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



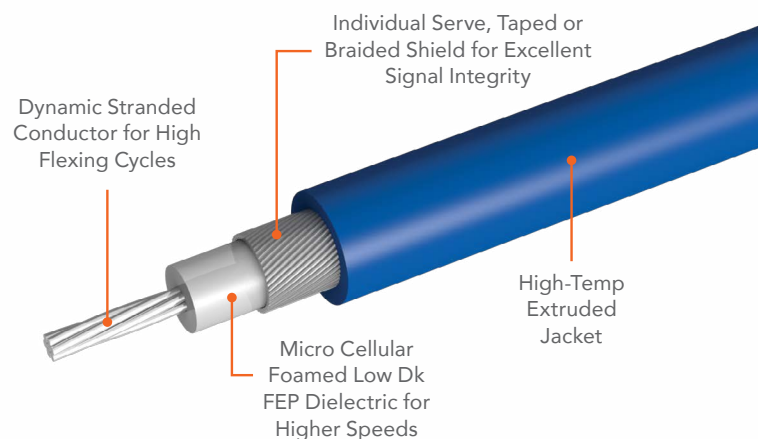
✓ **Good** design coupling with Samtec's co-extruded ultra low skew twinax



✗ **Bad** design coupling with individually extruded conductors & drain wire

MICRO COAX CABLE

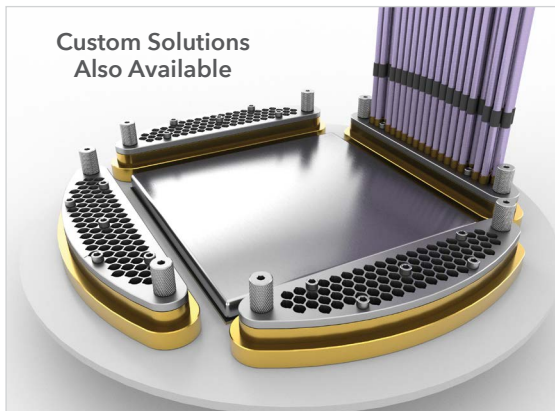
- Foaming introduces air voids for signal to travel faster
- Solid extrusion of foamed dielectric provides a constant and more durable construction
- Lighter weight and smaller size with higher bandwidth capabilities at longer lengths
- 26 – 38 AWG cable available
- Choice of signal conductor, shield and FEP dielectric to meet performance and cost specifications



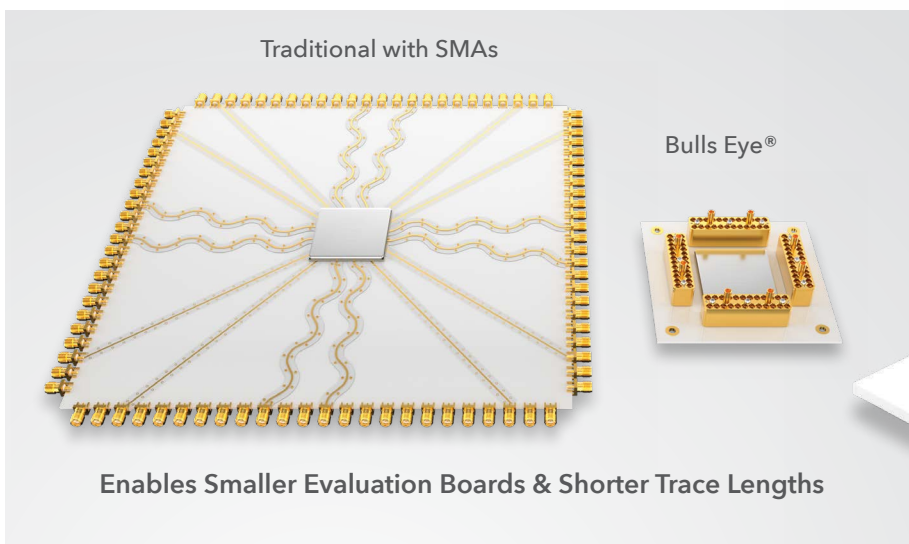
HIGH-PERFORMANCE RF TEST & PRECISION RF

BULLS EYE® HIGH-PERFORMANCE TEST

- 70 GHz, 50 GHz, 40 GHz or 20 GHz Solutions
- High-performance test assemblies
- Enables smaller evaluation boards and shorter trace lengths
- Compression interface to the board for easy on/off and eliminate soldering costs
- Microstrip or stripline PCB transmission types
- Assembly options: Dual Row (BE70A, BE40A, BDRA) or Quad Row (BQRA)
- Test boards available for performance verification
- RF Technical Group:
Dedicated RF engineers provide personal support for meeting specific challenges; contact RFGroup@samtec.com



BULLSEYE®
TEST POINT SYSTEM



PRECISION RF

- Microwave/mmWave cable assemblies and interconnects
- High-frequency bands from 18 GHz to 110 GHz
 - 1.00 mm, SMPM, 1.85 mm, 2.40 mm, SMP, SSMA, 2.92 mm, 3.50 mm, N Type, TNCA, SMA
 - 2.92 mm intermateable with 3.50 mm and SMA
 - 2.40 mm and 1.85 mm are intermateable
 - 1.00 mm, performance up to 110 GHz
 - 1.35 mm, performance up to 90 GHz (in development)
- Full cable assemblies with performance up to 70 GHz (90 GHz in development)
- Vertical integration of cable assemblies, cable connectors and board level interconnects enable the highest level of customer service and support in the industry
- Launch designs, custom product solutions, simulations, and physical test and measurement verifications
- Contact RFGroup@samtec.com for additional information

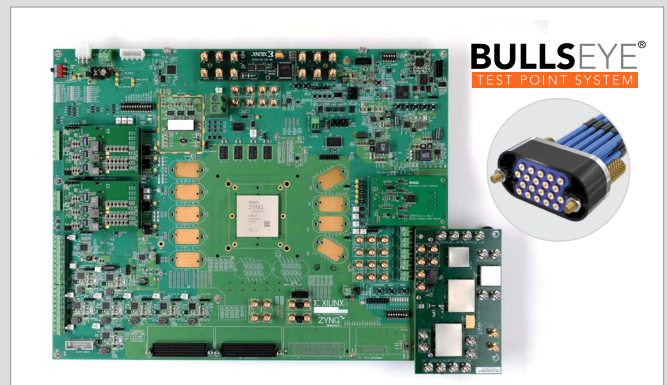


APPLICATION: XILINX® ZYNQ® ULTRASCALE+™ RFSOC ZCU1285 CHARACTERIZATION KIT

System designers can use the new Xilinx® characterization kit to evaluate high-speed interfaces integrated in the Zynq® UltraScale+™ Gen 2 RFSoc.

All ADCs, DACs and transceivers are accessible through Samtec's Bulls Eye® High-Performance Test Point System.

Engineers can attach the kit to custom baluns and test equipment for testing custom applications.

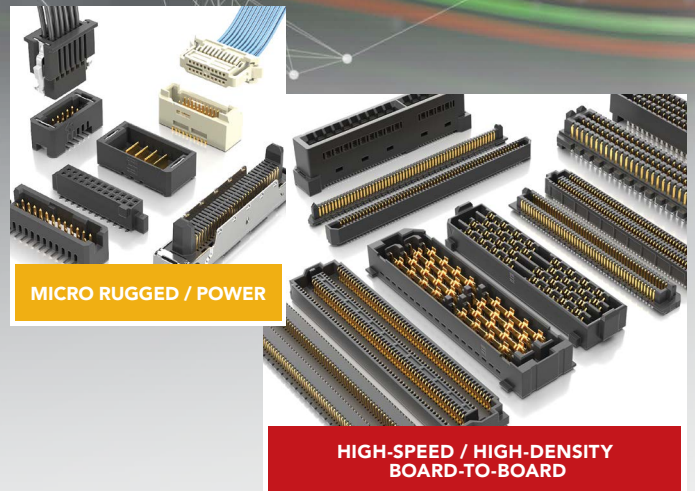
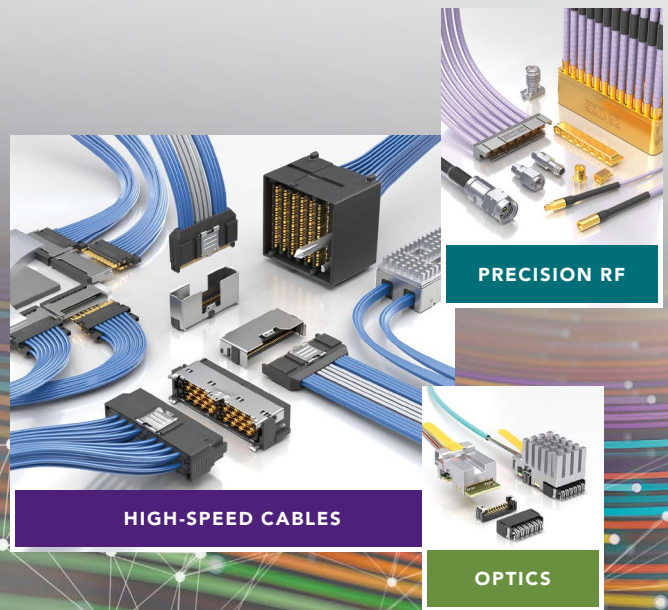


FULL SYSTEM SUPPORT

INTEGRATION LEADS TO INNOVATION

Samtec's integrated approach provides high-level design and development of advanced interconnect systems and **TECHNOLOGIES**, along with industry-leading expertise that allows us to offer effective strategies and support for optimizing the entire signal channel of high-performance systems.

Samtec is structured like no other company in the interconnect industry. We work in a fully integrated capacity that enables true collaboration and results in uniquely innovative **PRODUCTS** because our technology teams are not limited by the boundaries of traditional business units.



Samtec's Signal Integrity Engineers address next generation system design challenges with industry-leading expertise in high-performance interconnect systems, along with testing and validation services, system optimization support, and easy-to-use design and development tools. Contact sig@samtec.com to discuss your application needs.

SIGNAL INTEGRITY SERVICES & SUPPORT

Frontline Engineering Services

- High Data Rate Simulations
- Channel Analysis
- Signal Integrity Models
- PCB / BOR Designs
- Connector Selection

Technical Application Support

- Signal / Power Integrity Expertise
- Testing, Validation & Analysis
- Full Channel SI Analysis / Optimization
- PCB Layout & Routing Assistance
- Full System Design Support

Industry Standards Support

- Member/Participant of 30+ Industry, Corporate & De Facto Standards
- Compatible/compliant products include: VITA, PC/104™, PISMO™, IEEE, SFF-SIG, SATA, Xilinx®, Altera®, Arm®
- Visit samtec.com/standards

TESTING & VALIDATION CAPABILITIES

Design Qualification Testing (DQT)

- Standard testing undergone by all Samtec products to verify the product design meets our intent

Extended Life Product™ (E.L.P.™)

- Rigorous testing which evaluates contact resistance including 10 year Mixed Flowing Gas (MFG) & High Mating Cycles (250 to 2,500); visit samtec.com/ELP



Severe Environment Testing (SET)

- Additional testing ensures products are suitable for rugged and/or harsh environments and other extreme applications; visit samtec.com/SET

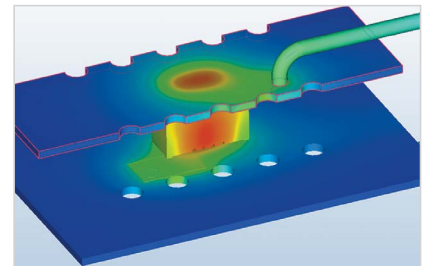
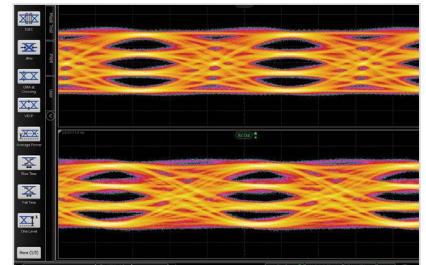


Signal Integrity Screening

- VNA based test system screens for manufacturing process anomalies that could lead to Signal Integrity degradation in higher data rate products

Leakage Testing

- Test platform developed in-house for applications with higher voltage levels and extremely sensitive current leakage specifications



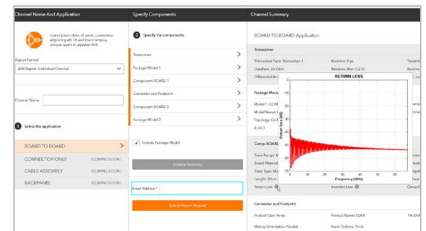
SIGNAL INTEGRITY DESIGN & DEVELOPMENT TOOLS

Digital Design Tools

- Easy-to-use tools developed in-house help streamline and simplify the design process
 - Solutionator® Parametric Search
 - Channelyzer® Full Channel Simulation & Analysis
 - Simulator™ Real-Time Performance Data

Development Tools

- A full library of evaluation and development test platforms for high-speed interconnect systems
- Partnerships with SerDes vendors demonstrate next gen interconnect solutions



GLOBAL MANUFACTURING & SUPPORT



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