FIREFLY™
MICRO FLYOVER SYSTEM™

**FUTURE-PROOF MICRO FOOTPRINT**
Flexibility of copper and optical using the same micro connector allows for increased density, simplified PCB and reduced power dissipation.

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

**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.

**RUGGEDNESS**
Variety of rugged options ideal for harsh environmental applications.

Learn more at [www.samtec.com/firefly](http://www.samtec.com/firefly)
COMMERCIAL FIREFLY™

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 10/40/100 GbE Ethernet, InfiniBand™, Fibre Channel and Aurora

**14** Gbps | **25** Gbps
---|---
4 x 12 | 4 x 12

**16** Gbps | **28** Gbps
---|---
2 x 12 | 4 x 4

<table>
<thead>
<tr>
<th>ECUO</th>
<th>WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B04</td>
<td>4 Tx + 4 Rx</td>
</tr>
<tr>
<td>-T12</td>
<td>12 Tx</td>
</tr>
<tr>
<td>-R12</td>
<td>12 Rx</td>
</tr>
<tr>
<td>-Y12</td>
<td>12 Tx + 12 Rx</td>
</tr>
<tr>
<td>-U12</td>
<td>12 Channel AOC (Unidirectional)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATA RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-14 = 14 Gbps per lane</td>
</tr>
<tr>
<td>-16 = 16.1 Gbps per lane (N/A -B04)</td>
</tr>
<tr>
<td>-25 = 25.7 Gbps per lane</td>
</tr>
<tr>
<td>-28 = 28.1 Gbps per lane (-B04 only)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CABLE LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>–“XXX” = Overall Length in Centimeters</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HEAT SINK</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1 = Flat</td>
</tr>
<tr>
<td>-2 = Pin-fin (-14 &amp; -16 only)</td>
</tr>
<tr>
<td>-3 = Flat with groove</td>
</tr>
<tr>
<td>-4 = PCIe® Pin-fin (-14 &amp; -16 only)</td>
</tr>
<tr>
<td>-5 = 1.75 cm tall Pin-fin (-B04 only)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FIBER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4 = Aqua loose tube with Boot</td>
</tr>
<tr>
<td>-5 = Jacketed ribbon with boot</td>
</tr>
<tr>
<td>-6 = Jacketed ribbon</td>
</tr>
<tr>
<td>-7 = Black loose tube with boot</td>
</tr>
<tr>
<td>-8 = Black loose tube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>END 2 OPTIONS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Y12 requires -2X end option (Leave blank for -U12)</td>
</tr>
<tr>
<td>-12 Fibers</td>
</tr>
<tr>
<td>-01 = MTP® Male</td>
</tr>
<tr>
<td>-02 = MTP® Female</td>
</tr>
<tr>
<td>-07 = MXC® Internal Plug</td>
</tr>
<tr>
<td>-0E = MPO Plus®, Male, bayonet</td>
</tr>
<tr>
<td>-24 Fibers</td>
</tr>
<tr>
<td>-21 = MTP® Male</td>
</tr>
<tr>
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</table>

**EASY MATING INSERTION SEQUENCE**

1. Align cable assembly
2. Drop assembly down
3. Slide assembly forward
4. Depress latch to lock

MTP® and MXC® are registered trademarks of US Conec Ltd. MPO Plus® is a registered trademark of SENKO Advanced Components, Inc.

* These are standard options. See page 5 for other end options available.
**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 (Backward compatible with all FireFly™ optical)

**UCC8 - 0.80 mm Pitch Power & Communication**

- Power pins & control signals

**APPLICATION FLEXIBILITY**

Ideal for high-performance applications such as medical, test and measurement, FPGA and AI/HPC.

**ROADMAP**

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

**Immersion Cooling** - Capable of immersion for liquid cooled systems.

**Direct Connect™**

On-package interconnect enables 56 Gbps PAM4 performance, eliminates distortion through the BGA region and improves density.
PCIe® 4.0-OVER-FIBER

FIREFLY™ OPTICAL CABLE SYSTEM

- Transmits PCIe® 3.0/4.0 data rates through FireFly™ optical up to 100 m
- Supports PCIe® protocol for low latency, power savings and guaranteed transmission
- Extended temperature version with a range of -40 °C to +85 °C
- 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

TARGET APPLICATIONS

Ideal for high-density applications such as ATE, broadcast video, mil/aero and factory automation.
ADAPTOR CARD WITH FIREFLY™

- Uses PCUO FireFly™ optical cable for clear signal transmissions with increased reach and cost optimization
- Supports PCIe® 3.0/4.0 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

APPLICATION FLEXIBILITY

The Adaptor Card enables computer-to-computer or computer-to-endpoint communications over long distances, and is ideal for high-performance and data quality applications including: AI and HPC, rugged embedded computing, video broadcast, machine vision, optical inspection, data acquisition and factory automation.
Extended temperature range from -40 °C to +85 °C for military, aerospace and industrial applications

- Demonstrated error-free transmission during applied external vibrations and shock test to methods specified in MIL-STD-810
- Variety of integral heat sinks provide optimal cooling for thermal operating conditions
- Multiple end options available, including MT38999, MTP®, MXC®, Glenair® Series 79, VITA 66.X and other common rugged interfaces

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<th>HEAT SINK</th>
<th>FIBER TYPE</th>
<th>END 2 OPTIONS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B04</td>
<td>4 Tx + 4 Rx</td>
<td>-10 10.3125 Gbps</td>
<td>-“XXX” Overall Length in Centimeters</td>
<td>-1 = Flat</td>
<td>-5 = Jacketed ribbon with boot</td>
<td></td>
</tr>
<tr>
<td>-T12</td>
<td>12 Tx</td>
<td>-25 25.7 Gbps （-B04 only）</td>
<td></td>
<td>-2 = Pin-fin</td>
<td>-6 = Jacketed ribbon</td>
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</tr>
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END OPTION FLEXIBILITY

Samtec and partners 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, optical solutions
- Developed for military, aerospace and industrial applications

**Glenair® Series 79 MT Connector**
- Samtec’s Extended Temp FireFly™ optical with Glenair® Series 79 MT fiber optic connector
- Features ultra miniature size, reduced weight, shielding and environmental protection
- Ideal for military, aerospace and industrial applications

**VITA 66.X Interface**
- Extended Temp FireFly™ with MT ferrule attach to blind mate fiber optic interconnects for use in VPX backplanes and plug-in modules
- Ideal for ruggedized, embedded computing applications

RUGGED ENVIRONMENT CAPABILITIES

- Tin whisker mitigation
- Conformal coating
- Salt fog testing
- Extended shock and vibration
- MIL-STD testing
- Fungal resistant
- Extended temperature ranges
- Additional ruggedization capabilities

APPLICATION FLEXIBILITY

Extended Temp FireFly™ is ideal for military, aerospace and industrial applications.
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
- FireFly™ loopback cable assemblies available for testing and debugging

Standard Copper (ECUE)
- 14 Gbps
- 100Ω, 34 AWG or 36 AWG Eye Speed® twinax cable

Optimized Copper (ECUE-2)
- 28 Gbps NRZ/56 Gbps PAM4 card design
- 100Ω, 34 AWG Eye Speed® ultra low skew twinax cable
- Optimized for use with connector UEC5-2

PCI Express®-Over-FireFly™ Copper (PCUE)
- PCIe® 4.0 capable
- 100Ω, 34 AWG Eye Speed® ultra low skew twinax cable
- Optimized for use with connector UEC5-2
EVALUATION & 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.

28 Gbps FIREFLY™ EVALUATION KIT
Samtec’s 28 Gbps FireFly™ Evaluation Kit offers an easy-to-use platform for testing and real-time evaluation of the FireFly™ Micro Flyover System™. The kit supports copper or optical FireFly™ in x4, x8 or x12 configurations.
(Samtec P/N: REF-209623-01)

14 Gbps FIREFLY™ FMC DEVELOPMENT KIT
Samtec’s 14 Gbps FireFly™ FMC Development Kit is VITA 57.1 electrically 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 electrically 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)

25 Gbps FIREFLY™ FMC+ DEVELOPMENT KIT
Samtec’s 25 Gbps FireFly™ FMC+ Module is VITA 57.4 electrically compliant and provides up to 300 Gbps full-duplex bandwidth over 12 channels from an FPGA to an industry-standard multi-mode fiber optic cable.
(Samtec P/N: REF-223064-01)

ECUE FLYOVER® SI EVALUATION KIT
Samtec’s ECUE Evaluation Kit routes eight high-speed differential pairs via UEC5-2/UCC8 series mating connectors, user-selected twinax cable lengths and 2.40 mm RF connectors.
(Samtec P/N: REF-201830-XX)