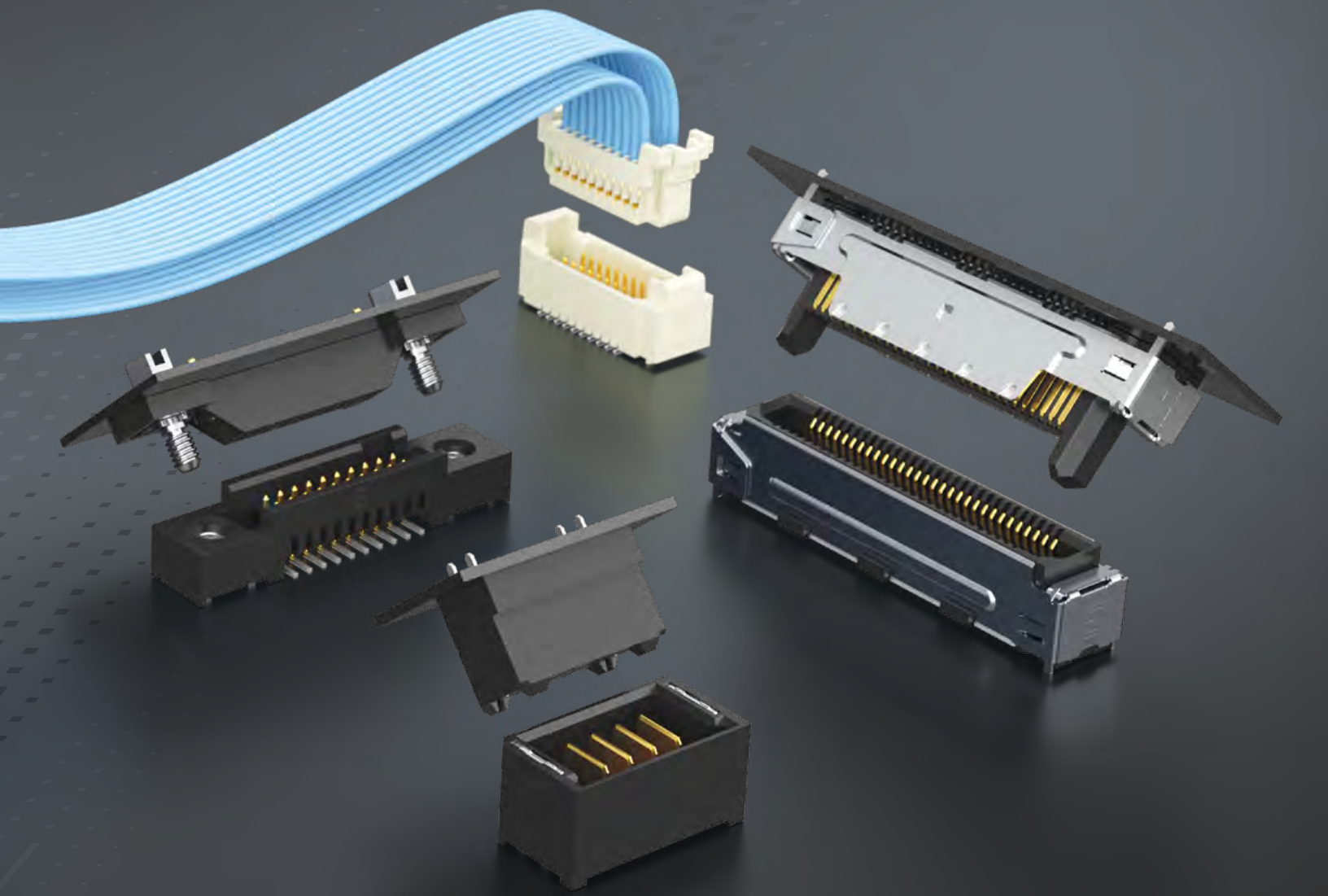
MICRO RUGGED

APPLICATION DESIGN GUIDE



MICRO RUGGED
INTERCONNECT SOLUTIONS

Rugged contact systems, micro power interconnects and rugged signal integrity create the foundation of Samtec's micro rugged solutions for high cycle, high power and harsh environment applications. Samtec's rugged products are offered in conjunction with full engineering support, online tools and a service attitude that is unmatched in the connector industry.

SI

RUGGED SIGNAL INTEGRITY

HIGH SPEEDS TO 40 Gbps

EDGE RATE® CONTACT DESIGN INCREASES WEAR LIFE

EXPERTISE IN SIGNAL INTEGRITY DESIGN & ANALYSIS

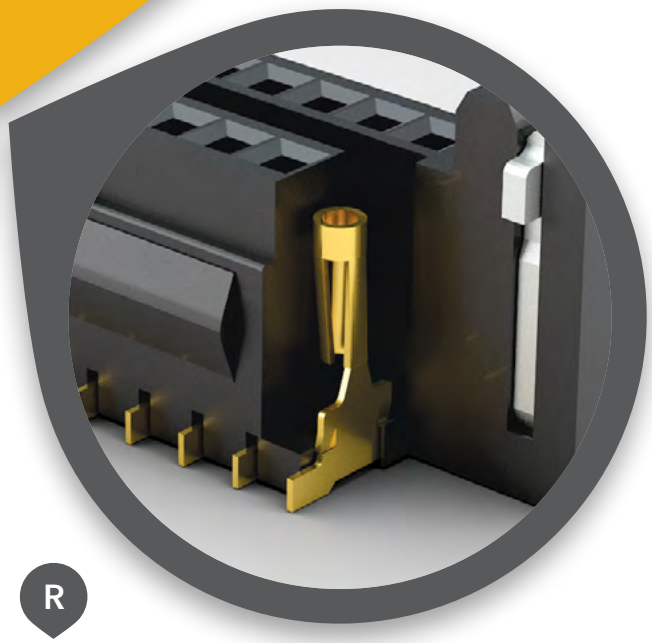
MP

MICRO POWER

3 TO 30 AMPS

CONFIGURABILITY OF POWER & SIGNAL

SPACE-SAVING FORM FACTOR



R

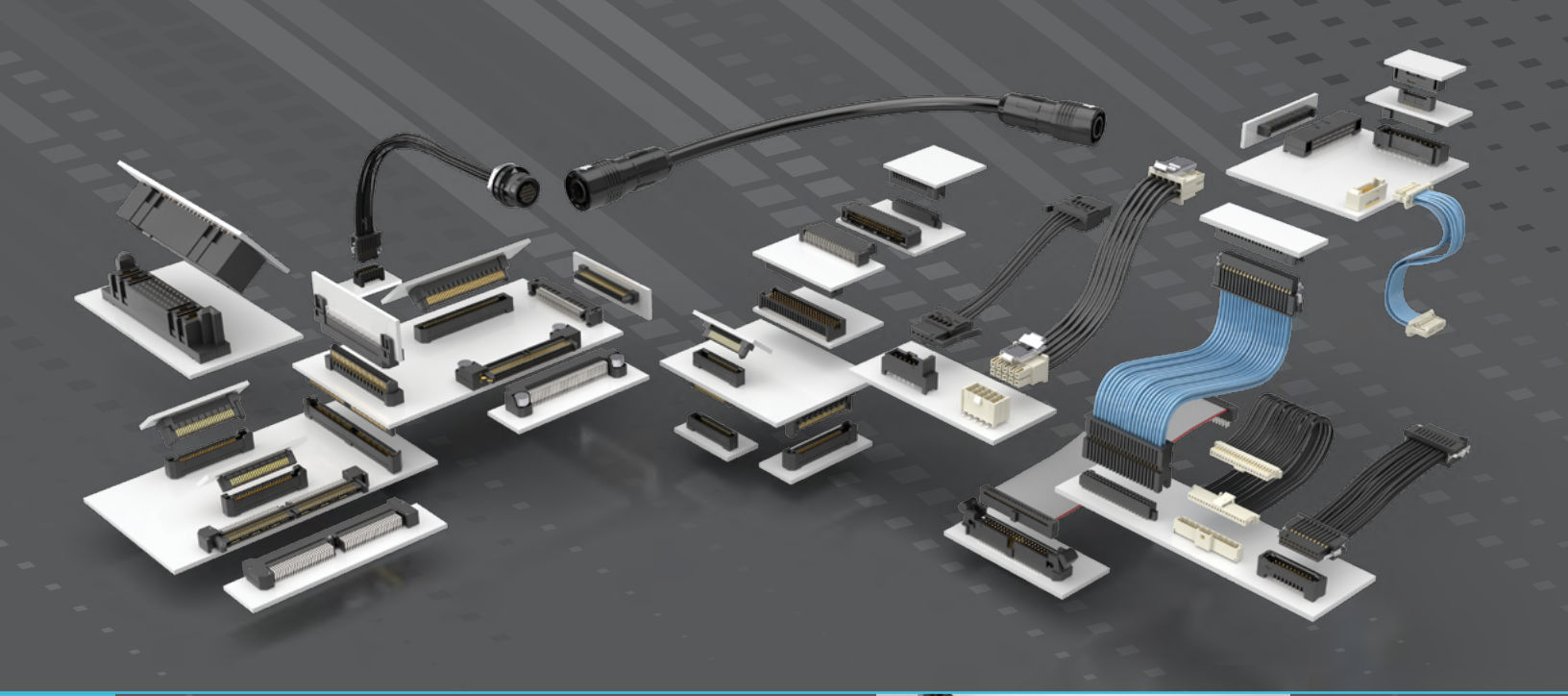
RUGGED CONTACT SYSTEM

1,000+ MATING CYCLES

TIGER EYE™ HEAT-TREATED BeCu CONTACTS

REDUNDANT POINTS OF CONTACT FOR HIGH-RELIABILITY

Learn more at **www.samtec.com**



BOARD-TO-BOARD SYSTEMS

- Edge Rate® system for rugged signal integrity performance
- Tiger Eye™ contact system for high-reliability in rugged applications
- 0.50 mm to 2.00 mm pitch
- Stack heights from 5 mm to 18 mm

MICRO POWER SYSTEMS

- 3 to 30 A per power blade
- Small form factor
- Micro power/signal combinations
- Variety of pitches

DISCRETE WIRE ASSEMBLIES

- Choice of pitch as low as 0.80 mm
- Rugged, high-performance Tiger Eye™ systems
- Individually shrouded contacts
- High power systems to 34.5 A per power blade

SEALED I/O SYSTEMS

- IP68 and IP67 rated for dust and water
- Variety of circular shell sizes with power, power/signal pin outs
- Rectangular designs for space savings
- Rugged latching

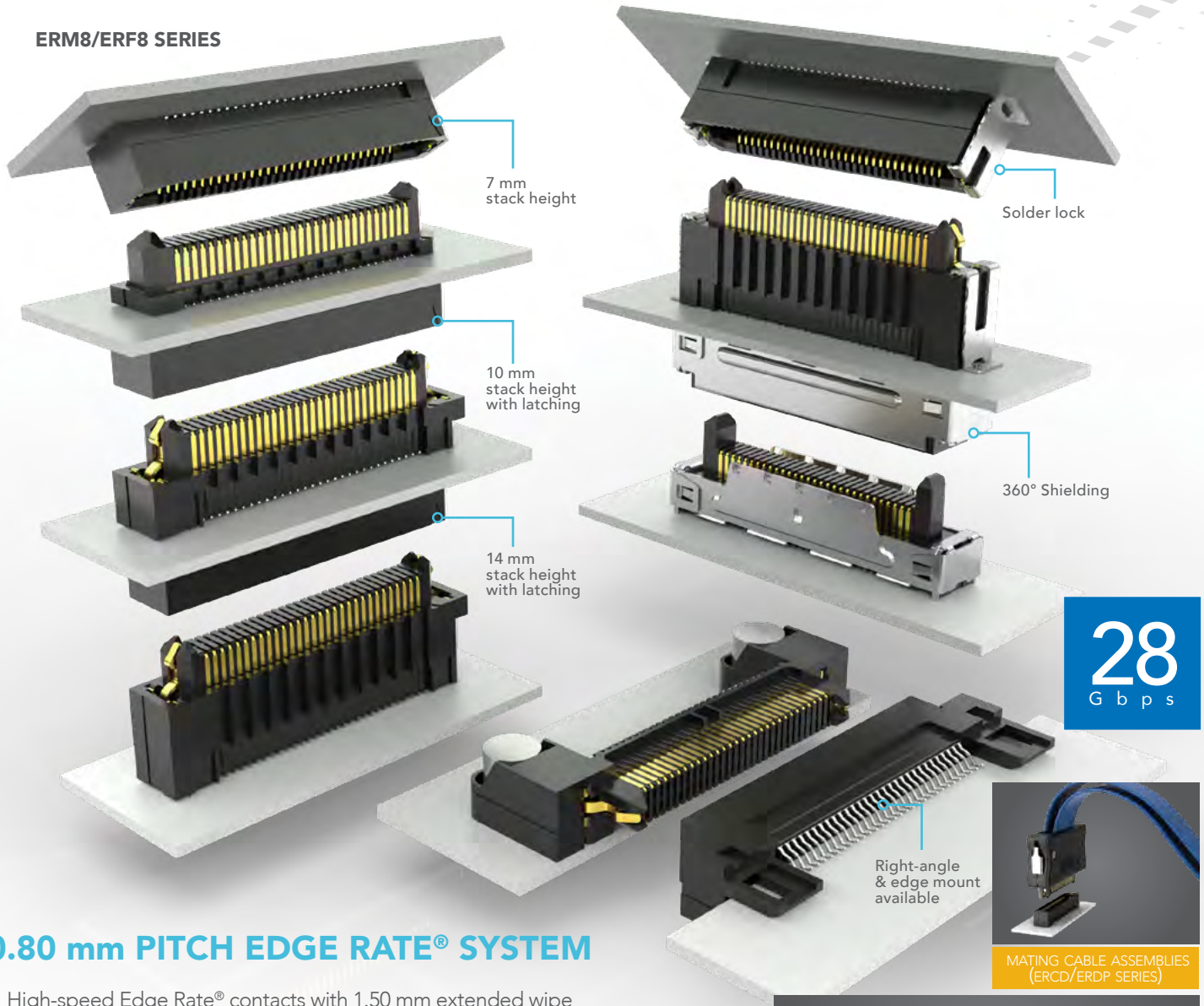
SI R MP

EDGE RATE® CONTACT SYSTEMS

EDGE® RATE CONTACT

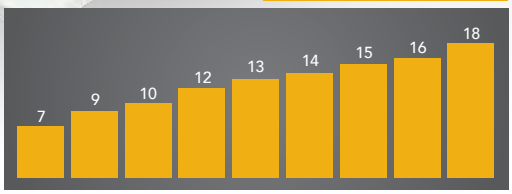
OPTIMIZED FOR SI PERFORMANCE • INCREASED CONTACT WIPE • HIGH CYCLES

ERM8/ERF8 SERIES



28 Gbps

MATING CABLE ASSEMBLIES (ERCD/ERDP SERIES)



AVAILABLE STACK HEIGHTS (mm) *(ACTUAL SIZE)*

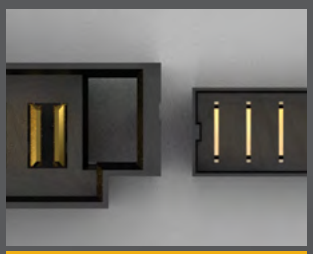
0.80 mm PITCH EDGE RATE® SYSTEM

- High-speed Edge Rate® contacts with 1.50 mm extended wipe
- Rugged metal latching for increased retention force
- 360° shielding option reduces EMI
- Cost-effective metal solder lock in development for a more secure connection to the board

Samtec designs and builds all automation equipment in-house.

MICRO POWER SYSTEM

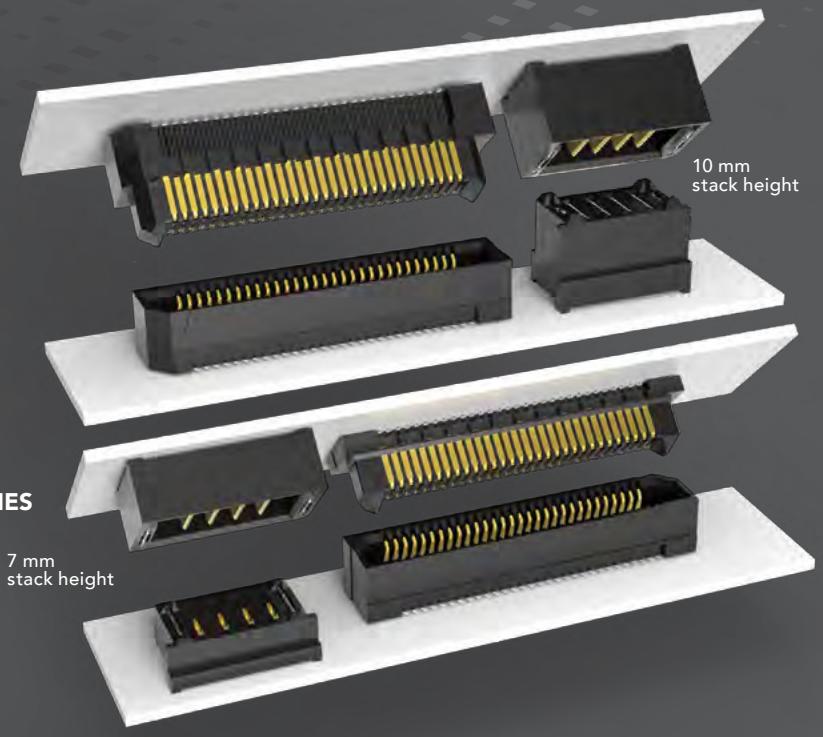
- Use with Samtec's Edge Rate® and other high-speed systems for power/signal applications
- 5 mm to 20 mm stack heights
- 2 to 5 power blades on a 2.00 mm pitch
- Allows for staging of power and signal/ground
- Modular interlocking, shielding and right-angle options in development



2.00 mm PITCH VS.
3.81 mm PITCH (UPX SERIES)

UMPT/UMPS SERIES

15 A
per power pin
4 pins powered

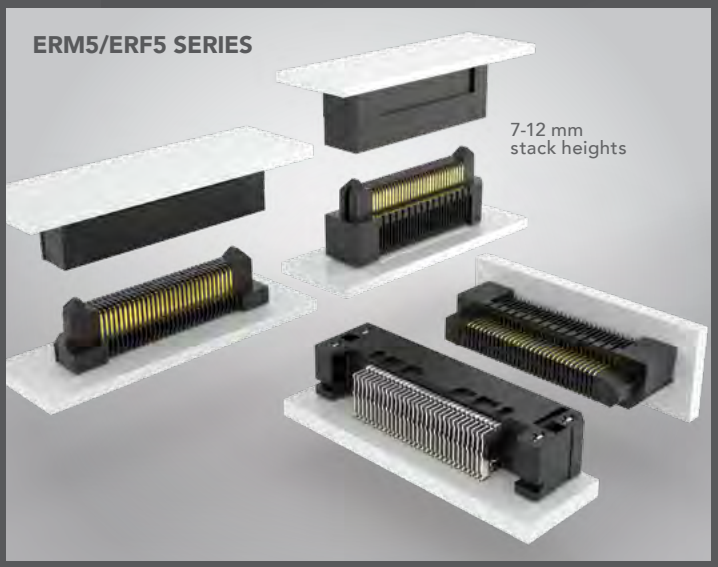


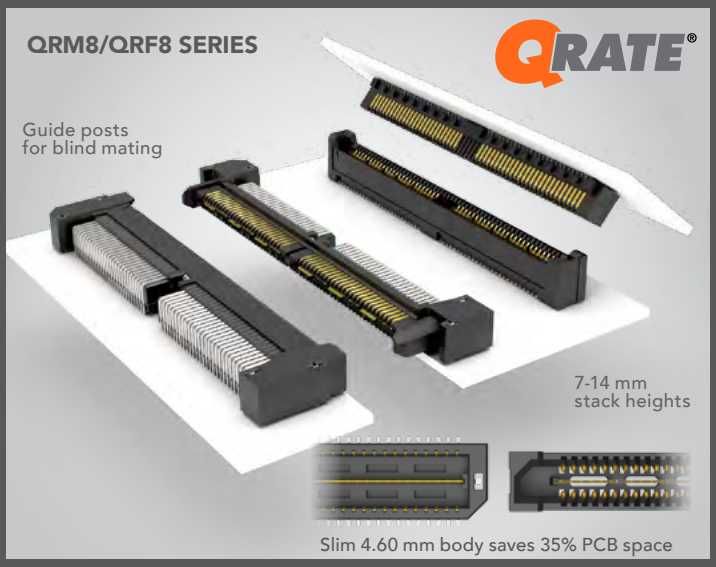
0.50 mm PITCH EDGE RATE®

- 1.00 mm contact wipe for a reliable connection
- 28 Gbps high-speed channel performance*
- Rugged friction locks and weld tabs available
- Up to 40% PCB space savings vs. ERM8/ERF8

Q RATE® SLIM GROUND PLANE

- Widely accepted industry standard integral power/ground plane
- 0.80 mm pitch with 1.20 mm contact wipe
- 31 Gbps high-speed channel performance*

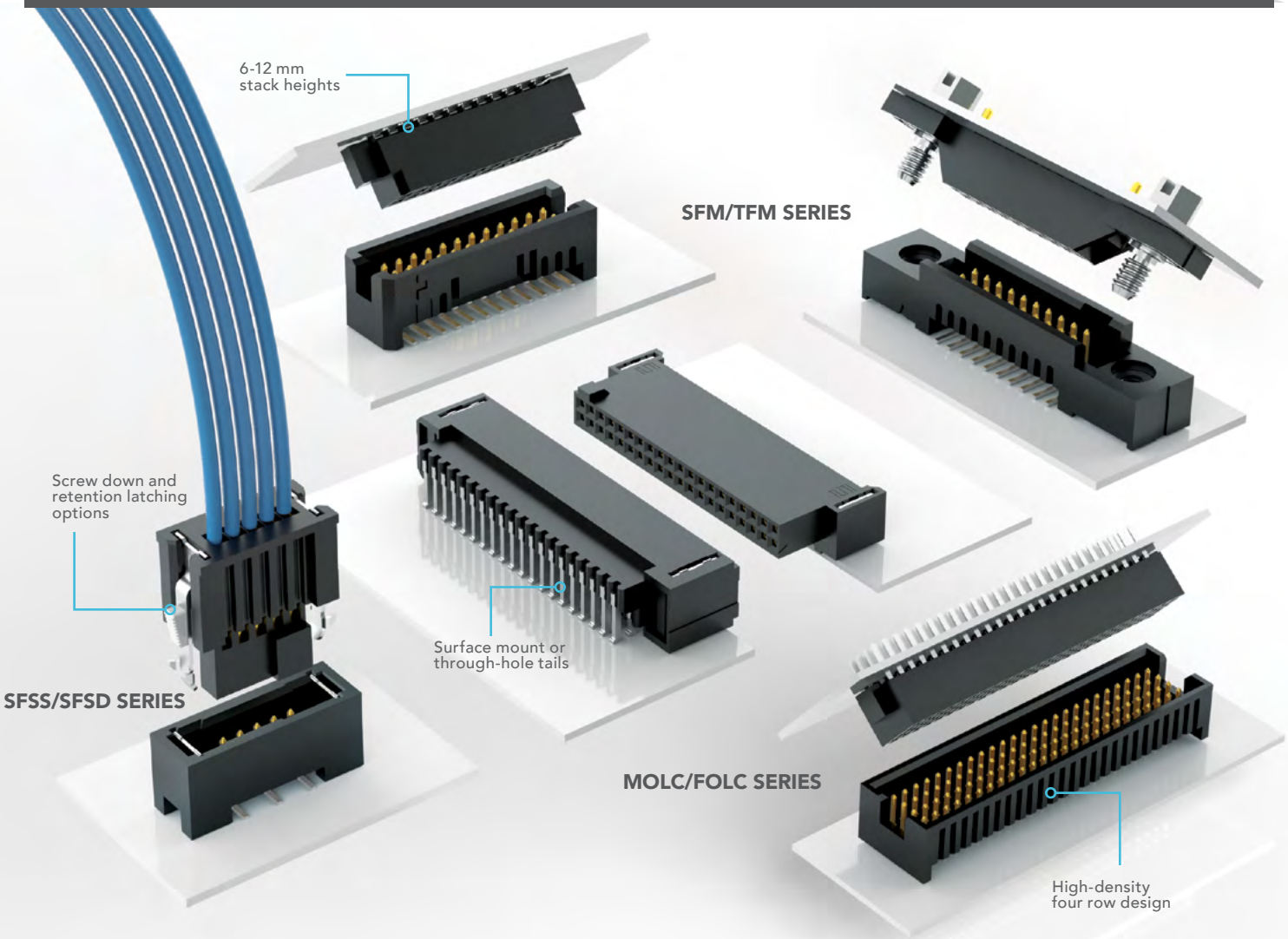




* High-speed channel performance figure based on Samtec reference channel. For full SI Performance data visit **samtec.com** or contact **sig@samtec.com**

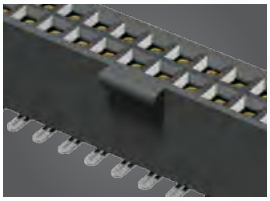
TIGER EYE™ CONTACT SYSTEMS

HIGH-RELIABILITY • MULTI-FINGER BeCu CONTACT • HIGH MATING CYCLES

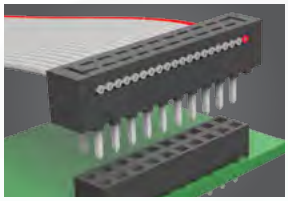


1.27 mm PITCH TIGER EYE™ SYSTEM

- **Tiger Eye™ is Samtec's most rugged contact system rated to 1,000+ mating cycles**
- Screw down, locking clip, friction latching and weld tab ruggedizing options
- Shrouded, polarized and keyed
- Discrete wire assemblies available in single or double row, 30 and 28 AWG PVC or Teflon® wire



LOCKING FOR INCREASED UNMATING FORCE (SFML SERIES)



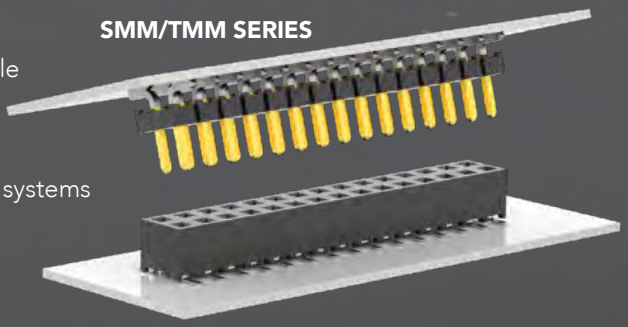
MATING IDC CABLE ASSEMBLIES (FFXD & FFXP SERIES)

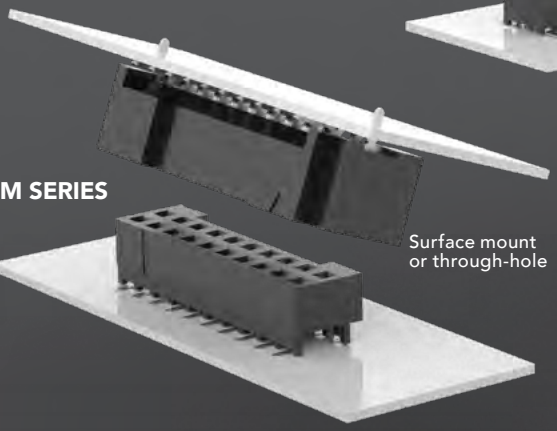
Samtec stamps over **1 BILLION** Tiger Eye™ contacts per year.

2.00 mm PITCH TIGER EYE™ SYSTEM

- Wide range of stack heights
- Right-angle mating headers available
- Optional screw downs, weld tabs and locking clips
- Mating discrete wire and IDC cable systems

SMM/TMM SERIES





S2M/T2M SERIES

Surface mount or through-hole

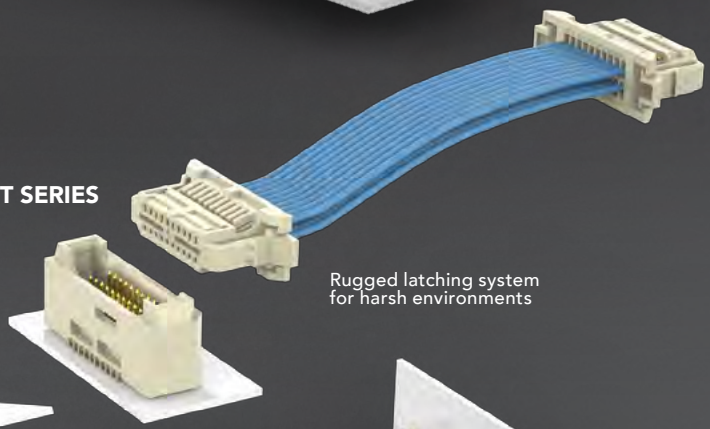
Available in 30-24 AWG PVC or Teflon®

S2SD SERIES

0.80 mm PITCH TIGER EYE™ SYSTEM

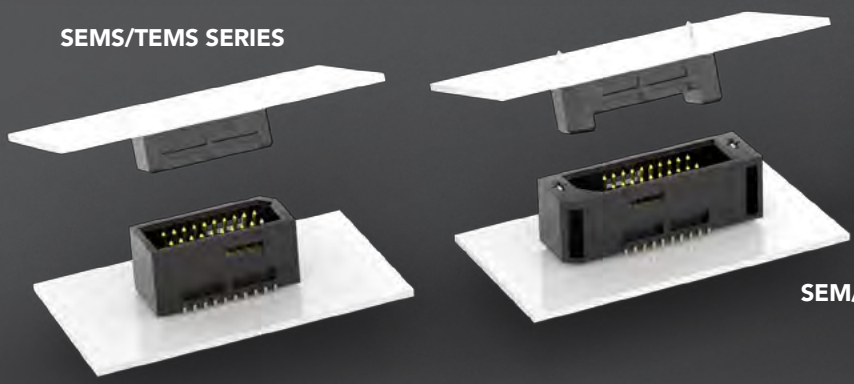
- Micro pitch and slim body for space-savings
- 6 mm, 7 mm and 10 mm stack heights
- Locking clip, alignment pins and weld tab ruggedizing features
- Discrete wire assembly with 32 AWG Teflon® wire

SESDT SERIES

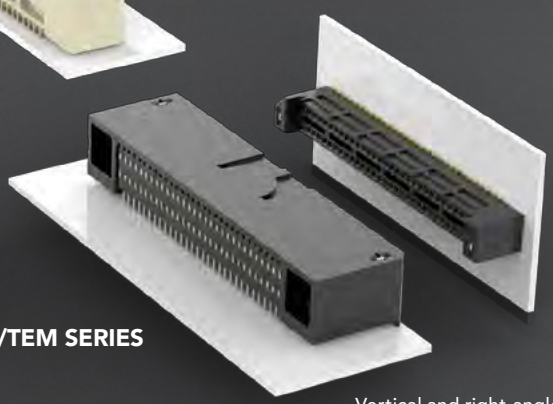


Rugged latching system for harsh environments

SEMS/TEMS SERIES



SEM/TEM SERIES



Vertical and right-angle mating headers

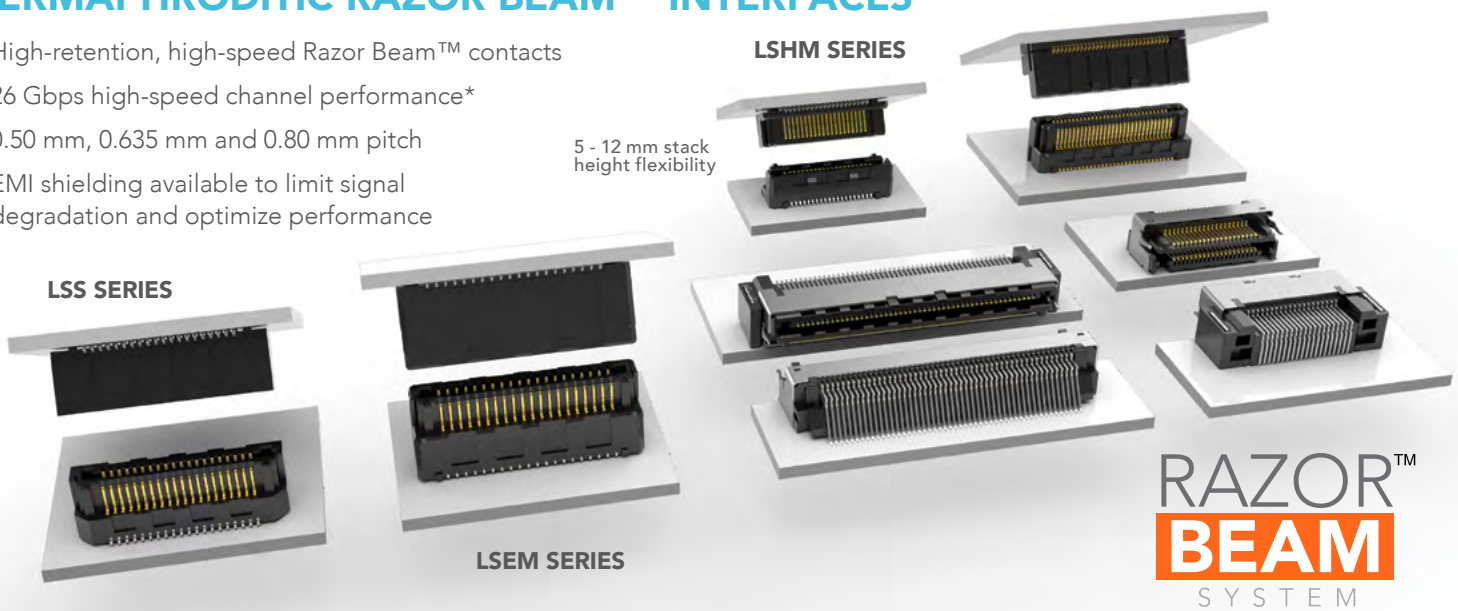
SI R MP

MICRO SYSTEMS

HIGH-DENSITY • HIGH-RETENTION CONTACTS • SLIM ROW-TO-ROW DESIGNS

HERMAPHRODITIC RAZOR BEAM™ INTERFACES

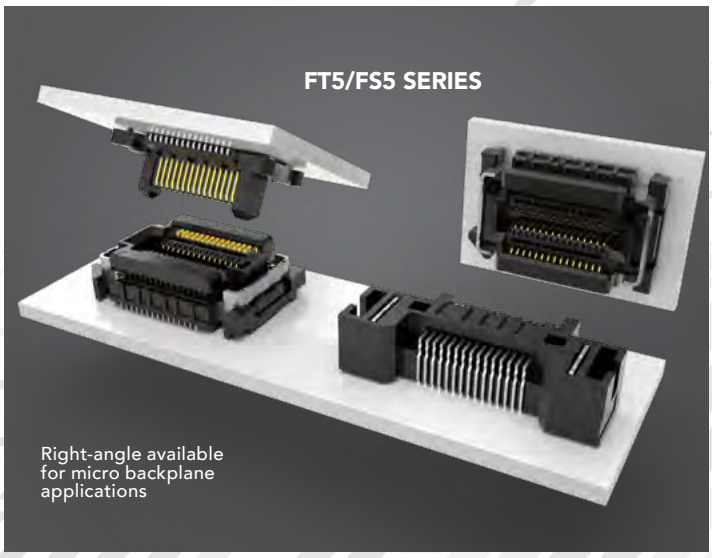
- High-retention, high-speed Razor Beam™ contacts
- 26 Gbps high-speed channel performance*
- 0.50 mm, 0.635 mm and 0.80 mm pitch
- EMI shielding available to limit signal degradation and optimize performance



RAZOR™ BEAM SYSTEM

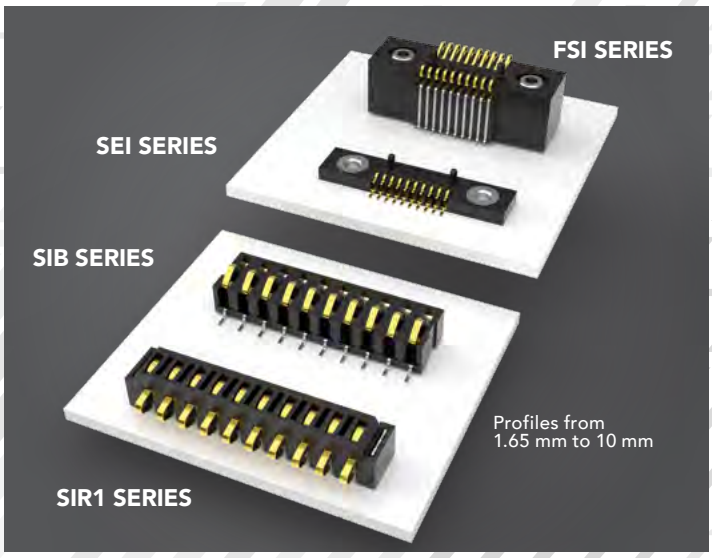
FLOATING CONNECTORS

- Provides 0.50 mm contact float in the X and Y axes to compensate for misalignment
- 5 mm and 7 mm stack heights
- Micro 0.50 mm pitch



ONE-PIECE INTERFACES

- Robust design and mechanical hold-downs for high-shock and vibration applications
- Optional rugged weld tabs and locking clips
- 1.00 mm, 1.27 mm and 2.54 mm pitch designs



* High-speed channel performance figure based on Samtec reference channel. For full SI Performance data visit **samtec.com** or contact **sig@samtec.com**

Lead times for custom products are often the same as for Samtec's standard products.

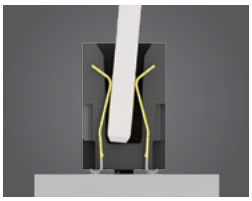
SI R MP

HIGH-SPEED EDGE CARD

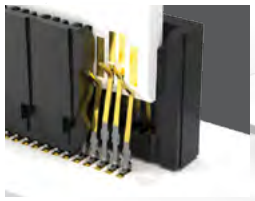
16 TO 40 Gbps • CHOICE OF PITCH • EDGE RATE® CONTACTS

0.80 mm & 1.00 mm PITCH SYSTEMS

- High-speed Edge Rate® contact system
- Vertical, right-angle and edge mount
- Power/signal combo to 60 A per power bank
- Pass-through application



MISALIGNMENT MITIGATION (HSEC1-DV SERIES)



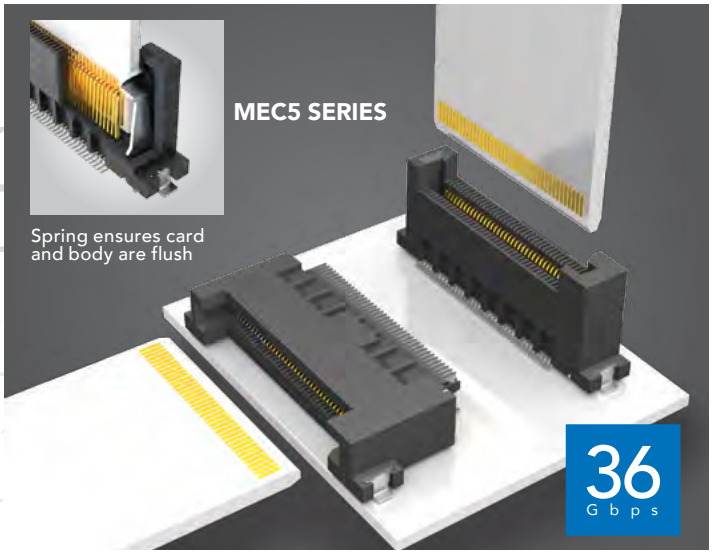
40 Gbps WITH DIFFERENTIAL PAIR (HSEC8-DP SERIES)

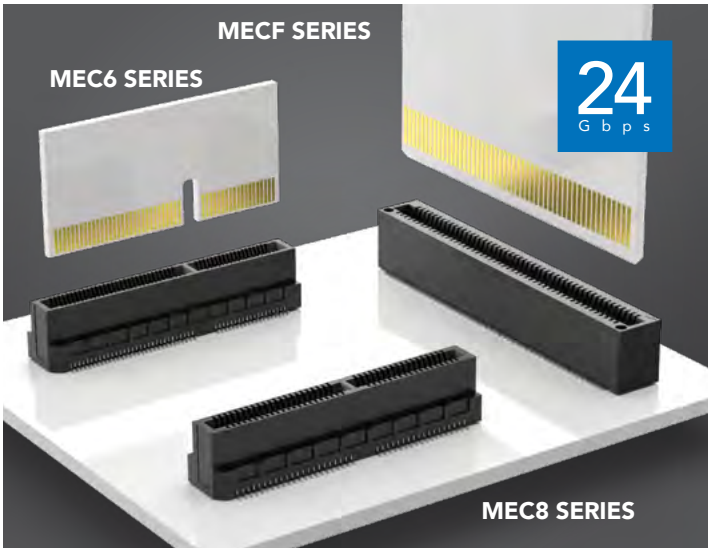
HIGH-DENSITY EDGE CARD SYSTEM

- Justification beam enables use of standard PCB tolerance
- 0.50 mm ultra-fine pitch with up to 200 total I/Os
- PCIe® Gen 4 compliant

MICRO EDGE CARD SYSTEMS

- 0.635 mm, 0.80 mm, 1.00 mm, 1.27 mm and 2.00 mm pitch
- Optional rugged weld tabs, board locks and solder locks
- Solutions for 1.60 mm (0.62") and 2.36 mm (.093") thick cards





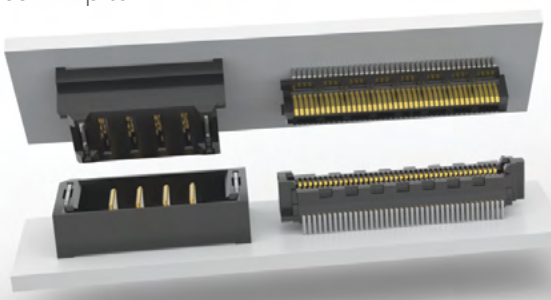
POWER/SIGNAL SYSTEMS

3 TO 15 A PER BLADE • MICRO PITCH • DESIGN FLEXIBILITY AND CONFIGURABILITY

MICRO POWER SYSTEMS

- 5 mm to 20 mm stack heights
- Use with Samtec's high-speed connector systems
- Design flexibility as a two-piece system for power/signal applications
- 2 to 5 power blades on a 2.00 mm pitch

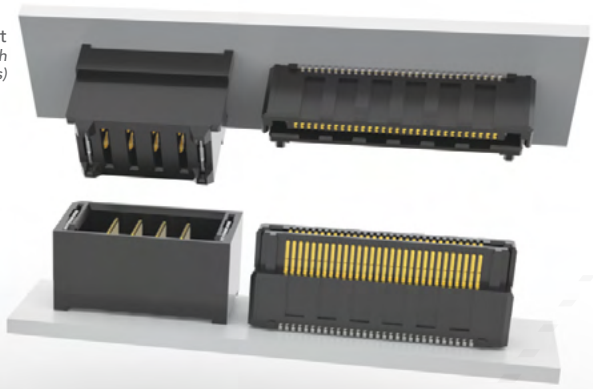
2.00 mm PITCH VS.
3.81 mm PITCH (UPX SERIES)



5 mm stack height
Micro Power shown with Razor Beam™ LP (ST4/SS4 Series)

UMPT/UMPS SERIES

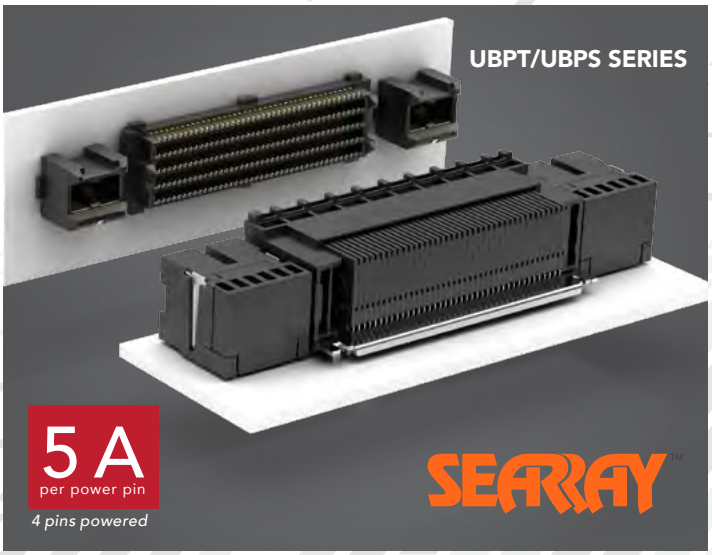
10 mm stack height
Micro Power shown with Razor Beam™ (LSHM Series)



15 A per power pin
4 pins powered

SEARAY™ HIGH-DENSITY POWER/SIGNAL COMBO

- Vertical and right-angle power modules for use with SEARAY™ and SEARAY™ 0.80 mm
- 0.80 mm and 1.27 mm pitch open-pin-field arrays
- Edge Rate® contact system less prone to damage when "zippered" to unmate



Q2™ POWER/SIGNAL COMBO

- Increased insertion depth for rugged applications
- 0.635 mm pitch with integral power/ground plane
- Shielding, power pins, retention pins and RF options
- Eight total power pins at 4 A per pin (4 pins powered)

Custom designs make up almost 28% of Samtec's business. See page 15 for more information.

R MP

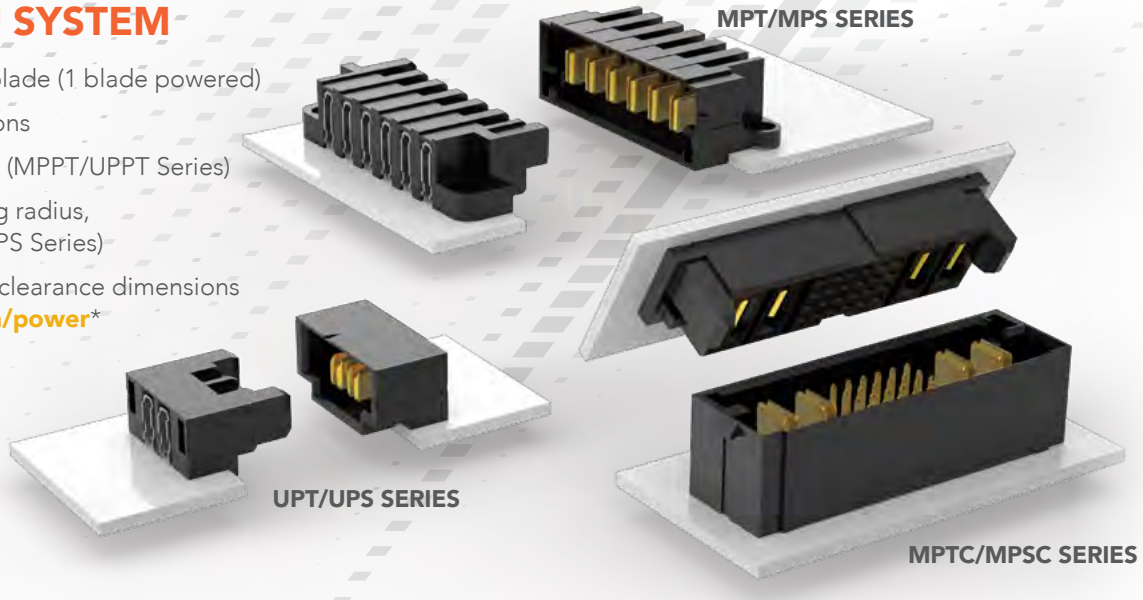
HIGH POWER SYSTEMS

20 TO 60 A PER BLADE • CHOICE OF PITCH • LOW PROFILE DESIGNS

POWERSTRIP™ SYSTEM

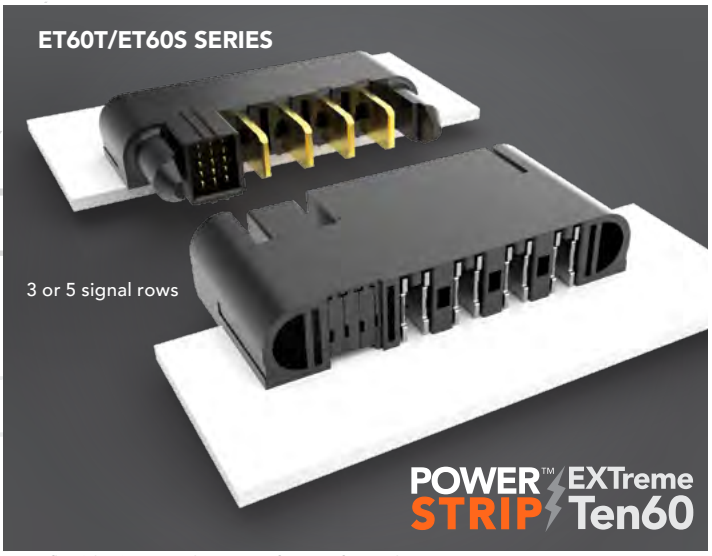
- 23.5 A/blade to 58.7 A/blade (1 blade powered)
- Power/signal combinations
- Hermaphroditic headers (MPPT/UPPT Series)
- "Hinging" for 90° mating radius, blind mating (FMPT/FMPS Series)
- Standard creepage and clearance dimensions available at **samtec.com/power***

POWER™ STRIP



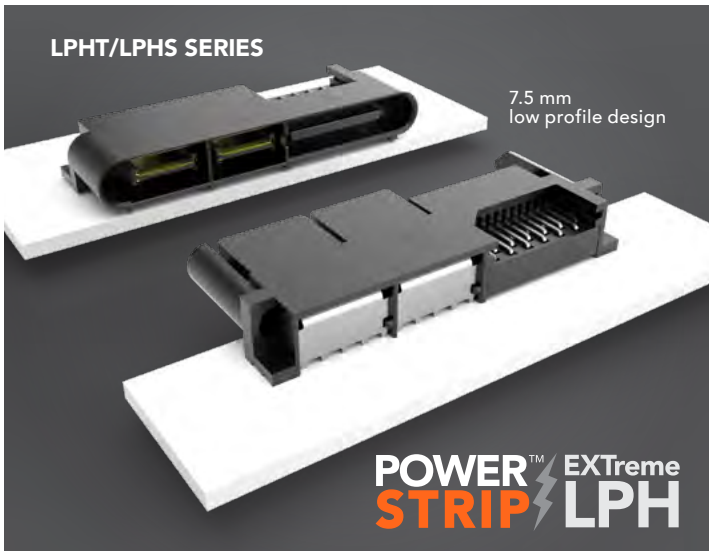
EXTREME TEN60POWER™

- Up to 60 A/blade (2 blades powered)
- High-density signals available in the same form factor
- AC power, AC-DC combos and split power options
- Standard creepage and clearance dimensions available at **samtec.com/power***



EXTREME LPHPOWER™

- Up to 30 A/blade (4 blades powered)
- High-density, double stacked power blades
- 16, 20, 24 and 32 signal options
- Standard creepage and clearance dimensions available at **samtec.com/power***



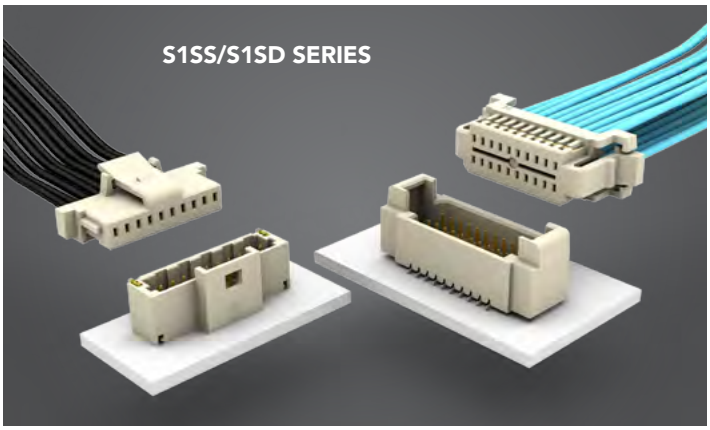
* For flexible design solutions to fit specific applications, contact Samtec.

MICRO DISCRETE WIRE

CHOICE OF PITCH • 3 TO 35 A PER CONTACT • RUGGED LATCHING

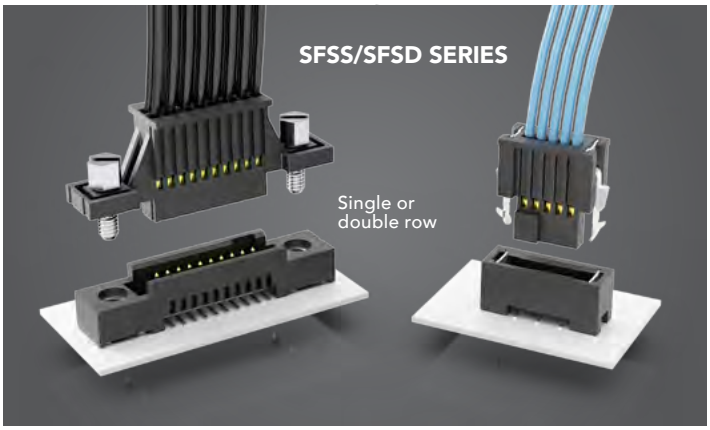
1.00 mm PITCH SYSTEM

- 3.3 A/contact*
- 2 to 20 total pins, single or double row
- Low profile down to 3.2 mm
- Available with or without retention latch



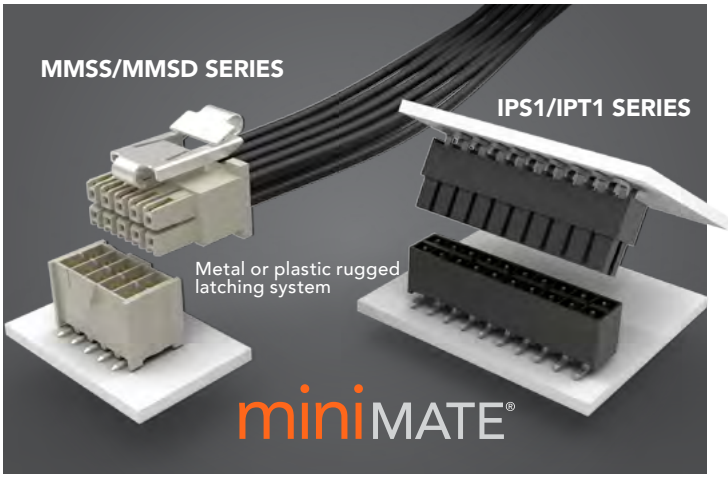
1.27 mm PITCH TIGER EYE™ SYSTEM

- 2.9 A/contact*
- High-reliability, multi-finger BeCu Tiger Eye™ contacts
- Rugged screw down and retention latch options



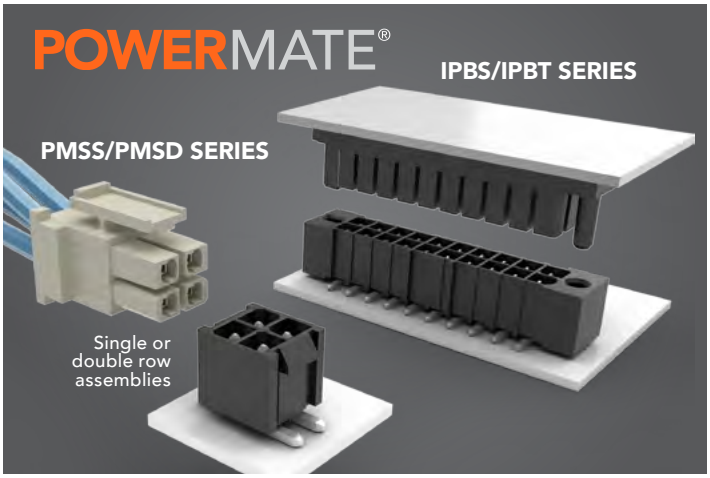
MINI MATE® SYSTEM

- 5.4 A/contact*
- .100" (2.54 mm) pitch with individually shrouded contacts
- Panel mount cable assembly accommodates panel thickness of 0.84 mm to 2.28 mm



POWER MATE® SYSTEM

- 10.3 A/contact*
- .165" (4.19 mm) pitch with individually shrouded contacts
- Standard creepage and clearance dimensions available at **samtec.com/power****



* 1 contact/blade powered per row ** For flexible design solutions to fit specific applications, contact Samtec.

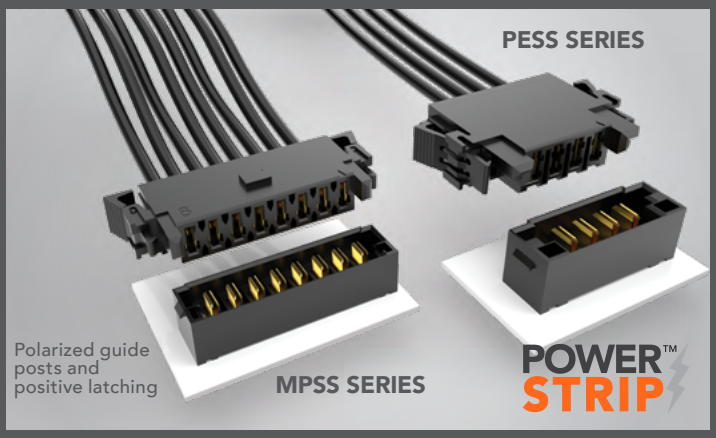
36% of Samtec's discrete wire sales are modified and custom products. See page 15 for more information.

POWERSTRIP™ SYSTEM

- 5.00 mm pitch for performance to 23.2 A/blade* and 6.35 mm pitch for 34.5 A/blade* performance
- Power/signal combination
- Standard creepage and clearance dimensions available at **samtec.com/power****

MICRO RUGGED IDC CABLE SYSTEMS

- 1.27 mm and 2.00 mm pitch systems with low 5.08 mm profile
- High-reliability Tiger Eye™ contacts
- Variety of options including rugged strain relief, polarization and daisy chains



DISCRETE WIRE COMPONENTS

- A broad selection of housings and contacts for build-it-yourself design and application flexibility
- Rugged screw downs, plastic and metal latches
- 32 to 10 AWG wire

DISCRETE WIRE TOOLING

- Hand tools and quick-change semi-automatic crimp applicators available
- Wide variety of additional application specific hardware and field service capabilities
- Visit **samtec.com/discretewire** or **samtec.com/tooling**

* 1 contact/blade powered per row ** For flexible design solutions to fit specific applications, contact Samtec.

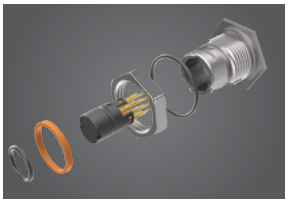
SI R

ACCLIMATE™ SEALED I/O

IP67 & IP68 • BAYONET/PUSH-PULL CIRCULARS • SPACE-SAVING RECTANGULARS

FLEXIBLE SEALED CIRCULAR SYSTEMS

- Metal or plastic, 12 mm, 16 mm & 22 mm shells
- Flexible pin configuration, gender and panel interface termination
- Bayonet-style latching systems meet IP68 requirements
- Cost-effective crimp version available
- Mini push-pull latching system meets IP67 requirements for dust and waterproof sealing



KITTED COMPONENTS FOR EFFICIENT FIELD ASSEMBLY

ACP/ACR SERIES
16 mm size metal shell

CCP/CCR SERIES
Crimp 12 mm shell

MCP/MCR SERIES
Mini push-pull system

ACCLIMATE™

ETHERNET AND USB SEALED SYSTEMS

- IP68 threaded circulars with rugged overmold design
- Space-saving rectangulars with positive latching for quick connect/disconnect
- IP67 sealed USB Type C port seals to panel without costly metal screws or dust caps

25-45% PANEL AREA SAVINGS

SSU-C SERIES
Meets USB 2.0 and base 3.1 standards

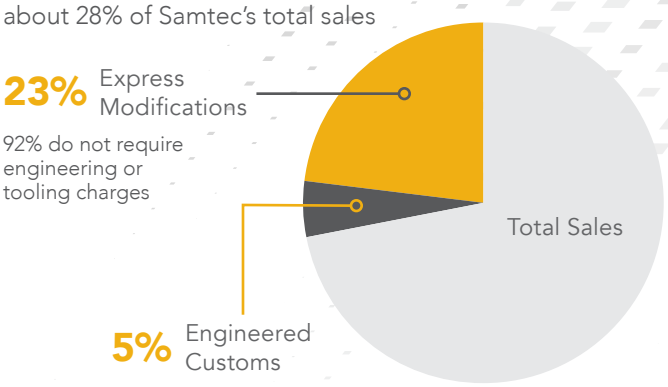
RCE/RPBE SERIES
USB or Ethernet (meets CAT3, CAT5 & CAT5e)

SCRUS/SCPU SERIES
10 or 17 mm shell size for Ethernet, Mini USB and USB

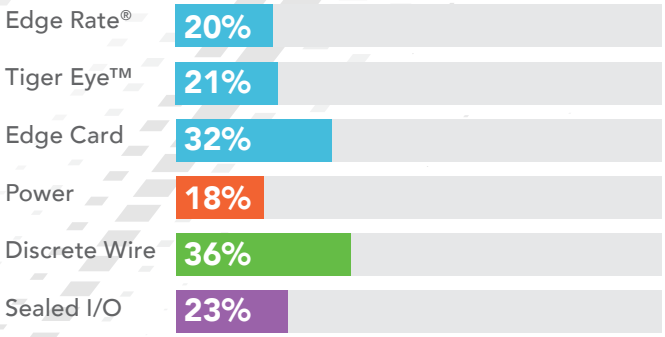
MODIFIED & CUSTOM SOLUTIONS

WILLINGNESS, SUPPORT & EXPERTISE

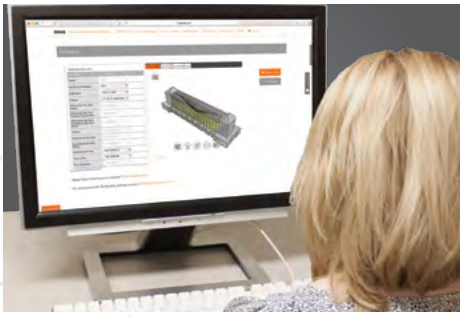
Customs and Modifications make up about 28% of Samtec's total sales



A substantial percentage of each Micro Rugged product segment is custom

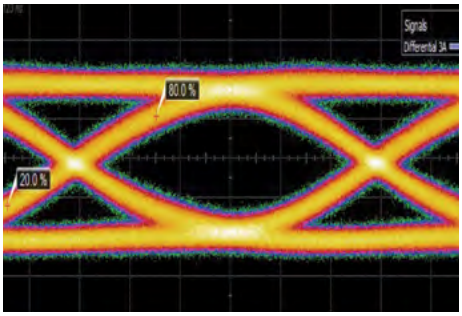


INDUSTRY LEADING CUSTOMER SERVICE



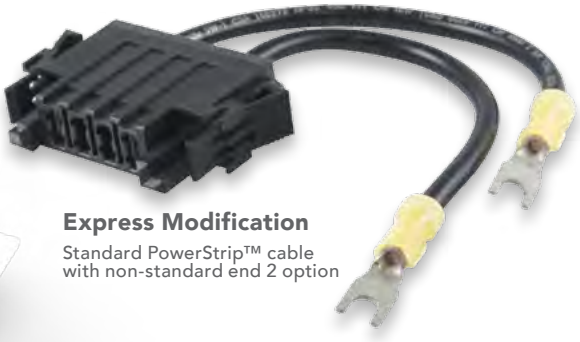
FLEXIBLE IN-HOUSE MANUFACTURING

SIGNAL INTEGRITY EXPERTISE

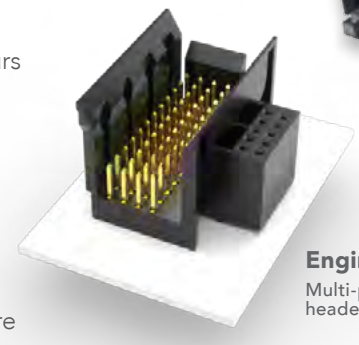


FLEXIBLE CAPABILITIES

- Full engineering, design and prototype support
- Design, simulation and processing assistance
- Quotes and samples turned around in 24 hours
- Flexible, quick-turn manufacturing
- Dedicated Application Specific Product engineers and technicians
- Modified or custom options for board level connectors and cable assemblies including: contacts, bodies, stamping, plating, wiring, molding, ruggedizing features and much more



Express Modification
Standard PowerStrip™ cable with non-standard end 2 option



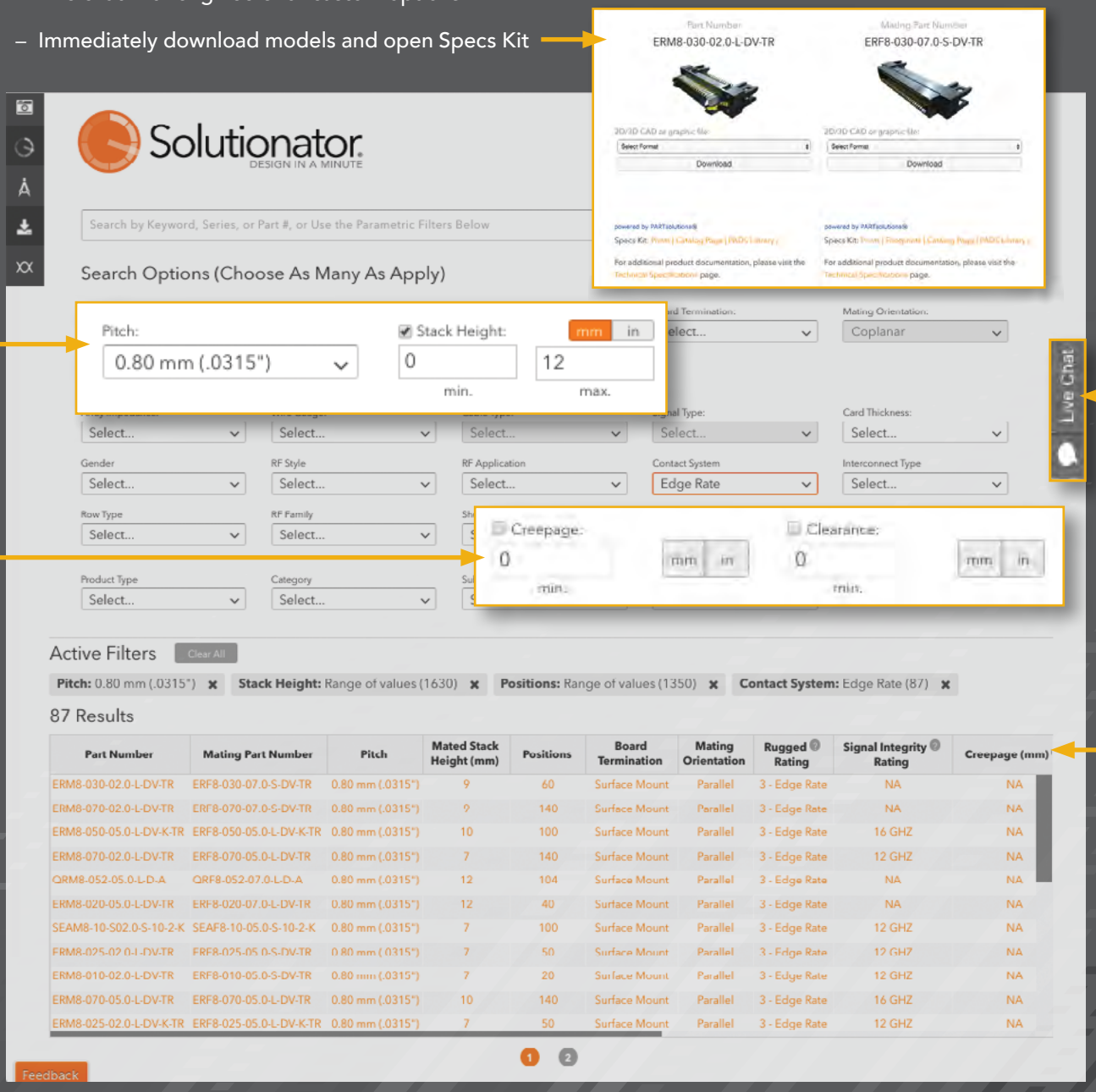
Engineered Custom
Multi-power staging, power/signal combo, header/socket combo, custom body

Contact the Application Specific Products Group at **asp@samtec.com** for express modifications or **customasp@samtec.com** for engineered customs.

SOLUTIONATOR®

QUICKLY BUILD MATED SETS ONLINE

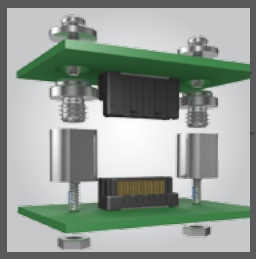
- Wide variety of search parameters and filters: creepage and clearance, pitch, stack height, etc.
- Easily sort results to find the right mated set
- Live chat with engineers for custom options
- Immediately download models and open Specs Kit



www.samtec.com/solutionator

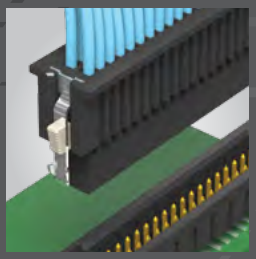
RUGGED FEATURES

RUGGEDIZING OPTIONS



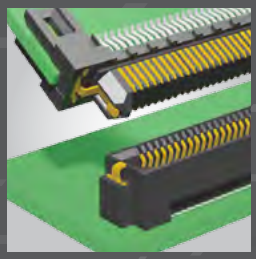
JACK SCREWS

Ideal for high normal force, zippering and other rugged applications



POSITIVE LATCHING

Manually activated latches increase unmating force by up to 200%

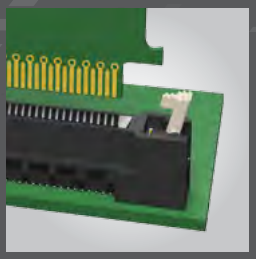


FRICTION LOCKS

Metal or plastic friction locks increase retention/withdrawal force

RETENTION PINS

Increase unmating force by up to 50%

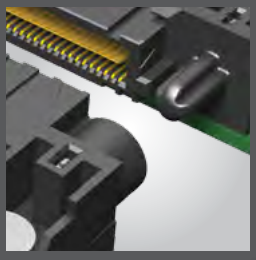


BOARD LOCKS

Boards are mechanically locked together

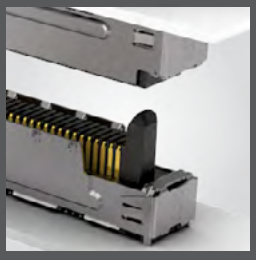
WELD TABS

Significantly increase sheer resistance of connector to PCB



GUIDE POSTS

Easy and secure mating

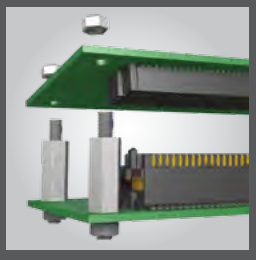


SHIELDING

360° shielding reduces EMI

SCREW DOWNS

Secure mechanical attachment to the board



BOARD STANDOFFS

Precision machined standoffs for 5 mm to 25 mm board spacing

CONTACT SYSTEMS

TIGER EYE™

High-reliability
High Mating Cycles
Multi-finger Contact

TIGER CLAW™

Dual Wipe Contact
Pass-through Applications
Ultra-low Profile

BLADE & BEAM

Mating/Alignment "Friendly"
Cost-effective

TIGER BEAM™

Best Cost
Reliable Performance
Post & Beam Contact

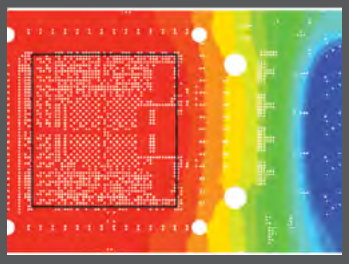
EDGE RATE®

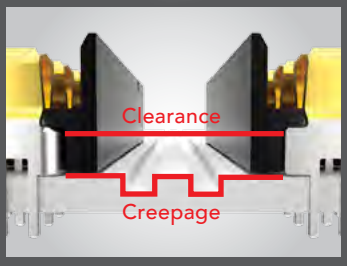
Designed for Signal Integrity
Superior Impedance Control
Reduced Broadside Coupling

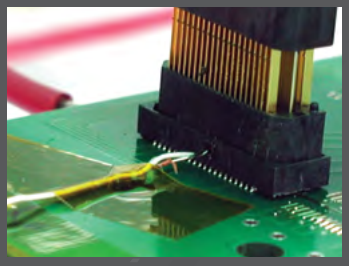
POWER INTEGRITY & E.L.P.™

POWER INTEGRITY SERVICES

- Standard power test data, including current carrying capacity, working voltage, voltage drop and resistance, creepage and clearance, is available for select power systems
- Current Cycling Test Data, which demonstrates connector performance in realistic and common applications, is available for select series
- Power Integrity Guidelines are based on test data and proven design parameters, and are designed to help in connector selection and PCB design maximization
- Power Integrity Certified products undergo testing and additional requirements unique to Samtec. To be certified, products must pass Current Cycling Test EIA 365-55, have current carrying capacity, resistance and amps vs. number of contacts data available and Power Integrity Guidelines developed
- Visit **samtec.com/powerintegrity** for more information







EXTENDED LIFE PRODUCT™

E.L.P.™ products are tested to rigorous standards, which evaluate contact resistance in simulated storage and field conditions.

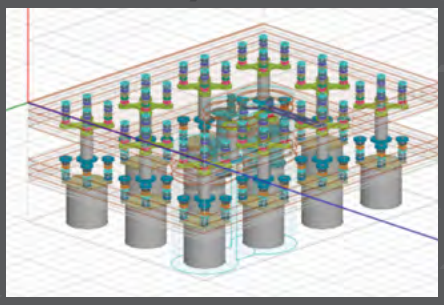
- 10 year Mixed Flowing Gas (MFG)
- High Mating Cycles (250 to 2,500)
- Certain plating and/or contact options will apply
- For complete details on Samtec's E.L.P.™ program, a list of qualifying products and test results, please visit **samtec.com/ELP** or email the Customer Engineering Support Group at **CES@samtec.com**

PITCH	TYPE	CONTACT	SERIES*
0.50 mm	Q Series® Strip	Blade & Beam	QSH/QTH
	Basic Strip	Blade & Beam	BSH/BTH
0.635 mm	Q Series® Strip	Blade & Beam	QSS/QTS
	Basic Strip	Blade & Beam	BSS/BTS
0.80 mm	Edge Rate® Strip	Edge Rate®	ERF8/ERM8
	Edge Card	Edge Rate®	HSEC8
	Q Rate® Strip	Edge Rate®	QRM8/QRF8
	Q Series® Strip	Blade & Beam	QSE/QTE
	Basic Strip	Blade & Beam	BSE/BTE
	Strip	Tiger Eye™	SEM/TEM
1.00 mm	Strip	Tiger Claw™	CLM/FTMH
1.27 mm	SEARAY™ Array	Edge Rate®	SEAF/SEAM
	Strip	Tiger Eye™	SFM/TFM
	Strip	Tiger Claw™	CLP/FTSH
	Strip	Tiger Beam™	FLE/FTSH
2.00 mm	Strip	Tiger Eye™	SMM/TMM
	Strip	Tiger Claw™	CLT/TMMH
2.54 mm	Strip	Tiger Claw™	SSM/TSM
	Strip	Tiger Claw™	BCS/TSW

* Tested socket/terminal combination shown. Other mating headers also available. Contact Samtec if header design you need is not shown.

FULL SYSTEM SIGNAL INTEGRITY

Teraspeed® and Signal Integrity Group Engineers Help Optimize and Validate Your High-Performance System. Services are available at any level you require: from early stages of the design process including package design, materials selection and PCB routing, through in-depth analysis, modeling and simulation, with measurement validation services available to 67 GHz.



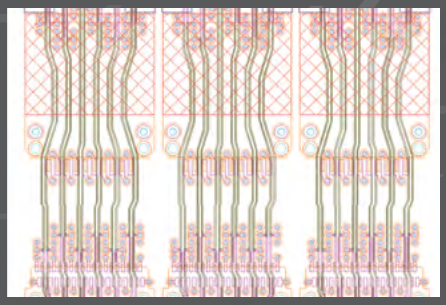
PACKAGE DESIGN & MATERIALS

Bumpout / Ballout Optimization

Layout & Routing

Ballout Transition Structures

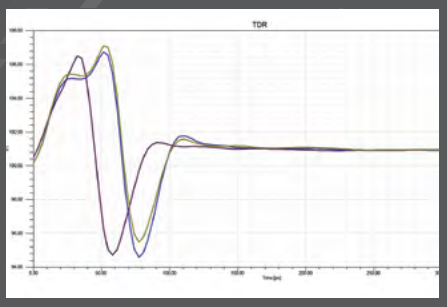
Material Recommendations



MODELING

High Bandwidth Full-Wave

Custom & Commercial Software

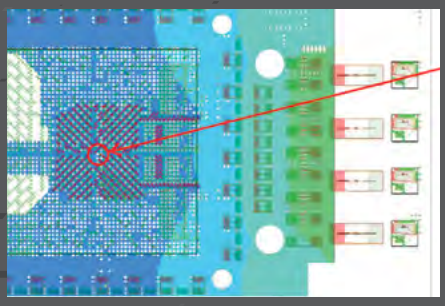


SIMULATION

Design Rules for Package & PCB Designs

Validate Implementation and Signaling Requirements for Critical Channels

Simulations via High-Performance Computing



ANALYSIS

Package, PCB and System-Level Power Integrity

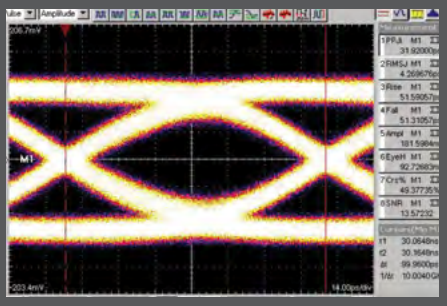
Package, PCB and System-Level Signal Integrity

TESTING

Post Design Simulation & Measurements

Measurement of Test Structures for Signal Integrity / Power Integrity Optimization

Material Characterization



VALIDATION

Validation Platform Engineering

Connectors, Packages & Devices

Characterization at Frequencies to 67 GHz

samtec

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FEBRUARY 2017