



# DATA CENTER FIBER CABLING SOLUTION



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**T&S Communications Co., Ltd.**

# ABOUT T&S

T&S, established in 2000 and located in Shenzhen, is one of the leading optical communication component manufacturers in China, specializing in developing, manufacturing, marketing an extensive range of fiber optical connectivity products from passive components to active categories for optical communications networks and data centers especially.

Our products include: pre-terminated cable assemblies, connectivity accessories, couplers/splitters, ceramic ferrules, PLC wafers & chips, high speed fiber optic transceivers, AOC and integrated functional modules.

T&S commits to provide clients with cost effective solutions and premium products with excellent performance. We have been supplying comprehensive selection of fiber optic connection products to clients in over 50 countries and regions especially in North America and Europe.

2000  
Foundation

2010  
National Hi-tech Enterprise

300570  
Stock Code



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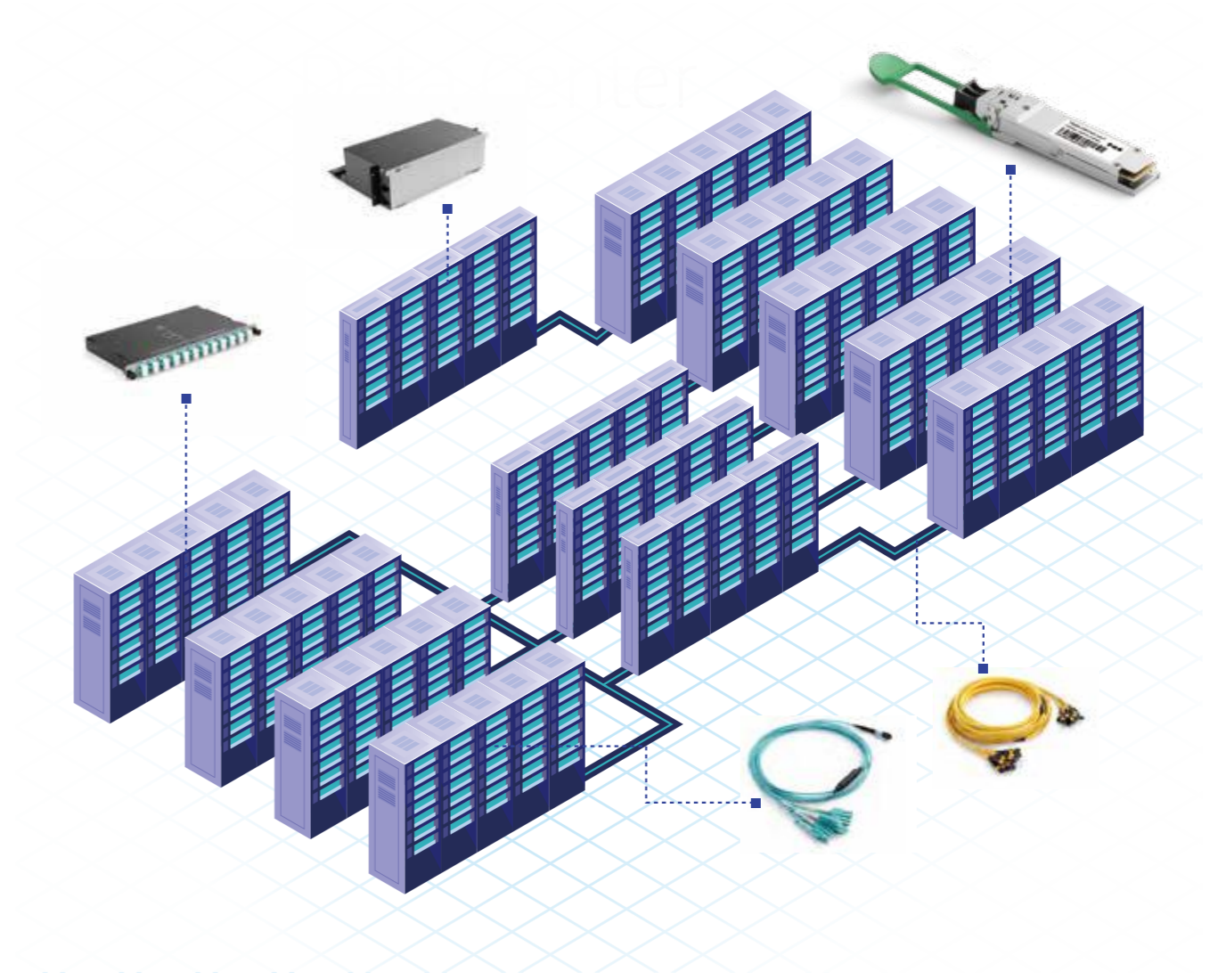


# Certificates



# Data Center Fiber Cabling Solution

From Ceramic ferrule, MT ferrule to various high density MPO/MTP cable assemblies, OXC optic cross component, high density fiber optic/copper hybrid enclosure and 100G transceiver, T&S has a full range of products designed for data center fiber cabling project. We provide flexible and extensible cabling solution for data centers with conventional network structure and cloud computing data centers based on virtual technology network.



# Pre-terminated Cable Assembly



## MTP/MPO Trunk Cable

### Description

Used to connect MDA and IDA, HAD; MDA and Incoming cable bay; MDA and EDA;

### Features

- 2-144F connection
- MPO connector kits from SENKO, NISSIN, or MTP from USCONEC
- MTP Pro connector allows switching polarity and male/female with a built-for purpose tools while connector housing remains closed
- Minimized high density structure
- 8/12/24/48F and 16/32F connectors are available
- Minimum bending radius is as low as 20D (dynamic) / 10D (static)
- 100% factory test
- Available for 10G/40G/100G networking
- Breakout structure eases cabling while saving space utilization for cables
- Pulling elements are optional for easier cabling at corner structures while offering powerful protection for connectors
- Various cables are available



### Pulling Elements



### Parameters

Fiber Count	2-144
Fiber Mode	SM: OS2 9/125um MM: OM3/OM4 50/125um
Connector Type	MPO, MTP, MTP Pro
Polarity	Type A, Type B, Type C
Insertion Loss	SM ≤ 0.75dB (std.); ≤ 0.35dB (low loss) MM ≤ 0.6dB (std.); ≤ 0.35dB (low loss)
Return Loss	SM ≥ 60dB (APC)
Wavelength	SM: 1310nm/1550nm, MM: 850/1300nm
Transmission Distance	OM4: 150m at 40/100G, 400m at 10G OM3: 100m at 40/100G, 300m at 10G
Operation Temperature	-40°C to +75°C
Storage Temperature	-40°C to +85°C
Standard Compliant	<ul style="list-style-type: none"> <li>- ROHS, CE (EN 50575 CPR) and ISO9001</li> <li>- Telecordia GR-1435-CORE</li> <li>- IEC 61753-1</li> <li>- IEC 61754-7</li> <li>- IEC 61755-3-31</li> <li>- IEC 61755-3-32</li> <li>- TIA 605-4 (FOCIS 5)</li> <li>- TIA 568.3-D</li> <li>- YD/T1272.5</li> </ul>

## MTP/MPO Patch Cord

### Description

Generally, MTP/MPO patch cords are used to connect network devices of MPO port and trunk cables when MTP/MPO patch cord is under no stretch. They are usually on the same cabling frame or neighboring frames of the same line.

### Features

- 8/12/16/24/32/48/72F connection;
- 2x12, 2x8 and 3x8 MTP to MTP connections are available;
- MPO connector kits from SENKO, NISSIN, or MTP from USCONEC
- MTP Pro connector allows switching polarity and male/female with a built-for purpose tools while connector housing remains closed;
- Minimized high density structure;
- Minimum bending radius is as low as 20D (dynamic) / 10D (static)
- 100% factory test;
- Available for 10G/40G/100G networking;
- Various cables are available;



### Parameters

Fiber Count	8-72
Fiber Mode	SM: OS2 9/125um MM: OM3/OM4 50/125um
Connector Type	MPO, MTP, MTP Pro
Polarity	Type A, Type B, Type C
Insertion Loss	≤0.75dB (std.); ≤0.35dB (low loss)
Return Loss	SM: ≥50dB (UPC), ≥60dB (APC) MM: ≥20dB
Wavelength	SM: 1310nm/1550nm, MM: 850/1300nm
Transmission Distance	OM4: 150m at 40/100G, 400m at 10G OM3: 100m at 40/100G, 300m at 10G
Operation Temperature	-40°C to +75°C
Storage Temperature	-40°C to +85°C
Standard Compliant	<ul style="list-style-type: none"> <li>- ROHS, CE (EN 50575 CPR) and ISO9001</li> <li>- Telecordia GR-1435-CORE</li> <li>- IEC 61753-1</li> <li>- IEC 61754-7</li> <li>- IEC 61755-3-31</li> <li>- IEC 61755-3-32</li> <li>- TIA 605-4 (FOCIS 5)</li> <li>- TIA 568.3-D</li> <li>- YD/T1272.5</li> </ul>



## MTP/MPO Fanout Cable

### Description

Designed for multi-connection between trunk cable and devices of duplex LC optic ports in short distance.

### Features

- Up to 48F connection is available
- MPO connector kits from SENKO, NISSIN, or MTP/MTP Pro from USCONEC, IL of Connector is as low as 0.75dB (standard) / 0.35dB (low loss)
- MTP Pro connector allows switching male/female with a built-for purpose tools while connector housing remains closed
- Minimized high density structure
- 8/12/24/48F and 16/32F MPO/MTP connectors are available
- Minimum bending radius is as low as 20D (dynamic) / 10D (static)
- 100% factory test
- Available for 10G/40G/100G networking
- Various cables are available



### Parameters

Fiber Count	8-48	
Fiber Mode	SM: OS2 9/125um MM: OM3/OM4 50/125um	
Connector Type	MPO,MTP,MTP Pro,LC	
Insertion Loss	MPO/MTP/MTP Pro	SM: ≤0.75dB (std.); ≤0.35dB (low loss) MM: ≤0.60dB (std.); ≤0.35dB (low loss)
	LC	SM: ≤0.20dB (UPC); ≤0.30dB (APC); MM: ≤0.20dB
Return Loss	MPO/MTP/MTP Pro	SM: ≥60dB (APC)
	LC	SM: ≥50dB (UPC) ≥65dB (APC)
Wavelength	SM: 1310nm/1550nm, MM: 850/1300nm	
Transmission Distance	OM4: 150m at 40/100G, 400m at 10G OM3: 100m at 40/100G, 300m at 10G	
Operation Temperature	-40°C to +75°C	
Storage Temperature	-40°C to +85°C	
Standard Compliant	<ul style="list-style-type: none"> <li>- ROHS, CE (EN 50575 CPR) and ISO9001</li> <li>- Telecordia GR-1435-CORE</li> <li>- Telecordia GR-326-CORE</li> <li>- IEC 61753-1</li> <li>- IEC 61754-7</li> <li>- IEC 61754-20</li> <li>- IEC 61755-3-1</li> <li>- IEC 61755-3-2</li> <li>- IEC 61755-3-31</li> <li>- IEC 61755-3-32</li> <li>- TIA 605-4 (FOCIS 5)</li> <li>- TIA 568.3-D</li> <li>- YD/T 1272.5</li> <li>- YD/T 1272.1</li> </ul>	

# LC/SC Duplex Patch Cord

## Description

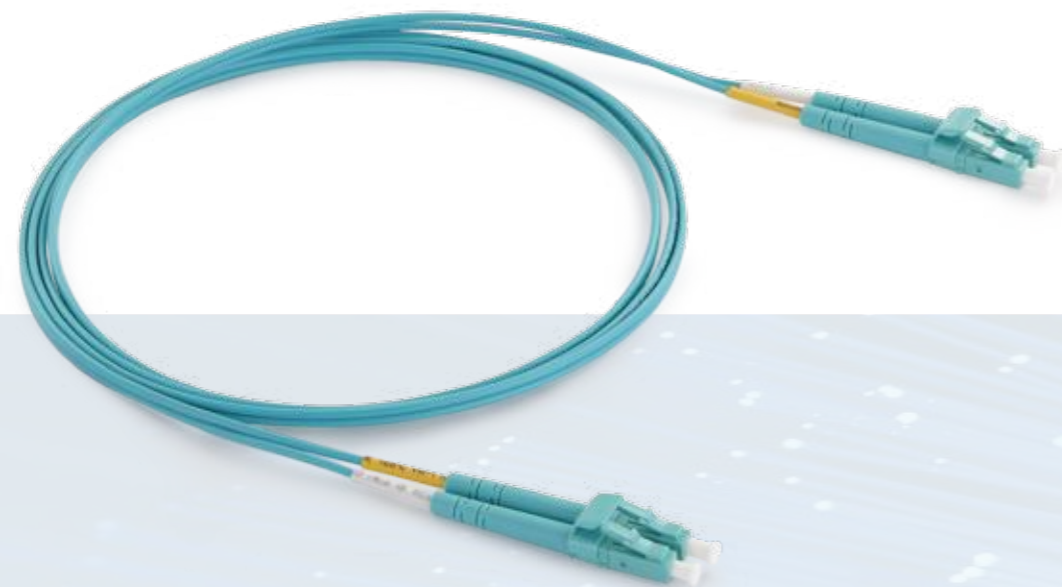
Available for optic cross connections between MDA, HAD, EDA and telecommunication devices or direct connection.

## Features

- Minimized high density structure
- Uniboot structure is available
- Minimum bending radius is as low as 20D (dynamic) / 10D (static)
- 100% factory test
- Available for 10G/40G/100G networking
- Various cables are available

## Parameters

Fiber Count	2
Fiber Mode	SM: OS2 9/125um MM: OM3/OM4 50/125um
Connector Type	LC SC
Insertion Loss	SM: ≤0.20dB(UPC); ≤0.3dB(APC); MM: ≤0.20dB
Return Loss	SM: ≥50dB(UPC), ≥65dB(APC)
Wavelength	SM: 1310nm/1550nm, MM: 850/1300nm
Transmission Distance	OM4: 150m at 40/100G, 400m at 10G OM3: 100m at 40/100G, 300m at 10G
Operation Temperature	-40°C to +75°C
Storage Temperature	-40°C to +85°C
Standard Compliant	<ul style="list-style-type: none"> <li>- ROHS, CE (EN 50575 CPR) and ISO9001</li> <li>- Telecordia GR-326-CORE</li> <li>- IEC 61753-1</li> <li>- IEC 61754-4</li> <li>- IEC 61754-20</li> <li>- IEC 61755-3-1</li> <li>- IEC 61755-3-2</li> <li>- TIA 605-4 (FOCIS 5)</li> <li>- TIA 568.3-D</li> <li>- YD/T 1272.1</li> <li>- YD/T 1272.3</li> </ul>



# Fiber Optic Enclosure and Module Cassette

## Fiber Optic Enclosure

The fiber optic/copper hybrid distribution box provides a solution for the coexistence of fiber optic/copper cabling, so that copper cabling can be upgraded seamlessly to optical fiber cabling. The fiber optic/copper hybrid distribution box provides a way to facilitate the convenience and effectiveness of the fiber optic/copper cabling system management.

T&S developed two series of fiber optic/copper hybrid distribution boxes (TS-FD1 and TS-FD2). The distribution box of this series has distinct appearance characteristics: the iconic front door, highlighting a strong sense of design. Drawer design makes it easier for installation and maintenance, so that the installation is no longer limited to box inner space. The open rear cable management rack can be disassembled. The design combining cable management and fusion maximizes the box function, and makes effective and efficient cable management accessible. T&S fiber optic/copper hybrid distribution box has strong compatibility and expansibility, and is one of the best choices of fiber optic/copper cabling project.



Iconic Front Door



Open Rear Cable Management Rack/Demountable



Drawer with Guideway



96F Fusing Bracket

## Fiber Optic Enclosure TS-FD1 Series



### TS-FD1 Fiber Optic Enclosure



TS-FD1-1U



TS-FD1-2U



TS-FD1-3U

Model	Description	
	Item	Specification
TS-FD1-1U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Slot Count	3
TS-FD1-2U	Capacity	72F (LC duplex)
	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
TS-FD1-3U	Slot Count	6
	Capacity	144F (LC duplex)
	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
TS-FD1-3U	Installation	19' Rack Mounted
	Slot Count	12
	Capacity	288F (LC duplex)



## Fiber Optic Enclosure TS-FD2 Series



## Fiber Optic Cable Fusing Enclosure



### TS-FD2 Fiber Optic Enclosure

Model	Description	
	Item	Specification
TS-FD2-1U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Slot Count	4
	Capacity	96F (LC duplex)
TS-FD2-2U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Slot Count	8
	Capacity	192F (LC duplex)
TS-FD2-3U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Slot Count	12
	Capacity	288F (LC duplex)
TS-FD2-4U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Slot Count	16
	Capacity	384F (LC duplex)

### Description

TS-RD1 series fiber optic cable fusing enclosure is capable for fusing connection on the rack.

### TS-RD1 Fiber Optic Fusing Enclosures

Model	Description	
	Item	Specification
TS-RD1-1U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Capacity	96F (LC duplex)
TS-RD1-2U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Capacity	192F (LC duplex)
TS-RD1-4U	Material	Black Cold-reduced Sheet; Aluminum Sheet
	Coating	Powder Coated
	Color	Black Body; Grey Front Door
	Installation	19' Rack Mounted
	Capacity	288F (LC duplex)

TS-FD2-1U



TS-FD2-2U



TS-FD2-3U



## Integrated Functional Module



### Description

MD modules accompany TS-FD1 fiber optic enclosures; MD2 modules accompany TS-FD2 fiber optic enclosures.

### MD1 Module Series

Model	Capacity	Rear Adapter	Front Adapter	Fiber Type	IL & RL
MD1-1M24L	24F	1xMPO	12xLC duplex	OM3	IL SM ≤ 1.0dB (std.) SM ≤ 0.60dB (low loss) MM ≤ 0.80dB (low loss) MM ≤ 0.50dB (low loss)
MD1-2M24L	24F	2xMPO	12xLC duplex		
MD1-3M24L	24F	3xMPO	12xLC duplex		
MD1-2M6M	48F	2xMPO	6xMPO	OS2	RL SM: ≥ 50dB (UPC), ≥ 60dB (APC)
MD1-1M12S	12F	1xMPO	6xSC duplex		

### MD2 Module Series

Model	Capacity	Rear Adapter	Front Adapter	Fiber Type	IL & RL
MD2-1M24L	24F	1xMPO	12xLC duplex	OM3	IL SM ≤ 1.0dB (std.) SM ≤ 0.60dB (low loss) MM ≤ 0.80dB (low loss) MM ≤ 0.50dB (low loss)
MD2-2M24L	24F	2xMPO	12xLC duplex		
MD2-3M24L	24F	3xMPO	12xLC duplex		
MD2-2M6M	48F	2xMPO	6x8F MPO	OS2	RL SM: ≥ 50dB (UPC), ≥ 60dB (APC)
MD2-1M12S	12F	1MPO	6xSC duplex		



# Adapter Panel

## Description

PD1 panel series accompany TS-FD1 fiber optic enclosures; PD2 panel series accompany TS-FD2 enclosures.

### PD1 Panel Series

Model	Capacity	Adapter Type	
		Port	Color
PD1-6R	6 F	CAT5/CAT6	White Black
PD1-12S	12 F	6xLC duplex 6xSC duplex	Beige Aqua Blue Green Violet
PD1-24L	24 F	12xLC duplex	
PD1-6M	96 F	6xMPO	



### PD2 Panel Series

Model	Capacity	Adapter Type	
		Port	Color
PD2-6R6	6 - port	CAT6	White Black
PD2-12R6	12 - port	CAT6	
PD2-12S	12 F	6xSC duplex	Beige Aqua Blue Green Violet
PD2-24L	24 F	12xLC duplex	
PD2-6M	6 - port	6xMPO	



# Fiber Optic Transceiver



## 10G SFP+ Series TSSP-85192-SR

### Description

- Optical interface compliant to IEEE 802.3ae
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- 850nm VCSEL transmitter, PIN photo-detector
- Operating case temperature: 0 to 70 °C
- Low power consumption
- Maximum link length of 300m@OM3 fiber
- All-metal housing for superior EMI performance
- RoHS6 compliant

### Optical Performance

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Central Wavelength	$\lambda_t$	840	850	860	nm
Average Optical Power	$P_{avg}$	-6.5	-	-1	dBm
Extinction Ratio	ER	3.5	-	-	dB
Transmitter Dispersion Penalty	TDP	-	-	3.9	dB
Relative Intensity Noise	Rin	-	-	-128	dB/Hz
Optical Return Loss Tolerance	-	-	-	12	dB
<b>Receiver</b>					
Central Wavelength	$\lambda_r$	840	850	860	nm
Receiver Sensitivity in 10.3Gbps (OMA)	$P_{sens}$	-	-	-11.1	dBm
Stressed Sensitivity in 10.3Gbps (OMA)	-	-	-	-7.5	dBm
Los Function	Los	-30	-	-12	dBm
Overload	Pin	-	-	-1.0	dBm
Optical Return Loss Tolerance	-	-	-	-12	dB



## 10G SFP+ Series TSSP-31192-LR

### Description

- Optical interface compliant to IEEE 802.3ae 10GBASE-LR
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- 1310nm DFB transmitter, PIN photo-detector
- Operating case temperature: 0 to 70 °C
- Low power consumption
- Applicable for 10km SMF connection
- RoHS6 compliant

### Optical Performance

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Central Wavelength	$\lambda_c$	1260	1310	1355	nm
Spectral Width (-20dB)	$\Delta\lambda_{20}$	-	-	0.3	nm
Average Optical Power	$P_o$	-8.2	-	+1	dBm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Optical Transmit Power (disabled)	PTX_DISABLE	-	-	-30	dBm
Extinction Ratio	ER	3.5	-	-	dB
Relative Intensity Noise	RIN	-	-	-128	dB/Hz
Optical Return Loss Tolerance	Orl	-	-	21	dB
<b>Receiver</b>					
Central Wavelength	$\lambda$	1260	-	1600	nm
Average Receive Power	$P_{avg}$	-15.8	-	-1.0	dBm
Receiver Sensitivity in 10.3Gbps (OMA)	$R_{sen1}$	-	-	-14.1	dBm
Stressed Sensitivity in 10.3Gbps(OMA)	$R_{sen2}$	-	-	-11.3	dBm
Reflectance	Rrx	-	-	-26	dB
LOS Asserted	Lsa	-28	-	-	dBm
LOS De-Asserted	Lda	-	-	-16	dBm
LOS Hysteresis	Lh	0.5	-	-	dB

10G BIDI SFP+ series

## TSBP-23192-LR TSBP-32192-LR



### Description

- Simplex LC Connector Bi-Directional SFP+ Optical Transceiver
- Compliant with SFF-8431, SFF-8432 and IEE802.3ae
- Up to 10km on 9/125um SMF
- Two types:  
A:1270nm DFB Laser transmitter,1330nm receiver  
B:1330nm DFB Laser transmitter,1270nm receiver
- Digital Diagnostic SFF-8472 Compliant
- Operating case temperature 0 ~ 70 °C
- RoHS6 compliant

### Optical Performance

(TSBP-23192-LR, 1270 DFB & PIN/TIA)

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Optical Wavelength	$\lambda_C$	1260	1270	1280	nm
Side Mode Suppress Ratio	SMSR	30	-	-	dB
Spectral Width(-20dB)	$\Delta\lambda$	-	-	1	nm
Average Output Power	P <sub>op</sub>	-8.2	-	0.5	dBm
Extinction Ratio	ER	3.5	-	-	dB
Eye Mask	-	compliant with IEEE 802.3			
<b>Receiver</b>					
Average Receive Power	RSENS	-	-	-14.1	dBm
Receiver Overload	P <sub>MAX</sub>	-	-	+0.5	dBm
Centre Wavelength	$\lambda_C$	1320	-	1340	nm
LOS Asserted	LOSD	-	-	-15	dBm
LOS De-Asserted	LOSA	-30	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

### Optical Performance

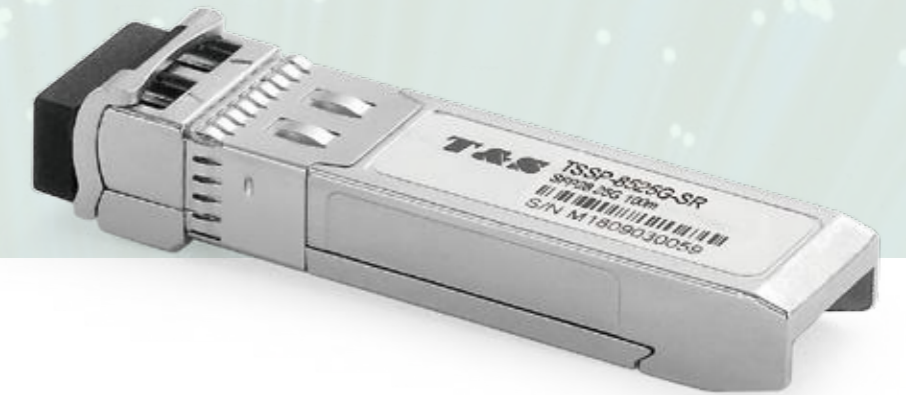
(TSBP-23192-LR, 1330 DFB & PIN/TIA)

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Optical Wavelength	$\lambda_C$	1320	1330	1340	nm
Side Mode Suppress Ratio	SMSR	30	-	-	dB
Spectral Width(-20dB)	$\Delta\lambda$	-	-	1	nm
Average Output Power	P <sub>op</sub>	-8.2	-	0.5	dBm
Extinction Ratio	ER	3.5	-	-	dB
Eye Mask	-	Compliant with IEEE 802.3			
<b>Receiver</b>					
Average Receive Power	RSENS	-	-	-14.1	dBm
Receiver Overload	P <sub>MAX</sub>	-	-	+0.5	dBm
Centre Wavelength	$\lambda_C$	1260	-	1270	nm
LOS Asserted	LOSD	-	-	-15	dBm
LOS De-Asserted	LOSA	-30	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB

25G SFP28

## TSSP-8525G-SR

850nm SFP+ multi-mode transceiver, with diagnostic monitoring



### Description

- Supports 25.78Gb/s bit rate
- 850nm VCSEL laser and PIN photo-detector
- Maximum link length of 70m on OM3 MMF and 100m on OM4 MMF
- Digital diagnostics functions are available via the I2C interface
- Operating case temperature  
Commercial: 0°C to +70 °C
- +3.3V single power supply
- Power consumption less than 1W
- RoHS compliant6

### Optical Performance

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Central Wavelength	$\lambda_t$	820	850	880	nm
Average Optical Power	P <sub>avg</sub>	-5.0	-	2.4	dBm
Extinction Ratio	ER	2.0	-	-	dB
Transmitter Dispersion Penalty	TDP	-	-	3.9	dB
Optical Return Loss Tolerance	-	-	-	12	dB
<b>Receiver</b>					
Central Wavelength	$\lambda_r$	820	-	880	nm
Receiver Sensitivity in 125.78125Gbps (OMA)	P <sub>sens</sub>	-	-	-5.2	dBm
Los function	Los	-30	-	-12	dBm
Overload Input Optical Power	P <sub>in</sub>	2.4	-	-	dBm
Optical Return Loss Tolerance	-	-	-	-12	dB

## 40G QSFP

# TSQS-8540G-04MC

QSFP+ 40G SR4 400m transceiver, with diagnostic monitoring

## Description

- 4 channels full-duplex transceiver modules
- Transmission data rate up to 10.5Gbps per channel
- 4 channels 850nm VCSEL array
- 4 channels PIN photo detector array
- Hot-pluggable QSFP form factor
- Maximum link length of 300m on OM3 Multimode Fiber(MMF) and 400m on OM4 MMF
- Single 1X12 MPO connector receptacle
- Hot-pluggable electrical interface
- 0-70°C operating temp
- Low power consumption < 1.5W
- RoHS6 compliant

## Optical Performance

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Signaling Speed per Lane	-	-	10.5	-	Gb/s
Center Wavelength	$\lambda_C$	840	850	860	nm
RMS spectral Width	$\Delta\lambda$	-	-	0.4	nm
Average Launch Power per Lane	TXPx	-7.5	-	0.5	dBm
Transmit OMA per Lane	TxOMA	-2.5	-	3	dBm
Extinction Ratio	ER	3	-	-	dB
Optical Return Loss Tolerance	ORL	-	-	12	dB
Average Launch Power of OFF Transmitter, each lane	-	-	-	-30	dBm
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.23,0.34,0.43,0.27,0.35,0.4}				
<b>Receiver</b>					
Signaling Speed per Lane	-	-	10.5	-	Gb/s
Center Wavelength	$\lambda_C$	840	850	860	nm
Average Receive Power, Each Lane	RXPx	-9.9	-	2.4	dBm
Unstressed Receiver Sensitivity (OMA) per Lane	URS	-	-	-11.1	dBm
Stressed Receiver Sensitivity (OMA) per Lane	SRS	-	-	-7.5	dBm
Stressed Eye J2 Jitter, per Lane	-	-	-	0.3	UI
Stressed Eye J9 Jitter, per Lane	-	-	-	0.47	UI

## 40G QSFP

# TSQS-CW40G-02LC

QSFP+ 40G LR4 2km transceiver, with diagnostic monitoring

## Description

- Reach: 2 km via SMF
- Uncooled CWDM DFB lasers, directly modulated
- Using ITU G.694.2 wavelength grid at 1271, 1291, 1311, and 1331nm
- User controllable Transmit Input Equalization and Receiver Output Amplitude
- Fiber connector: SMF LC duplex connector
- Compliant with QDR/DDR InfiniBand data rates
- Hot-pluggable electrical interface
- 0-70°C operating temp
- Power dissipation < 3.5W
- RoHS6 compliant

## Optical Performance

Parameter	Symbol	Min	Typical	Max	Unit	
<b>Transmitter</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	-	1277.5	nm
	Ch1	$\lambda_1$	1284.5	-	1297.5	nm
	Ch2	$\lambda_2$	1304.5	-	1317.5	nm
	Ch3	$\lambda_3$	1324.5	-	1337.5	nm
Bit Rate per Channel	B	10.3125	-	10.7546	Gb/s	
Total Average Launch Power	POUT	-	-	8.0	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average Launch Power, Each lane	-	-6.8	-	2.0	dBm	
Optical Modulation Amplitude	OMA	-6.0	-	3.5	dBm	
Transmission & Dispersion Penalty	TDP	-	-	2.3	dB	
Transmitter Reflectance	-	-	-	-12	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					
Average Launch Power of OFF Transmitter, Each Lane	-	-	-	-30	dBm	
Optical Return Loss Tolerance	-	-	-	20	dB	
<b>Receiver</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	1271	1277.5	nm
	Ch1	$\lambda_1$	1284.5	1291	1297.5	nm
	Ch2	$\lambda_2$	1304.5	1311	1317.5	nm
	Ch3	$\lambda_3$	1324.5	1331	1337.5	nm
Bit Rate per Channel	B	10.3125	-	10.7546	Gb/s	
Average Receive Power, Each Lane	-	-13.5	-	2.0	dBm	
Unstressed Sensitivity (OMA) at 10 x 10 <sup>-12</sup> BER	OMAIN	-	-	-10.5	dBm	
Stressed Sensitivity (OMA)	OMAIN,str	-	-	-8.5	dBm	
Vertical Eye Closure Penalty, Each	VECP	-	-	1.9	dB	
Stressed Eye J2 Jitter, Each Lane	J2	-	-	0.42	UI	
Stressed Eye J9 Jitter, Each Lane	J9	-	-	0.65	UI	
Eye Mask Coordinates #1 {X1, X2 Y1, Y2} Hit Ratio = 5 X 10 <sup>-5</sup>	{0.29, 0.5 150, 425}					



40G QSFP

## TSQS-CW40G-10LC

QSFP+ 40G LR4 10km Transceiver, with diagnostic monitoring



### Description

- Reach: 10 km via SMF
- Uncooled CWDM DFB lasers, directly modulated
- Using ITU G.694.2 wavelength grid at 1271, 1291, 1311, and 1331nm
- User controllable Transmit Input Equalization and Receiver Output Amplitude
- Fiber connector: SMF LC duplex connector
- Compliant with QDR/DDR InfiniBand data rates
- Hot-pluggable electrical interface
- 0-70°C operating temp
- Power dissipation < 3.5W
- RoHS6 compliant

### Performance at Transmitter

Parameter	Symbol	Min	Typical	Max	Unit	
<b>Transmitter</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	-	1277.5	nm
	Ch1	$\lambda_1$	1284.5	-	1297.5	nm
	Ch2	$\lambda_2$	1304.5	-	1317.5	nm
	Ch3	$\lambda_3$	1324.5	-	1337.5	nm
Bit Rate per Channel	B	10.3125	-	10.7546	Gb/s	
Total Average Launch Power	POUT	-	-	8.0	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average Launch Power, Each lane		-6.8	-	2.0	dBm	
Optical Modulation Amplitude	OMA	-3.8	-	3.5	dBm	
Transmission & Dispersion Penalty	TDP	-	-	2.3	dB	
Transmitter Reflectance		-	-	-12	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
Average Launch Power of OFF Transmitter, Each Lane	-	-	-	-30	dBm	
Optical Return Loss Tolerance	-	-	-	20	dB	
<b>Receiver</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	1271	1277.5	nm
	Ch1	$\lambda_1$	1284.5	1291	1297.5	nm
	Ch2	$\lambda_2$	1304.5	1311	1317.5	nm
	Ch3	$\lambda_3$	1324.5	1331	1337.5	nm
Bit Rate per Channel	B	10.3125	-	10.7546	Gb/s	
Average Receive Power, Each Lane		-13.5	-	2.0	dBm	
Unstressed Sensitivity (OMA) at 10 x 10-12BER	OMAIN	-	-	-11.5	dBm	
Stressed Sensitivity (OMA)	OMAIN,STR	-	-	-9.9	dBm	
Vertical Eye Closure Penalty, Each	VECP	-	-	1.6	dB	
Stressed Eye J2 Jitter, Each Lane	J2	-	-	0.42	UI	
Stressed Eye J9 Jitter, Each Lane	J9	-	-	0.65	UI	
Eye Mask Coordinates #1 {X1, X2 Y1, Y2} Hit Ratio = 5 X 10E-5		{ 0.29, 0.5 150, 425}				

100G QSFP

## TSQS-851HG-01MC

QSFP28+ 100G SR4 100m Transceiver, With diagnostic monitoring



### Description

- 4 channels full-duplex transceiver modules
- Transmission data rate up to 25.78125Gbps per channel
- 4 channels 850nm VCSEL array
- 4 channels PIN photo detector array
- Hot-pluggable QSFP28 form factor
- Maximum link length of 70m on OM3 Multimode
- Fiber(MMF) and 100m on OM4 MMF
- Single 1X12 MPO connector receptacle Hot-pluggable electrical interface
- 0-70°C operating temp
- Low power consumption < 1.5W
- RoHS6 compliant

### Performance at Transmitter

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Signaling Speed per Lane	-	25.78125 ± 100ppm			Gb/s
Center Wavelength	$\lambda_C$	840	850	860	nm
RMS Spectral Width	$\Delta\lambda$	-	-	0.6	nm
Average Launch Power Per Lane	TXPx	-8.5	-	2.4	dBm
Transmit OMA Per Lane	TxOMA	-6.4	-	3	dBm
Extinction Ratio	ER	2	-	-	dB
Optical Return Loss Tolerance	ORL	-	-	12	dB
Average Launch Power Of OFF Transmitter, Each Lane	-	-	-	-30	dBm
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.3, 0.38, 0.45, 0.35, 0.41, 0.5}			
<b>Receiver</b>					
Signaling Speed Per Lane	-	25.78125 ± 100ppm			Gb/s
Center Wavelength	$\lambda_C$	840	850	860	nm
Average Receive Power, Each Lane	RXPx	-10.3	-	2.4	dBm
Stressed Receiver Sensitivity (OMA) Per Lane	SRS	-	-	-5.2	dBm
Stressed Eye J2 Jitter, Per Lane	-	-	-	0.39	UI
Stressed Eye J9 Jitter, Per Lane	-	-	-	0.53	UI



100G QSFP28

# TSQS-CW1HG-02LC

QSFP28 CWDM4 2km Transceiver, with diagnostic monitoring

## Description

- Reach: 2 km via SMF
- Uncooled CWDM DFB lasers, directly modulated
- Electrical interface: retimed CAUI-4 per 100G Ethernet IEEE 802.3bm Annex 83E
- User controllable Transmit Input Equalization and Receiver Output Amplitude
- Fiber connector: SMF LC duplex connector
- Hot pluggable
- 0-70°C operating temp
- Power dissipation < 3.5W
- RoHS6 complian



Parameter	Symbol	Min	Typical	Max	Unit	
<b>Transmitter</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	-	1277.5	nm
	Ch1	$\lambda_1$	1284.5	-	1297.5	nm
	Ch2	$\lambda_2$	1304.5	-	1317.5	nm
	Ch3	$\lambda_3$	1324.5	-	1337.5	nm
Bit Rate Per Channel	B	25.78125±100ppm			Gb/s	
Side Mode Suppression Ratio	SMSR	30	-	-	dBm	
Average Launch Power, Each Lane	-	-6.5	-	2.5	dB	
Optical Modulation Amplitude	OMA	-4.0	-	2.5	dBm	
Transmission & Dispersion Penalty	TDP	-	-	3.0	dBm	
Transmitter Reflectance	-	-	-	-12	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4} CWDM4 MSA Technical Specifications Rev 1.1					
Average Launch Power Of OFF Transmitter, Each Lane	-	-	-	-30	dBm	
Optical Return Loss Tolerance	-	-	-	20	dB	
<b>Receiver</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	1271	1277.5	nm
	Ch1	$\lambda_1$	1284.5	1291	1297.5	nm
	Ch2	$\lambda_2$	1304.5	1311	1317.5	nm
	Ch3	$\lambda_3$	1324.5	1331	1337.5	nm
Bit Rate Per Channel	B	25.78125±100ppm			Gb/s	
Unstressed Sensitivity (OMA) at 5 x 10 <sup>-5</sup> BER	OMAIN	-	-	-10	dBm	
Stressed Sensitivity (OMA)	OMAIN, str	-	-	-7.3	dBm	
Vertical Eye Closure Penalty, Each Lane	VECP	-	-	1.9	dBm	
Stressed Eye J2 Jitter, Each Lane	J2	-	-	0.3	dB	
Stressed Eye J9 Jitter, Each Lane	J9	-	-	0.5	UI	
Stressed Eye J4 Jitter, Each Lane	J4	-	-	0.48	UI	
SRS Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.39, 0.5, 0.5, 0.39, 0.39, 0.4} CWDM4 MSA Technical Specifications Rev 1.1					

100G QSFP28

# TSQS-CW1HG-10LC

QSFP28 CWDM4 10km Transceiver, with diagnostic monitoring



## Description

- Reach: 10 km via SMF
- Optical link budget: Supports 6.5 dB of link budget
- Uncooled CWDM DFB lasers, directly modulated
- Electrical interface: retimed CAUI-4 per 100G Ethernet IEEE 802.3bm Annex 83E
- User controllable Transmit Input Equalization and Receiver Output Amplitude
- Fiber connector: SMF LC duplex connector
- Hot pluggable
- 0-70°C operating temp
- Power dissipation < 3.5W
- RoHS6 compliant

Parameter	Symbol	Min	Typical	Max	Unit	
<b>Transmitter</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	-	1277.5	nm
	Ch1	$\lambda_1$	1284.5	-	1297.5	nm
	Ch2	$\lambda_2$	1304.5	-	1317.5	nm
	Ch3	$\lambda_3$	1324.5	-	1337.5	nm
Bit Rate Per Channel	B	25.78125±100ppm			Gb/s	
Side Mode Suppression Ratio	SMSR	30	-	-	dBm	
Average Launch Power, Each Lane	-	-6.5	-	2.5	dB	
Optical Modulation Amplitude	OMA	-4.0	-	2.5	dBm	
Transmission & Dispersion Penalty	TDP	-	-	3.0	dBm	
Transmitter Reflectance	-	-	-	-20	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4} 100G 4WDM-10 MSA Technical Specifications Release 1.0					
Average Launch Power Of OFF Transmitter, Each Lane	-	-	-	-30	dBm	
Optical Return Loss Tolerance	-	-	-	20	dB	
<b>Receiver</b>						
Center Wavelength	Ch0	$\lambda_0$	1264.5	1271	1277.5	nm
	Ch1	$\lambda_1$	1284.5	1291	1297.5	nm
	Ch2	$\lambda_2$	1304.5	1311	1317.5	nm
	Ch3	$\lambda_3$	1324.5	1331	1337.5	nm
Bit Rate Per Channel	B	25.78125±100ppm			Gb/s	
Average Receive Power, Each Lane	-	-13.0	-	2.5	dBm	
Unstressed Sensitivity (OMA) at 5 x 10 <sup>-5</sup> BER	OMAIN	-	-	-11.5	dBm	
Stressed Sensitivity (OMA)	OMAIN, str	-	-	-8.6	dBm	
Vertical Eye Closure Penalty, Each Lane	VECP	-	-	2.6	dB	
Stressed Eye J2 Jitter, Each Lane	J2	-	-	0.3	UI	
Stressed Eye J4 Jitter, Each Lane	J4	-	-	0.48	UI	
SRS Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.39, 0.5, 0.5, 0.39, 0.39, 0.4} 100G 4WDM-10 MSA Technical Specifications Release 1.0					

# Active Optical Cable

## TSSP-85192-xxxC AOC

10G SFP+ Active Optical Cables, with diagnostic monitoring

### Features

- Electrical interface compliant to SFF-8431
- 850nm VCSEL laser and PIN photo-detector
- Maximum link length of 150m on OM2 MMF and 300m on OM3 MMF
- Hot Pluggable
- All-metal housing for superior EMI performance
- Operating temperature 0°C to 70°C
- RoHS6 compliant



## TSSP-8525G-xxxC AOC

25G SFP28 Active Optical Cables, with diagnostic monitoring

### Features

- Rate up to 25.78Gbps
- 850nm VCSEL laser and PIN photo-detector
- Maximum link length of 70m on OM3 MMF and 100m on OM4 MMF
- Built-in digital diagnostic functions
- +3.3V single power
- RoHS6 compliant





## TSQS-8540G-xxxC AOC

40G QSFP Active Optical Cables, with diagnostic monitoring

### Features

- Four-channel full-duplex active optical cable with QSFP+ plugs
- Electrical interface compliant to SFF-8436
- Support 40G data rate
- Hot Pluggable
- Built-in digital diagnostic functions
- Low power dissipation: <1.5W
- Operating case temperature 0°C to 70°C
- RoHS6 compliant



## TSQS-851HG-xxxC AOC

100G QSFP28 Active Optical Cables, with diagnostic monitoring

### Features

- Four-channel full-duplex active optical cable with QSFP28 plugs
- Multi-rate capability: 10Gb/s and 25Gb/s per channel
- Reliable VCSEL array technology using MMF
- Hot Pluggable
- Power dissipation: <3.5W
- Operating case temperature 0°C to 70°C
- RoHS6 compliant



## TSQSS-8540G-xxxC Breakout AOC

40G QSFP+ 4 x 10G SFP+ Active Optical Cables, with diagnostic monitoring

### Features

- Electrical interface compliant to SFF-8436 and SFF-8431
- 850nm VCSEL laser and PIN photo-detector
- Built-in digital diagnostic functions
- Operating case temperature 0°C to 70°C
- Hot Pluggable
- RoHS6 compliant



## TSQSS-851HG-xxxC Breakout AOC

100G QSFP28 to 4x25G SFP28 Active Optical Cables, with diagnostic monitoring

### Features

- Electrical interface compliant to SFF-8436 and SFF-8431
- 850nm VCSEL laser and PIN photo-detector
- Built-in digital diagnostic functions
- Operating case temperature 0°C to 70°C
- Hot Pluggable
- RoHS6 compliant

