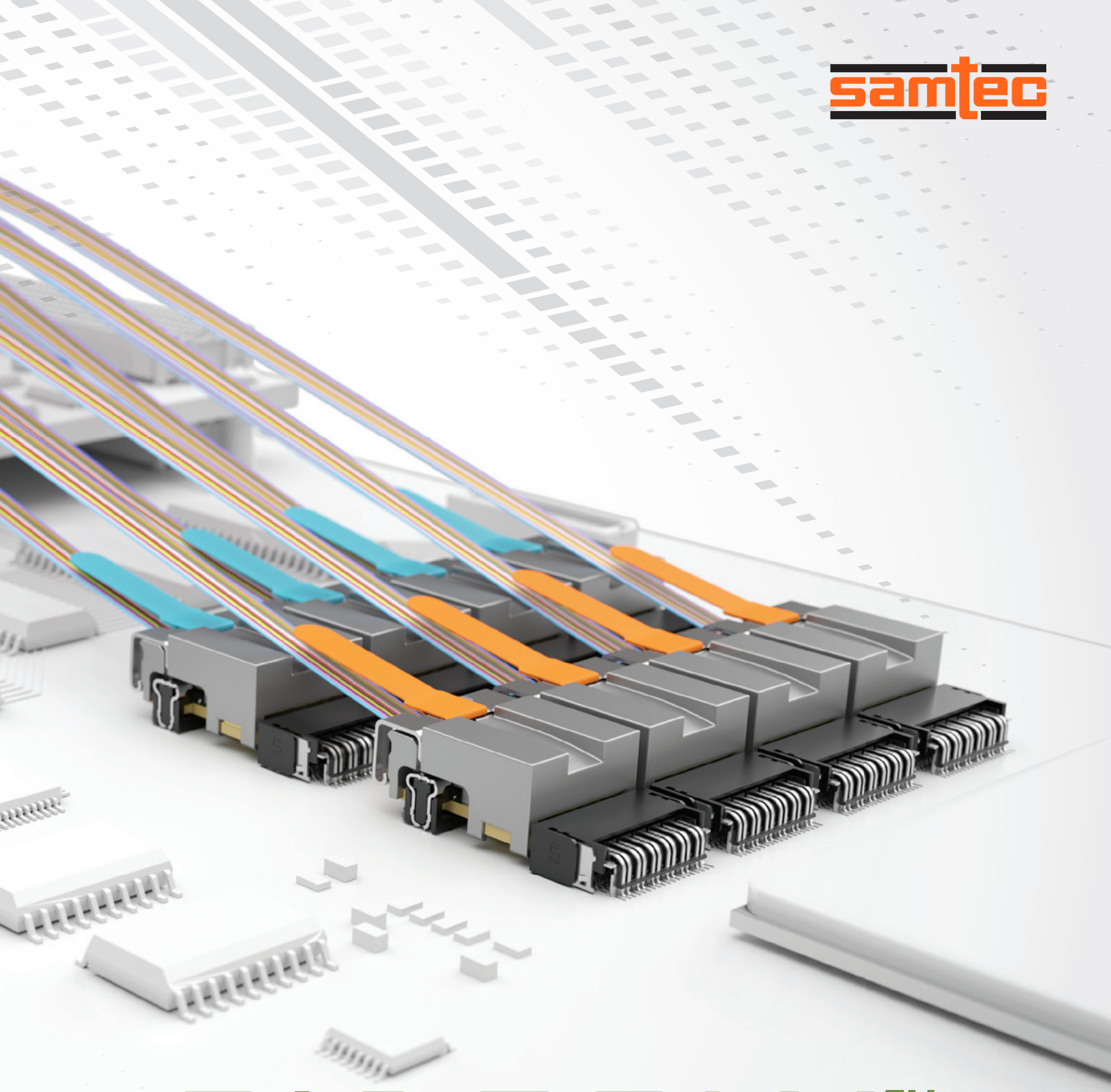


FIREFLY™

APPLICATION DESIGN GUIDE

FIREFLY™

MICRO FLYOVER SYSTEM™

FUTURE-PROOF

Interchangeability of FireFly™ copper and optical using the same high-performance connector set.

MINIATURE FOOTPRINT

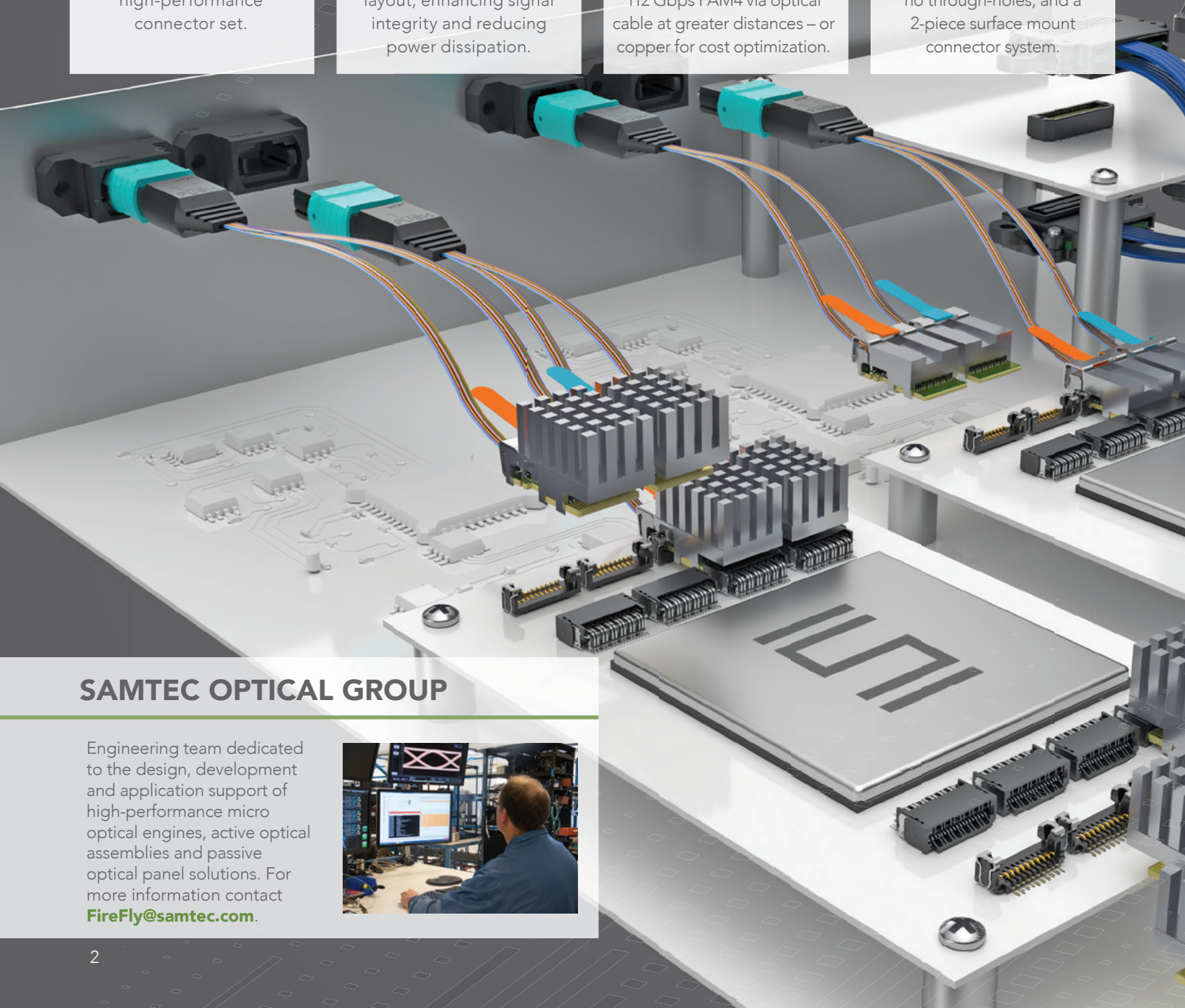
Allows for greater density and closer proximity to the IC, simplifying board layout, enhancing signal integrity and reducing power dissipation.

HIGH PERFORMANCE VERSATILITY

Data connection is taken "off board" for up to 28 Gbps per lane with a path to 112 Gbps PAM4 via optical cable at greater distances – or copper for cost optimization.

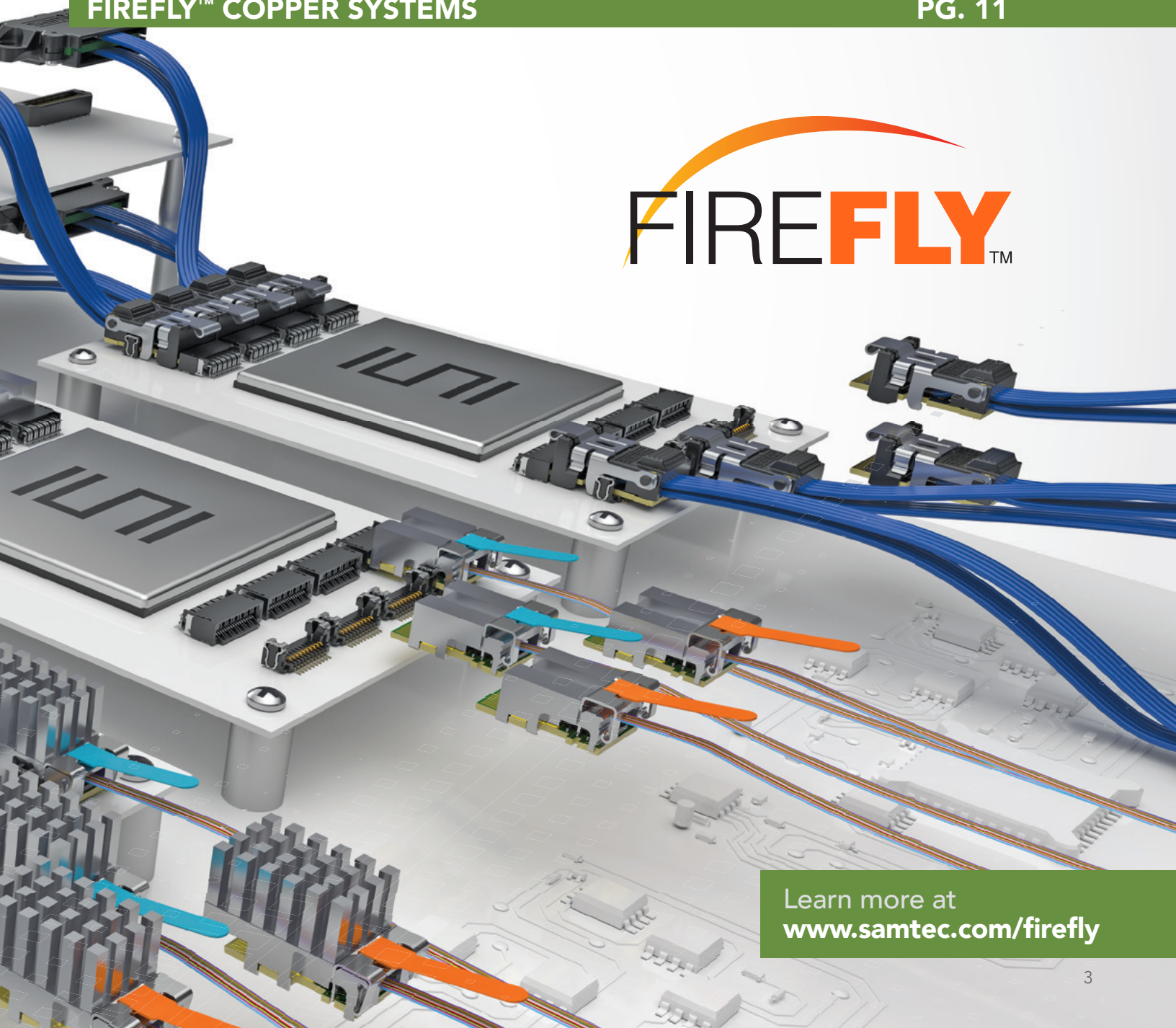
EASE OF USE

Simple assembly process with easy insertion/ removal and trace routing, no through-holes, and a 2-piece surface mount connector system.



SAMTEC OPTICAL GROUP

Engineering team dedicated to the design, development and application support of high-performance micro optical engines, active optical assemblies and passive optical panel solutions. For more information contact **FireFly@samtec.com**.



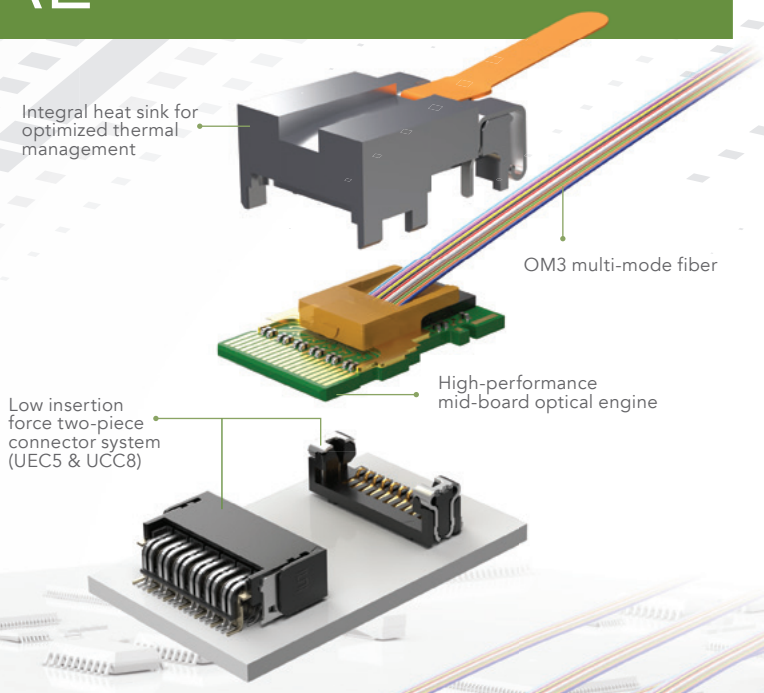
FIREFLY™

Learn more at
www.samtec.com/firefly

FIREFLY™ OPTICAL

Data connection is taken "off board," simplifying board layout and enhancing signal integrity from IC to faceplate

- Up to 28 Gbps per channel via optical cable for greater reach
- Industry leading miniature footprint allows for higher density close to the data source
- Simple to use system with easy insertion/removal and trace routing, no through-holes, and a surface mount connector system
- Supports data center, HPC and FPGA protocols, including Ethernet, InfiniBand™, Fibre Channel and Aurora



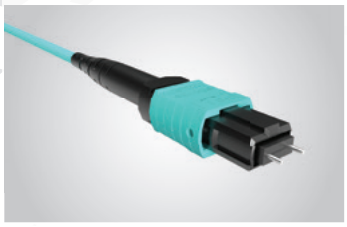
14 Gbps	x4 x12
16 Gbps	x12
25 Gbps	x4
28 Gbps	x4

FIREFLY™

SERIES	WIDTH	DATA RATE	OVERALL LENGTH	0	HEAT SINK	1	FIBER TYPE	END OPTION*	
								-Y12 requires 24 fibers	
								12 Fibers	**24 Fibers**
ECUO	**-T12** = x12 Tx Transceiver **-R12** = x12 Rx Receiver **-Y12** = x12 Duplex (Y Configuration) **-B04** = x4 Duplex	**-14** = 14 Gbps per lane **-16** = 16 Gbps per lane (x12 only) **-25** = 25 Gbps per lane (x4 only) **-28** = 28 Gbps per lane (x4 only)	**-"XXX"** = Overall Length in Centimeters (011 cm - 999 cm) (Minimum length will depend on fiber type and End 2 option specified)		**-1** = Flat **-2** = Pin-Fin (-14 & -16 only) **-3** = Flat with 3-ribbon pass-through **-4** = PCIe® Pin-Fin (-14 & -16 only) **-5** = High-Performance Pin-Fin (For use with -25 & -28)		**-1** = OM3 Low Bend Radius Ribbon **-2** = OM3 Low Bend Radius Loose Tube	-01 = MTP®, male -02 = MTP®, female -05 = MT male -06 = MT female -07 = MXC®	-21 = MTP®, male -22 = MTP®, female -25 = MT male -26 = MT female -27 = MXC®

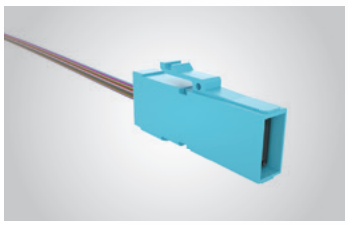
* These are standard options. See page 5 for other end options available. **MTP® and MXC® are registered trademarks of US Conec Ltd.

END OPTION FLEXIBILITY



MPO (MTP®)
High-density connectors for panel applications and minimal keep-out areas on the board

MT
Low insertion force connectors for high-density cabling and backplane applications

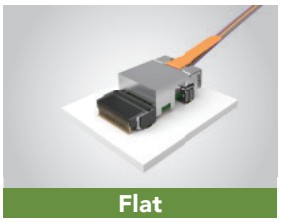


MXC®
High-density connectors for front panel or backplane applications

ARIB STD-B58 Interface
BNC-type connector with optical MT ferrule for ultra-high density applications

HEAT SINK FLEXIBILITY

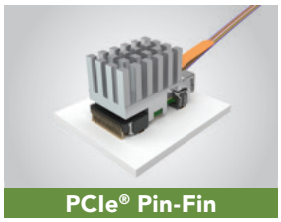
Conduction Cooling



Flat

Grooved
Groove allows ribbon cables to pass through so FireFly™ can be placed closer together

Convection Cooling



PCIe® Pin-Fin
PCIe® card height compliant

Standard Pin-Fin

High-Performance
Accommodates applications with specific power and temperature requirements

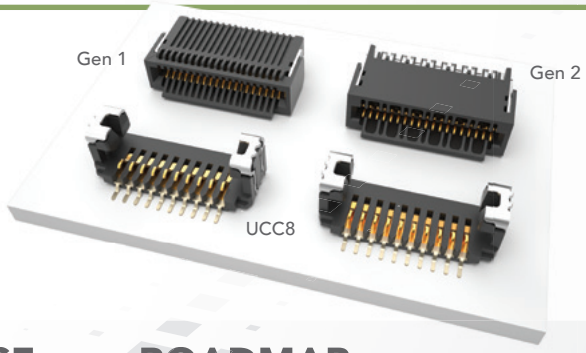
FIREFLY™ CONNECTOR SYSTEM

UEC5 - 0.50 mm Pitch High-Speed Data

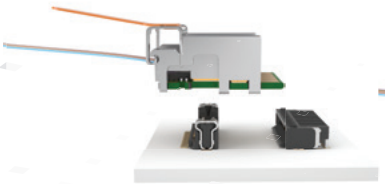
- Two generations available
  - Gen 1 (UEC5-XXX-1) for up to 20 Gbps
  - Gen 2 (UEC5-XXX-2) for 20+ Gbps

UCC8 - 0.80 mm Pitch Power & Communication

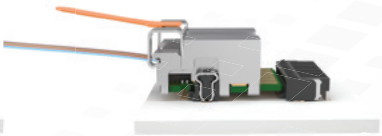
- Power pins & control signals



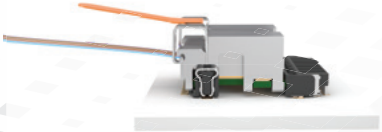
EASY MATING INSERTION SEQUENCE



1. Align cable assembly



2. Drop assembly down



3. Slide assembly forward

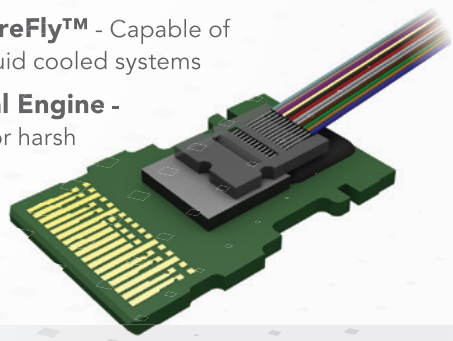
4. Depress latch to lock

ROADMAP

Advanced Optics - Samtec is focused on bringing to market 112 Gbps PAM4 solutions that are scalable, manufacturable and cost-efficient

Submersible FireFly™ - Capable of immersion for liquid cooled systems

Rugged Optical Engine - Rugged design for harsh environments

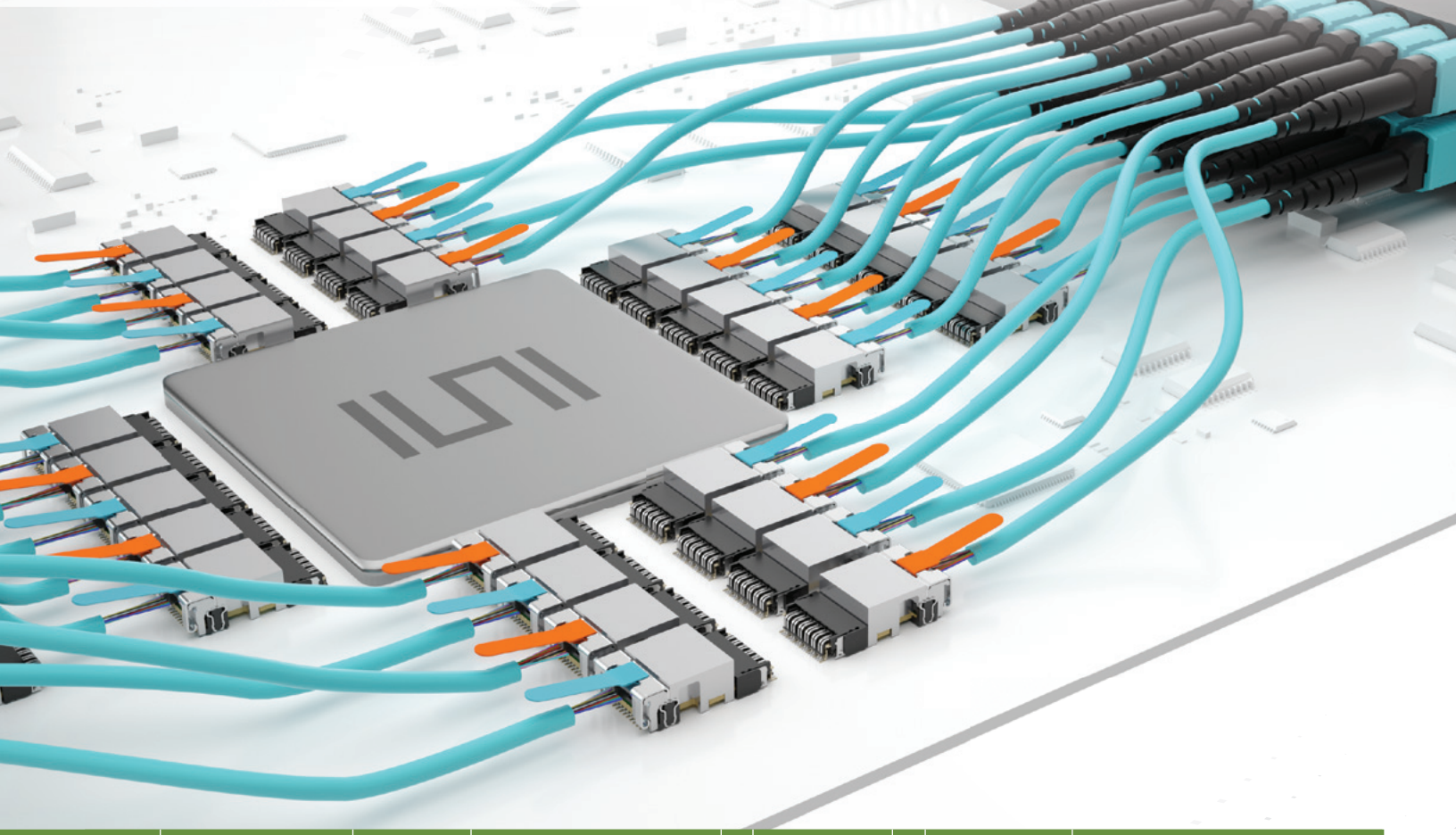


EXTENDED TEMP FIREFLY™

Extended temperature range from -40 °C to +85 °C for military and industrial applications

- Demonstrated error-free transmission during applied external vibrations and shock test to methods specified in MIL-STD-810G
- Variety of integral heat sinks provide optimal cooling for thermal operating conditions
- Multiple end options available, including MT38999, MTP®, MXC®, ARINC 801 and ARIB STD-B58 interface

10 Gbps | x4 x12

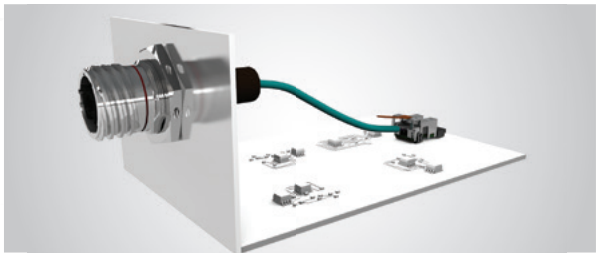


SERIES	WIDTH	DATA RATE	OVERALL LENGTH	0	HEAT SINK	1	FIBER TYPE	END OPTION*	
								-Y12 requires 24 fibers	
ETUO	**-T12** = x12 Tx Transceiver **-R12** = x12 Rx Receiver **-Y12** = x12 Duplex (Y Configuration) **-B04** = x4 Duplex	**-10** = 10.3125 Gbps	**-"XXX"** = Overall Length in Centimeters (011 cm - 999 cm) (Minimum length will depend on fiber type and End 2 option specified) (Custom higher loss link budgets are supported; contact Samtec)		**-1** = Flat **-2** = Pin-Fin **-3** = Flat with 3-ribbon pass-through **-5** = High-Performance Pin-Fin		**-1** = OM3 Low Bend Radius Ribbon **-2** = OM3 Low Bend Radius Loose Tube	**12 Fibers** -01 = MTP®, male -02 = MTP®, female -05 = MT male -06 = MT female -07 = MXC®	**24 Fibers** -21 = MTP®, male -22 = MTP®, female -25 = MT male -26 = MT female -27 = MXC®

*These are standard options. See page 7 for other end options available.

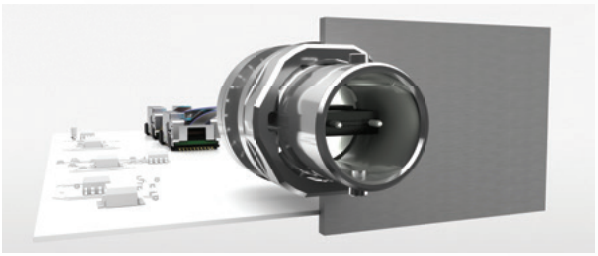
END OPTION FLEXIBILITY

Samtec has partnered with companies such as Amphenol® and Positronic® to combine FireFly™ with a variety of rugged end 2 options, including:



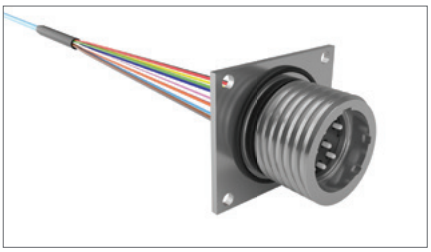
Amphenol® MT38999

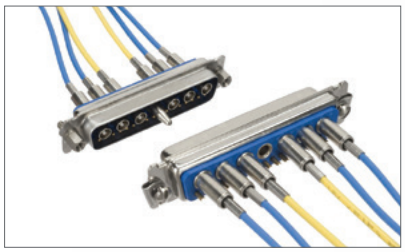
- Samtec's Extended Temp FireFly™ optical with Amphenol® Aerospace bulkhead interconnects (MT38999) for rugged, passive optical solutions
- Developed for industrial and military applications



ARIB STD-B58 Interface

- BNC-type interface with optical MT ferrule combined with Extended Temp FireFly™ meets ARIB STD-B58
- Initially developed for broadcast video; ideal for ultra-high density applications





ARINC 801 Termini

- Genderless terminus for ease of use combined with Extended Temp FireFly™ ensures accurate alignment with low-insertion loss and return loss values (shown: ARINC 801 Connector in D38999 shell and ARINC 801 in Optik-D™)

ARINC 801 Termini photo courtesy of Amphenol® Aerospace | Optik-D™ Series photo courtesy of Positronic®

APPLICATION FLEXIBILITY

Extended Temperature FireFly™ is ideal for military, aerospace and industrial applications.

ROADMAP

25 Gbps Extended Temp FireFly™

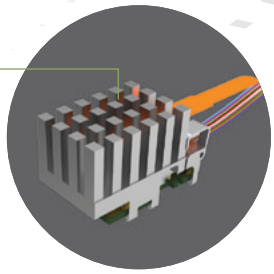
Higher speed solution for harsh environment applications

PCIe®-OVER-FIBER

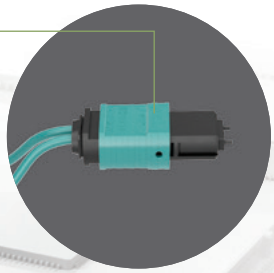
FIREFLY™ OPTICAL CABLE SYSTEM

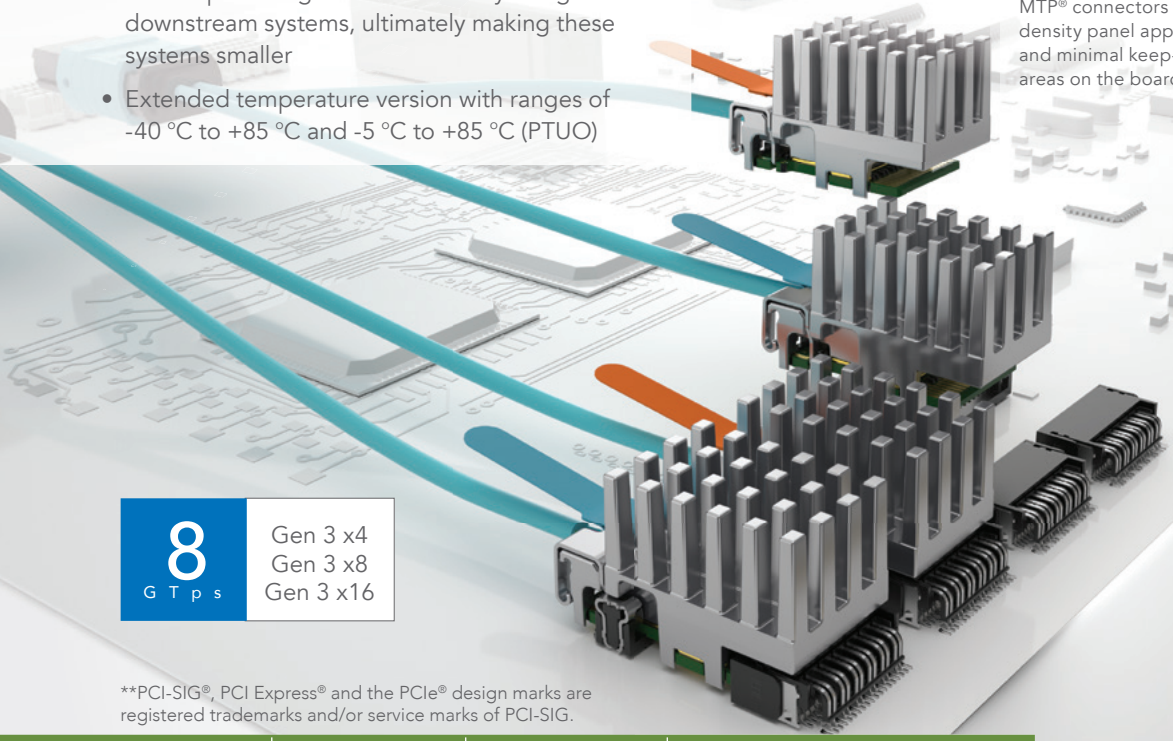
- Transmits PCIe® signals at Gen 3 data transfer rates through FireFly™ optical up to 100 m; Gen 4 in development
- Supports PCIe® protocol for low latency, power savings and guaranteed transmission
- Duplex auxiliary signals allow both transparent and non-transparent bridging
- Micro optical engines allow for easy design into downstream systems, ultimately making these systems smaller
- Extended temperature version with ranges of -40 °C to +85 °C and -5 °C to +85 °C (PTUO)

PCIe® card electromechanical height compliant heat sink



MTP® connectors for high-density panel applications and minimal keep-out areas on the board





8 GTps	Gen 3 x4 Gen 3 x8 Gen 3 x16

**PCI-SIG®, PCI Express® and the PCIe® design marks are registered trademarks and/or service marks of PCI-SIG.

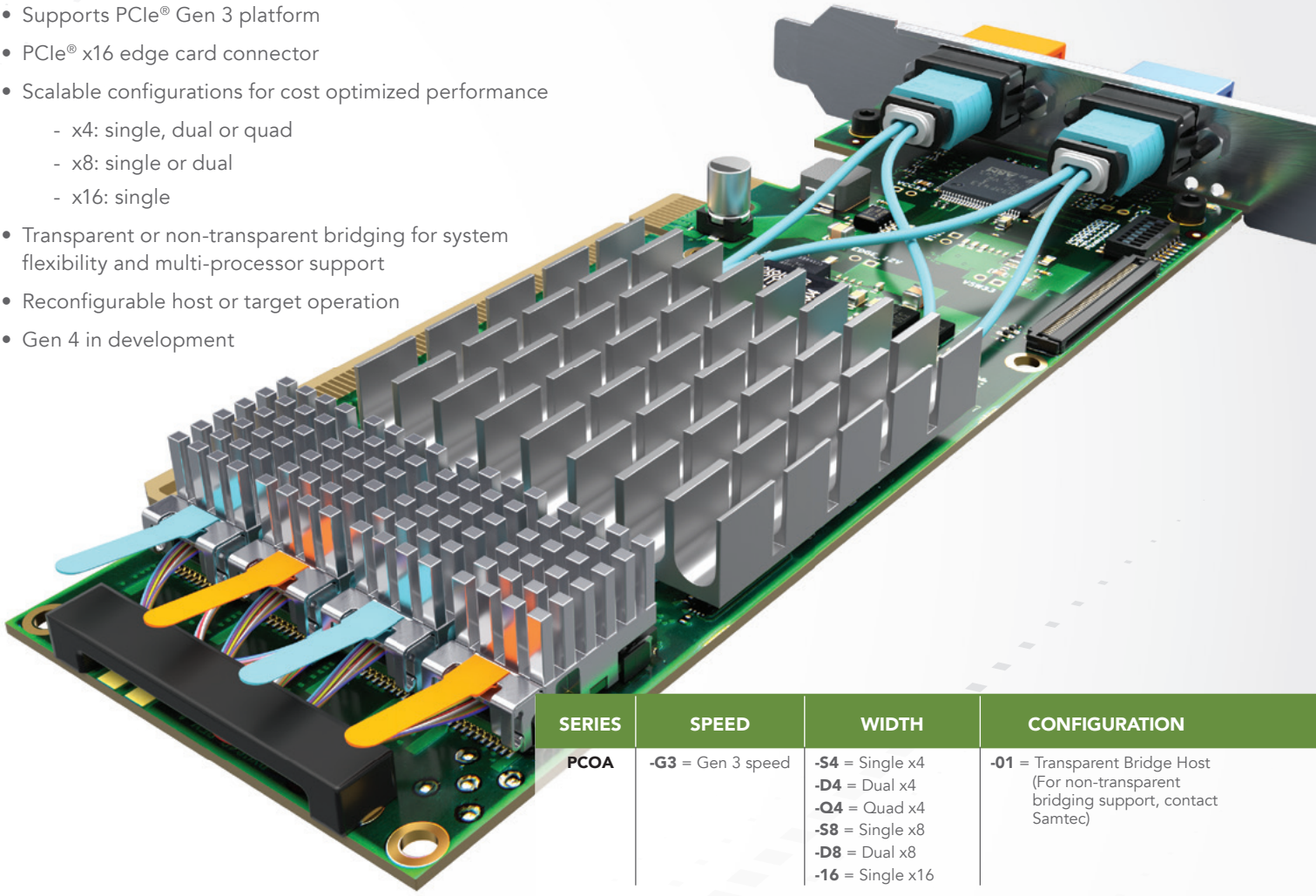
SERIES	SPEED	WIDTH	CABLE LENGTH
PCUO = PCIe®-Over-Fiber **PTUO** = Extended Temp	**-G3** = Gen 3 speed	**-04** = x4 PCIe® Gen 3 **-08** = x8 PCIe® Gen 3	**-"XXX"** = Overall Length in Centimeters (10 cm minimum)

TARGET APPLICATIONS

Ideal for high-density applications such as broadcast video, HPC, storage, military and disaggregated computing.

ADAPTOR CARD WITH FIREFLY™

- Uses PCUO FireFly™ optical cable for clear signal transmissions with increased reach and cost optimization
- Supports PCIe® Gen 3 platform
- PCIe® x16 edge card connector
- Scalable configurations for cost optimized performance
  - x4: single, dual or quad
  - x8: single or dual
  - x16: single
- Transparent or non-transparent bridging for system flexibility and multi-processor support
- Reconfigurable host or target operation
- Gen 4 in development



SERIES	SPEED	WIDTH	CONFIGURATION
PCOA	**-G3** = Gen 3 speed	**-S4** = Single x4 **-D4** = Dual x4 **-Q4** = Quad x4 **-S8** = Single x8 **-D8** = Dual x8 **-16** = Single x16	**-01** = Transparent Bridge Host (For non-transparent bridging support, contact Samtec)

APPLICATION FLEXIBILITY

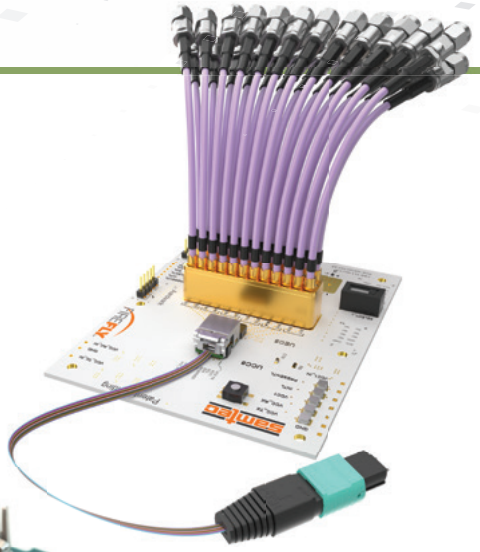
The Adaptor Card enables computer-to-computer or computer-to-endpoint over long distances, and is ideal for high-performance and data quality applications including: AR/VR high-definition cameras, video editing systems, security systems, data acquisition and industrial applications.




KITS & SERVICES

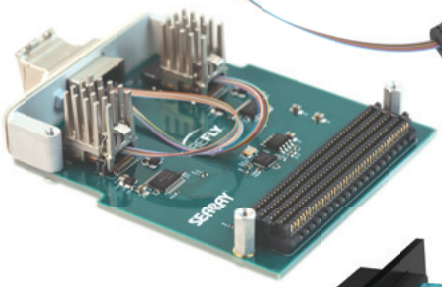
CHARACTERIZATION & DEVELOPMENT KITS

From concept and prototype to development and production, Samtec-designed and Partner-designed kits and boards featuring FireFly™ Micro Flyover System™ simplify design and reduce time to market. For more information, please visit **Samtec.com/kits** or contact **KitsAndBoards@samtec.com**



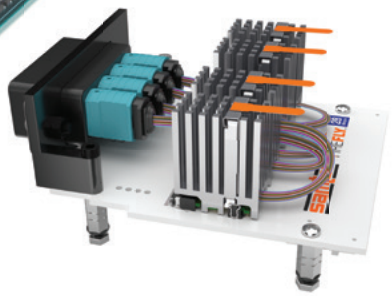
FireFly™ Test Kit

Rated up to 25 Gbps, this kit allows the designer real-time evaluation of an actively running copper or optical FireFly™ system in their lab, with their inputs, via Samtec's Bulls Eye® test point system. (Samtec P/N: FIK-FIREFLY-XX)



14 Gbps FireFly™ FMC Development Kit

Samtec's 14 Gbps FireFly™ FMC Development Kit is VITA 57.1 compliant and provides up to 140 Gbps full-duplex bandwidth over 10 channels from an FPGA to an industry-standard multi-mode fiber optic cable. (Samtec P/N: REF-193429-01)



25/28 Gbps FireFly™ FMC+ Development Kit

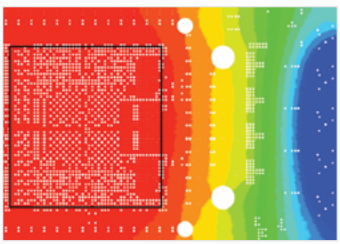
Samtec's 25/28 Gbps FireFly™ FMC+ Module is VITA 57.4 compliant and provides up to 400/448 Gbps full-duplex bandwidth over 16 channels from an FPGA to an industry-standard multi-mode fiber optic cable. (Samtec P/N: REF-200772-XXX-XX-01)

ADVANCED DESIGN SERVICES

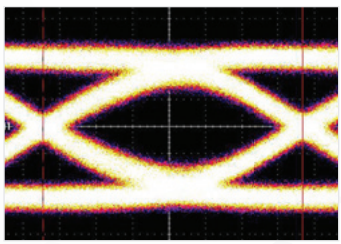
Samtec Signal Integrity engineers use their design expertise and extensive experience in high-performance systems to provide Tier 1 level support for advanced optical systems.

Our advanced techniques for system analysis are executed with custom simulation software and High-Performance Computing (HPC), enabling reliable results which are validated through measurements to 67 GHz.

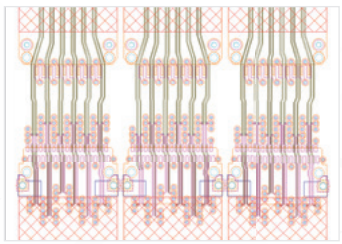
For more information, or to discuss your specific application, please contact **FireFly@samtec.com**.



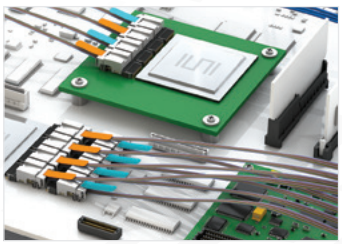
Power Integrity



Signal Integrity



Package Design & Analysis



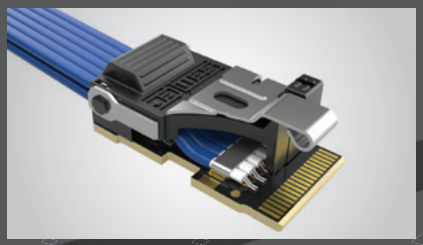
PCBs, Modules & Connectors

FIREFLY™ COPPER

High-performance, high-density copper Flyover™ solution

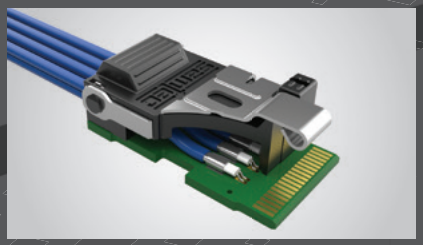
- Pin compatible with optical FireFly™ using the same connector system
- Low-cost solution for seamless integration of new and existing designs
- Variety of end 2 termination options

14 Gbps	x4 Bidirectional ECUE x12 Unidirectional ECUE
28 Gbps	x4 Bidirectional ECUE-2



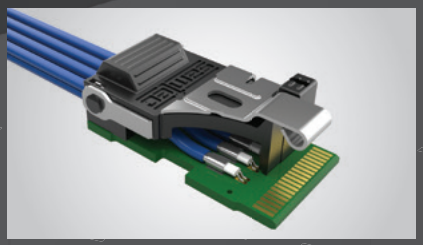
Standard Copper (ECUE)

- 14 Gbps
- 100 Ω, 34 AWG or 36 AWG Eye Speed® twinax cable



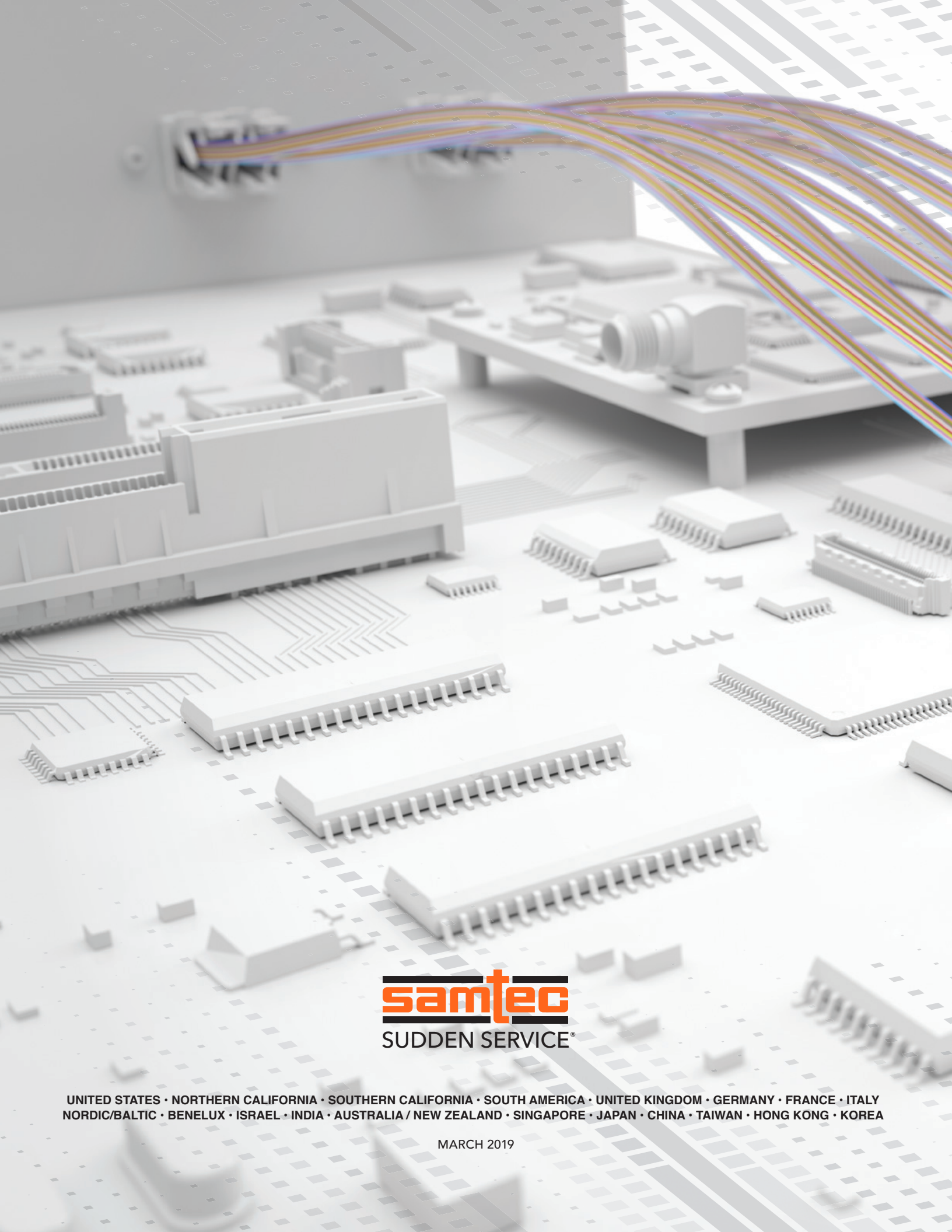
Optimized Copper (ECUE-2)

- 28 Gbps card design
- 100 Ω, 34 AWG Eye Speed® ultra low skew twinax cable
- Optimized for use with connector UEC5-2



PCIe®-Over-FireFly™ Copper (PCUE)

- Gen 4 compatible
- 100 Ω, 34 AWG Eye Speed® ultra low skew twinax cable
- Optimized for use with connector UEC5-2



samtec

SUDDEN SERVICE®

UNITED STATES · NORTHERN CALIFORNIA · SOUTHERN CALIFORNIA · SOUTH AMERICA · UNITED KINGDOM · GERMANY · FRANCE · ITALY
NORDIC/BALTIC · BENELUX · ISRAEL · INDIA · AUSTRALIA / NEW ZEALAND · SINGAPORE · JAPAN · CHINA · TAIWAN · HONG KONG · KOREA

MARCH 2019