HIGH SPEED INPUT/OUTPUT SOLUTIONS

QUICK REFERENCE GUIDE

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

HIGH SPEED I/O SOLUTIONS

PT Connectors														
SFP	SFP+	zSFP+	SFP 112G	SFP DD	QSFP/ QSFP+	QSFP-DD 112G	QSFP-DD	zQSFP+	OSFP	CFP	CFP2	CFP4	CXP	CDFP
1367073-X 1658197-1	1888247-X 2110759-1	2170088-X	2378765-1	2325864-X 2335809-1	1761987-9 2110819-1	2372133-1	2318579-1 2318579-2	1551920-2	2324869	2057630-1	2274845-1	2288229-1	Included in Assembly	Included in Assembly

SFP Products
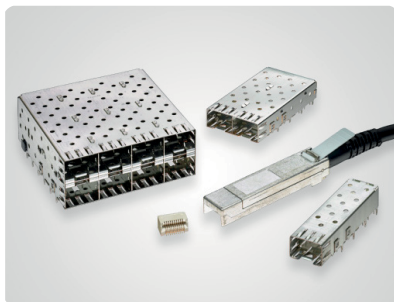
- Supports data rates up to 4Gbps
- 20 position PT (Pluggable Transceiver) connector
- Single port, ganged, and stacked cages available
- Standard and low profile options available for stacked ports

Reference Part Numbers:

1367073-1
1658391-2
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
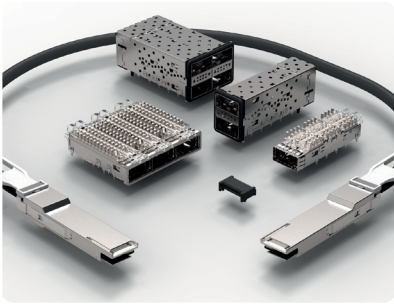2170680-1

zSFP+ Products

- Supports data rates up to 28Gbps NRZ and 56Gbps PAM4
- 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
2349202-6

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

QSFP-DD Product

- Faceplate density equal to current 1xN QSFP28
- 1x1, 1x2, 1x3, 1x4, 1x5 and 1x6 cages available
- Cages are belly-to-belly compatible
- Connector is traditional SMT with 4 rows
- 56G QSFP-DD cages are drop-in compatible to QSFP-DD 112G Connector
- Multiple heatsink and lightpipe options available
- Customizable with standard PCIe, SAN and NET heatsink heights, or to customer defi ned requirements
- 1, 2 and 4 lightpipe configurations

Reference Part Numbers:

QSFP-DD 56G	QSFP-DD 112G
2318579-1	2372133-1
2318579-2	2372133-2
2342933-1	
2-2324171-6	
2340397-1	

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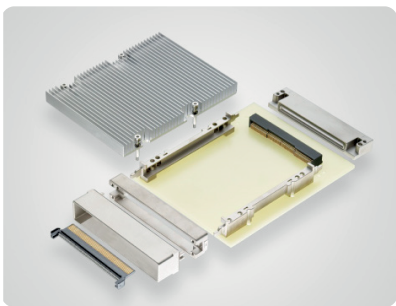
- Designed for Ethernet "long reach"
- Supports data rates up to 100 Gbps with 10 Gbps per channel
- 148 Position interconnect
- Excellent EMI shielding

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), 56 pins (CFP4)
- Ganged configurations available:
  - 1x1 and 1x2 cages for CFP2
  - 1x1 and 1x4 cages for CFP4
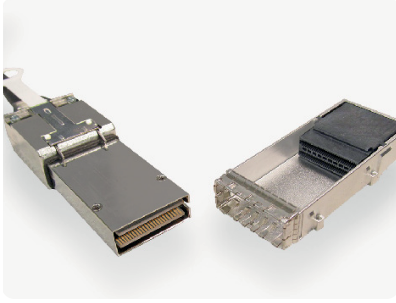- **AVAILABLE IN 2017**

CXP 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

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

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

OSFP Products

- Supports data rates up to 800 Gbps
- Superior thermal and signal integrity performance
- High port density

Reference Part Numbers:
Cages:
2317416-1
2338495-1

Connectors:
2324869

Dust Plug:
2324698-1

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

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+:	QSFP+:
2127931	2053638
2127932	2053453
2127934	2202165
2032757	

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:	QSFP28:
2821262	2231368
2821222	2821033
2821223	2821309
2821224	2829040

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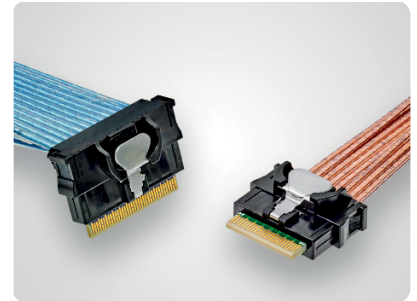
- Supports a choice of protocols (PCIe, SAS, SATA) for data rates up to 32 Gbps per channel
- Available in discrete pair or ribbon laminated 33 AWG cable
- 8x and 12x standard configurations available
- Robust latching for secure connections

Reference Part Numbers:

Straight:	Right Angle:
2820397-1	2820399-1
2820396-1	2821385-1

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:

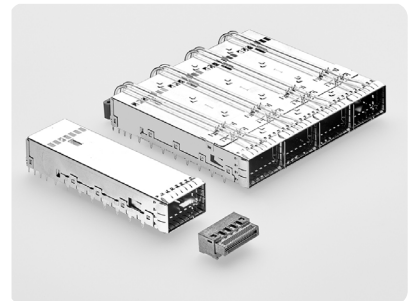1-2127833-4

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

OSFP Cable Assemblies

- Module designed to be in the range of MSA specification impedance
- Allows airflow through the module shell to cool downstream electronics in front-to-back airflow systems, or exhaust for back-to-front airflow

Reference Part Numbers:

2821906-5
2324441-2
2324442-2

SLIVER CABLE ASSEMBLIES PART NUMBER DETAILS

Card Edge Receptacles

Part Description	Orientation	Standard	TE Part Numbers					
			56 Position	84 Position	140 Position	168 Position	196 Position	280 Position
Card Edge Receptacle	Vertical	SFF-TA-1002	2327679-1	2327678-1	2327677-1	-	-	-
Card Edge Receptacle + Power	Vertical	N/A	-	-	2338718-1	-	-	-
Card Edge Receptacle	Vertical	N/A	-	-	-	2333799-1	-	-
Card Edge Receptacle	Vertical	SFF Derivative	-	-	-	-	2348234-1	2338461-1
Card Edge Receptacle	Right Angle	SFF-TA-1002	2327672-1	2327671-1	2327670-1	2336568-1	-	-
Card Edge Receptacle 1x1 SMT	Orthogonal	SFF-TA-1002, EDSFF	2329207-1	2329208-1	-	-	-	-
Card Edge Receptacle 1x4 SMT	Orthogonal	SFF-TA-1002, EDSFF	2339205-1	2339211-1	-	-	-	-
Card Edge Receptacle 1x1 PF	Orthogonal	SFF-TA-1002, EDSFF	2334227-1	TBD	-	-	-	-
Card Edge Receptacle 1x4 PF	Orthogonal	SFF-TA-1002, EDSFF	2343147-1	TBD	-	-	-	-
Card Edge Receptacle, 1.57mm Host PCB	Straddle	SFF-TA-1002, OCP NIC 3.0	-	2340326-1	2340324-1	2340321-1	-	-
Card Edge Receptacle, 1.57mm Host PCB	Straddle	N/A	2340331-1	-	-	-	-	-
Card Edge Receptacle, 1.93mm Host PCB	Straddle	SFF-TA-1002, OCP NIC 3.0	-	-	1-2340324-2	1-2340321-2	-	-
Card Edge Receptacle, 2.36mm Host PCB	Straddle	SFF-TA-1002, OCP NIC 3.0	-	-	2-2340324-1	2-2340321-1	-	-

Receptacles for Cable Assemblies

| Part Description	Orientation	Standard	TE Part Numbers			
			28 Position	56 Position	84 Position	140 Position
Receptacle for Cable Assembly	Vertical	SFF-TA-1002	-	2332141-1	2331813-1	2332139-1
Receptacle for Cable Assembly	Right Angle	SFF-TA-1002	-	2332208-1	2331814-1	2332205-1
Receptacle for Cable Assembly	Right Angle	SFF Derivative	2345808-1	-	-	-

Cable Part Numbers

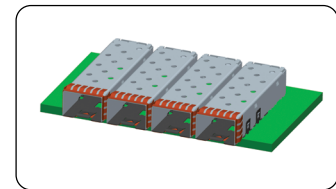| Part Description	Impedance	Wire Size	TE Part Numbers- Pull Tab Cable Assemblies					
			56 Position		84 Position		140 Position	
			0.5 Meter	1.0 Meter	0.5 Meter	1.0 Meter	0.5 Meter	1.0 Meter
Straight to Straight Cable	85	33 AWG	2361330-1	2361330-2	2361341-1	2361341-2	2361352-1	2361352-2
Straight to R/A Cable	85	33 AWG	2361332-1	2361332-2	2361343-1	2361343-2	2361354-1	2361354-2
R/A to R/A Cable	85	33 AWG	2361334-1	2361334-2	2361345-1	2361345-2	2361356-1	2361356-2
Lateral to Lateral Cable	85	33 AWG	2361336-1	2361336-2	2361347-1	2361347-2	2361358-1	2361358-2
Straight to Straight Cable	85	30 AWG	2361331-1	2361331-2	2361342-1	2361342-2	2361353-1	2361353-2
Straight to R/A Cable	85	30 AWG	2361333-1	2361333-2	2361344-1	2361344-2	2361355-1	2361355-2
R/A to R/A Cable	85	30 AWG	2361335-1	2361335-2	2361346-1	2361346-2	2361357-1	2361357-2
Straight to Straight Cable	100	33 AWG	2361337-1	2361337-2	2361348-1	2361348-2	2361359-1	2361359-2
Straight to R/A Cable	100	33 AWG	2361338-1	2361338-2	2361349-1	2361349-2	2361360-1	2361360-2
R/A to R/A Cable	100	33 AWG	2361339-1	2361339-2	2361350-1	2361350-2	2361361-1	2361361-2
Lateral to Lateral Cable	100	33 AWG	2361340-1	2361340-2	2361351-1	2361351-2	2361362-1	2361362-2

STANDARDS FOR HIGH SPEED I/O INTERFACES

Standard	Data Rate	Pluggable Interface													
		XFP	X2	SFP	SFP+	zSFP+	QSFP/ QSFP+	zQSFP+	CFP	CFP2	CFP4	CXP	CDFP	Mini-SAS	Mini-SAS HD
Fibre Channel	1G			X	X	X									
	2G			X	X	X									
	4G			X	X	X									
	8G				X	X									
	16G*				X	X	X								
	32G					X	X	X							
	64G						X								
	128G							X							
Ethernet	1G			X	X	X									
	10G	X	X		X	X	X	X							
	25G*					X		X							
	40G						X	X	X						
	100G							X	X		X	X			
	200G									X			X		
	400G														
InfiniBand	2.5G														
	5G														
	10G														
	14G*						X	X							
	26G*						X								
	100G							X				X			
SAS	3G													X	
	6G						X							X	X
	12G														X
	24G														X
Copper Cable Availability				X	X		X	X					X	X	X
	* Data rate per lane														

COMPONENTS OF A HIGH SPEED I/O INTERFACE

Lightpipe

Heat sink clip

Cage

Heat sink

Direct Attach Copper Cable

PT Connector
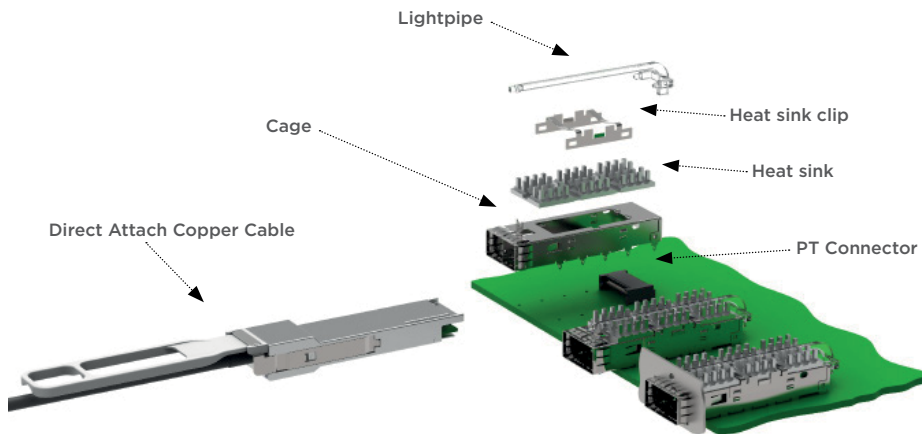
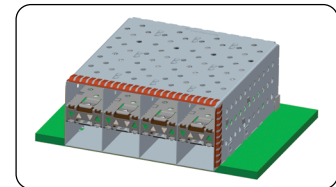## TYPICAL CAGE PORT CONFIGURATIONS

Single Port
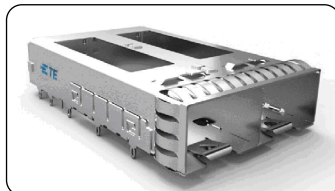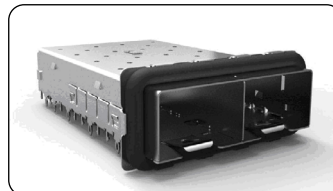
Ganged
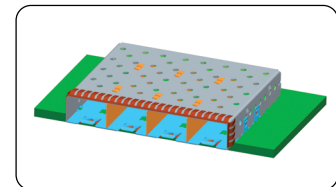
Belly-to-Belly
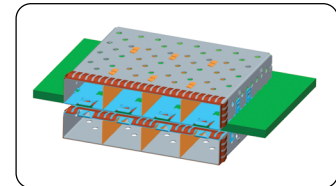
Stacked

Features

EMI Springs

- Lower cost
- Less force applied to bezel

EMI Gasket

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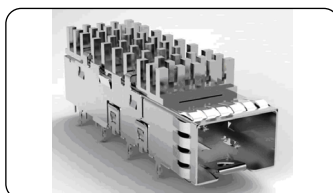- Shielding slightly better in single row cage designs
- Less susceptible to damage

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.

Lightpipes
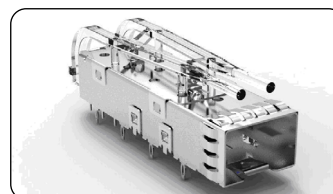
Heat Sinks

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.

TE TECHNICAL SUPPORT CENTER

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*as defined www.te.com/leadfree