The pluggable I/O interface offers significant advantages as a high speed I/O interconnect. With a standard equipment I/O interface and the flexibility of pluggable modules come the options for fiber and copper links, and various data rates and protocols.

TE Connectivity (TE) has always been at the forefront of development of pluggable I/O standards. TE continues to be engaged in new pluggable interface standards to support the rapidly changing market needs for higher bandwidth, and remains at the forefront with the technical expertise required to deliver superior designs for signal integrity and EMI at higher data rates.

**FEATURES AND BENEFITS**

- High speed I/O solutions that support higher data rates than traditional copper interfaces (e.g. RJ45)
- Provides a standard interface at the equipment and allows customer to choose between transceiver modules and direct attach cable assemblies based on the application
- All cages are full metal shielded for grounding and EMI suppression
- Standards supported include Fibre Channel, Ethernet, and InfiniBand, and SAS

**PRODUCT APPLICATIONS**

- Cellular Infrastructure
- Access Routers/ Switches
- High End Servers
- Medical Diagnostic Equipment
- Network Hubs

www.te.com/pluggableio
High Speed Pluggable I/O Solutions

PT Connectors

<table>
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<tr>
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<th>SFP</th>
<th>SFP+</th>
<th>zSFP+</th>
<th>X2</th>
<th>XFP</th>
<th>QSFP/QSFP+</th>
<th>zQSFP+</th>
<th>micro QSFP</th>
<th>CFP</th>
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SFP Products
- Supports data rates up to 4 Gbps
- 20 position PT (Pluggable Transceiver) connector
- Single port, ganged, and stacked cages available
- Standard and low profile options available for stacked ports

Reference Part Numbers:
1367073-1
1658196-1
2227302-1

SFP+ Products
- Supports data rates up to 16 Gbps
- 20 position PT connector
- EMI spring or gasket, light pipes, and heat sink options
- Connector and cable assembly are backward compatible with SFP

Reference Part Numbers:
2110759-1
2007198-1
2170680-1

QSFP/QSFP+ Products
- Supports data rates up to 40 Gbps with 10 Gbps per channel
- Four-channel package offering 3X the density of traditional SFP ports
- 38 Position SMT connector
- Through-bezel and behind-bezel cage options available

Reference Part Numbers:
2110819-1
1888631-2
2214574-4

zQSFP+ Products
- Supports data rates of more than 100 Gbps with 28 Gbps per channel
- New connector design to provide superior signal integrity
- Press-fit pin layout support belly-to-belly applications
- Share the same mating interface as the QSFP+ form factor

Reference Part Numbers:
1551920-2
2170790-2
2227670-1

zSFP+ Products
- Supports data rates up to 28 Gbps
- 20 position PT connector
- EMI spring or gasket, light pipes and heat sinks options
- Connector and 1xN cages are backward compatible to SFP+

Reference Part Numbers:
2170088-X
2274001-1
2180324-2

microQSFP Products
- 4 x 28 Gbps solution provides QSFP28 functionality in a smaller, generally SFP-sized form factor
- 33% higher density than QSFP to fit more ports (up to 72) on a standard line card
- 14.25mm port-to-port pitch
- Integrated module thermal solution offers significantly better thermal performance than QSFP28 solutions

Reference Part Numbers:
2291536-1
2297551-1
2297550-1
High Speed Pluggable I/O Solutions

**CFP Products**
- Designed for Ethernet “long reach”
- Supports data rates up to 100 Gbps with 10 Gbps per channel
- 148 Position interconnect
- Excellent EMI shielding

**Reference Part Numbers:**
2057631-1
2057630-1
2057592-2

**CFP2/CFP4 Products**
- Up to 28 Gbps per lane; 100 Gbps per port
- Up to 4x data rate per 19” line card vs CFP
- Up to 60% lower power consumption vs CFP
- Pin counts: 104 pins (CFP2), 96 pins (CFP4)
- Ganged configurations available:
  - 1x1 and 1x2 cages for CFP2
  - 1x1 and 1x4 cages for CFP4
- AVAILABLE IN 2017

**Reference Part Numbers:**
2149701-1
2149152-1
2149731-1

**XFP Products**
- Design for a 10 Gbps solution (transmitting 4 channels of data at a rate of 3.125 Gbps each)
- TE connector and guide rails accept X2 MSA compliant module
- XAUI Interface
- 70 Position PT connector

**Reference Part Numbers:**
1367337-1
1367608-1
1367710-1

**CDFP Products**
- Up to 400 Gbps per port (16 lanes per port transfer up to 28 Gbps per lane)
- 0.75mm contact pitch
- Pre-assembled, one-piece press-fit connector and cage
- Support direct attach copper and active optical interfaces

**Reference Part Numbers:**
2291931-1
2274233-1

**X2 Products**
- Designed for Ethernet “short reach”
- Supports 150 Gbps solutions with 12 channels of 12.5 Gbps data
- Includes both EMI spring and an EMI gasket
- Set position integrated connector

**Reference Part Numbers:**
2149701-1
2149152-1
2149731-1

**CFP2/CFP4 Products**
- Supports data rates up to 10 Gbps
- 30 Position SMT connector
- Gasket EMI containment features
- Patented riding heat sink for thermal dissipation

**Reference Part Numbers:**
1489951-1
1489948-2
2303074-1
1367500-1

**X2 Products**
- Design for a 10 Gbps solution (transmitting 4 channels of data at a rate of 3.125 Gbps each)
- TE connector and guide rails accept X2 MSA compliant module
- XAUI Interface
- 70 Position PT connector

**Reference Part Numbers:**
1367337-1
1367608-1
1367710-1
High Speed Pluggable I/O Solutions

Mini-SAS and Mini-SAS HD Products

• Multi-lane solutions designed to support 6 Gbps and 12Gbps data rates
• Meet the SAS 2.0 and SAS 2.1 specifications; Mini-SAS HD products have been proposed for the SAS 3.0 specification
• Mini-SAS products support both internal and external solutions
• Reduced size of the Mini-SAS HD system provides additional space for system designers
• Mini-SAS HD is a one-piece assembly featuring a cage and integrated connector

Reference Part Numbers:
1888321-2
1761987-7
2149375-1

Sliver Internal Cabled Interconnects

• Supports a choice of protocols (PCIe, SAS, SATA) for data rates up to 32 Gbps per channel
• 0.6mm pitch SMT connector design
• Flexible mounting and mating arrangements
• Supports present and future bandwidth needs without requiring requalification and redesign

Reference Part Numbers:
Vertical:  Right Angle:
2292096-1  2292055-1
2291316-1  2292069-1
High Speed Pluggable I/O Solutions

High Speed Cable Assemblies

SFP+/QSFP+ Cable Assemblies

- MSA SFF-8431 compliant
- Supports serial data rates up to 10Gbps
- Enhanced EMI suppression
- 24AWG through 30AWG cable available
- Passive and active assemblies

Reference Part Numbers:
SFP+: 2127931 2127932 2127934 2032757
QSFP+: 2053638 2053453 2202165

SFP28/QSFP28 Cable Assemblies

- Ethernet and InfiniBand compliant
- Supports data rates up to 28 Gbps per channel
- Low cost alternative to fiber optic assemblies
- 26 AWG through 33 AWG cable available
- QSFP28 to 4x SFP28 and QSFP28 to 2x QSFP28 hybrid cables

Reference Part Numbers:
SFP28: 2821262 2821222 2821223 2821224
QSFP28: 2231368 2821033 2821309 2829040

microQSFP Cable Assemblies

- Compatible with 25G/50G/100G Ethernet and InfiniBand EDR
- Supports data rates up to 28 Gbps per channel in SFP sized form factor
- 28 AWG through 33 AWG cable available
- Straight, hybrid and breakout assembly configurations available

Reference Part Numbers:
2821236 2821783 2821779

Mini-SAS Cable Assemblies

- SFF-8088 and SAS 2.0 compliant
- Supports trained and untrained systems
- Up to 6Gbps data rate
- Universal key and standard key slots
- 24, 28 and 30AWG bulk cable

Reference Part Number: 1-2127833-4

Mini-SAS HD Cable Assemblies

- SFF-8644 and SAS 2.1 / 3.0 compliant
- Improved cable latch design
- Scalable 4x and 8x cable plug configurations
- 26, 28 and 30AWG bulk cable

Reference Part Numbers:
2202503 2202506 2202509

Sliver Cable Assemblies

- Supports a choice of protocols (PCIe, SAS, SATA) for data rates up to 32 Gbps per channel
- Available in discrete pair or ribbon laminated 33 AWG cable
- 8x and 12x standard configurations available
- Robust latching for secure connections

Reference Part Numbers:
Straight: 2820397-1 2820396-1
Right Angle: 2820399-1 2821385-1
### Standards for High Speed I/O Interfaces

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* Data rate per lane
Components of a High Speed I/O Interface

- Lightpipe
- Cage
- Direct Attach Copper Cable
- Heat sink clip
- Heat sink
- PT Connector

Typical Cage Port Configurations

- Single Port
- Ganged
- Belly-to-Belly
- Stacked

Features

**EMI Springs**
- Lower cost
- Less force applied to bezel

**EMI Gasket**
- Tighter tolerances between board edge and bezel are required
- Shielding slightly better in single row cage designs
- Less susceptible to damage

Accessories

**Lightpipe Application:** TE provides surface mounted LED bulbs on the PCB that carry light signal through the lightpipe clipped onto the cage to the faceplate. Lightpipes are available in standard, low profile, reduced length or square.

**Heat Sinks**

**Heat Sink Technology for Thermal Management:**
The riding heat sinks use direct contact to the pluggable module to draw heat away from the source. TE heat sinks are available in three standards networking, SAN, PCI, or can be designed to customer specifications.
Questions to Ask at Design In:

What standard and data rate is required?
Please reference the standards for high speed I/O interface table on page 5.

Does the application have specific density requirements?
Assemblies can be configured by the number of ports and to meet height/width restrictions.

Does the application require light pipes?
Light pipes are available for SFP, SFP+, QSFP/QSFP+ and CXP.

Does the application require thermal dissipation?
Heat sinks are available for SFP, SFP+, QSFP/QSFP+, XFP, CFP and CXP. There are also several thermal designs available in the SFP+, zSFP+ and the zQSFP+ product set. Please see www.te.com/pluggableio for part numbers.

What are your cable requirements?
Depending on the pluggable I/O interface, copper cable assemblies are available in different cable lengths and options.

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UK: +44 (0) 800-267666
France: +33 (0) 1-3420-8686
Netherlands: +31 (0) 73-6246-999
China: +86 (0) 400-820-6015

Part numbers in this brochure are RoHS Compliant*, unless marked otherwise.
*as defined www.te.com/leadfree

te.com/pluggableIO

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