

40GBASE-LR4 QSFP+ 1310nm 10km DOM Transceiver for InfiniBand FDR10

QSFP-LR4-40G



Application

- InfiniBand FDR10

Standards

- IEEE 802.3ba 40GBASE-LR4
- MSA SFF-8436 QSFP+ Revision 4.8
- RoHS Compliant with EU 2015/863

Features

- Maximum Data Rate per Lane: 10.3125Gb/s
- Max. Power Consumption 3.5W, 1.5W in Low Power Mode
- Single 3.3V Supply Voltage
- 0~70 °C Case Operating Temperature
- CWDM DFB Laser and PIN Receiver Array
- QSFP+ MSA Package with Duplex LC Connector
- Two Wire Serial Interface (TWS) with Digital Diagnostic Monitoring
- Class 1 Laser Safety

Description

The QSFP+ Optical Transceiver Module is designed for use in 40Gb/s FDR10 InfiniBand systems throughput up to 10km over single mode fiber (SMF) using a wavelength of 1310nm via duplex LC connectors. This transceiver is compliant with QSFP+ MSA, SFF-8436 and IEEE 802.3ba standards. Digital diagnostics functions are also available via the I2C interface, as specified by the QSFP+ MSA, to allow access to real-time operating parameters.

With these features, this easy to install, hot swappable transceiver is suitable to be used in various applications, such as InfiniBand, data centers, high-performance computing networks, enterprise core and distribution layer applications.

Product Specifications

I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T_S	-40		85	°C
Supply Voltage	V_{CC}	-0.5		3.6	V
Relative Humidity (Non-condensing)	RH	5		85	%
Data Input Voltage–Differential	$ V_{DIP}-V_{DIN} $			1.0	V

II. Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T_{OPR}	0		70	°C	
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Maximum Sustained Supply Current	I_{CC}			1100	mA	per PIN
Maximum Power Dissipation	P_D			3.5	W	
Maximum Power Dissipation, Low Power Mode	P_{DLP}			1.5	W	
Data Rate per Lane	DR		10.3125	11.3	Gb/s	IEEE802.3ba

Parameter	Symbol	Min.	Typical	Max.	Units	Notes
Control Input Voltage High	V_{IH}	2		$V_{CC}+0.3$	V	
Control Input Voltage Low	V_{IL}	-0.3		0.8	V	
Two Wire Serial Interface Clock Rate				400	kHz	
Power Supply Noise				50	mVpp	
Rx Differential Data Output Load			100		ohms	
Operating Distance				10	km	

III. Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Units
Transmitter					
Wavelength L0	λ_1	1264.5	1271	1277.5	nm
Wavelength L1	λ_2	1284.5	1291	1297.5	nm
Wavelength L2	λ_3	1304.5	1311	1317.5	nm
Wavelength L3	λ_4	1324.5	1331	1337.5	nm
Side-mode Suppression Ratio	SMSR	30			dB
Total Average Optical Launch Power	P_{OUT}			8.3	dBm
Average Launch Power Tx_Off (per Lane)	P_{OUT_OFF}			-30	dBm
Average Optical Launch Power (per Lane)	P_{OUTL}	-7		2.3	dBm

Parameter	Symbol	Min.	Typical	Max.	Units
Extinction Ratio	ER	3.5			dB
Spectral Width	$\Delta\lambda$			1	nm
Optical Modulation Amplitude (per Lane)	OMA	-4		3.5	dBm
Launch Power in OMA Minus TDP (per Lane)	OMA-TDP	-4.8			dBm
Difference in Launch Power Between Any Two Lanes (OMA)	DLP			6.5	dB
Transmitter and Dispersion Penalty (per Lane)	TDP			2.6	dB
Optical Return Loss Tolerance	ORLT			20	dB
Transmitter Eye Mask Definition			(IEEE802.3ba) 0.25, 0.4, 0.45, 0.25, 0.28, 0.4		UI
Relative Intensity Noise	RIN			-128	dB/Hz
Receiver					
Wavelength L0	λ_1	1264.5	1271	1277.5	nm
Wavelength L1	λ_2	1284.5	1291	1297.5	nm
Wavelength L2	λ_3	1304.5	1311	1317.5	nm
Wavelength L3	λ_4	1324.5	1331	1337.5	nm
Receiver Sensitivity (OMA) per Lane				-11.5	dBm
Stressed Receiver Sensitivity in OMA (per Lane)				-9.6	dBm
Stressed Receiver Sensitivity Test Conditions					
Stressed Eye J2 Jitter (each Lane)			0.3		UI

Parameter	Symbol	Min.	Typical	Max.	Units
Stressed Eye J2 Jitter (each Lane)			0.3		UI
Stressed Eye J9 Jitter (each Lane)			0.47		UI
Vertical Eye Closure Penalty			1.9		dB
Damage Threshold for Receiver	$P_{in, damage}$	3.3			dBm
Average Power Input (each Lane)		-13.7		2.3	dBm
Optical Modulation Amplitude (per Lane)	OMA			3.5	dBm
Difference in Launch Power Between Any Two Lanes (OMA)	ΔOMA_{RL}			7.5	dB
Receiver Reflectance	RX_R			-26	dB
LOS Assert	LOS_A	-25			dBm
LOS De-assert	LOS_D			-15	dBm
LOS Hysteresis		0.5			dB

IV. Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
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Transmitter (Module Input)

Single Ended Input Voltage	V_{IN}	-0.3	4	V
Differential Data Input Swing	$V_{IN,P-P}$	150	1000	mVpp
AC Common Mode Input Voltage (RMS)		15		mV
Differential to Common-Mode Input Return Loss		10		dB
J2 Jitter Tolerance		0.17		UI
J9 Jitter Tolerance		0.29		UI
Data Dependent Pulse Width Shrinkage		0.07		UI
LOS Assert Threshold: Tx Data Input Differential Peak-Peak Voltage Swing		50		mVpp

Receiver (Module Output)

Single Ended Output Voltage	V_{OUT}	-0.3	4	V
Differential Data Output Swing	$V_{OUT,P-P}$	200	1000	mVpp
AC Common Mode Output Voltage (RMS)			7.5	mV
Output Transition Time, 20%~80%		28		ps
J2 Jitter Output			0.42	UI
J9 Jitter Output			0.65	UI
Power Supply Ripple Tolerance		50		mVpp

V. Timing

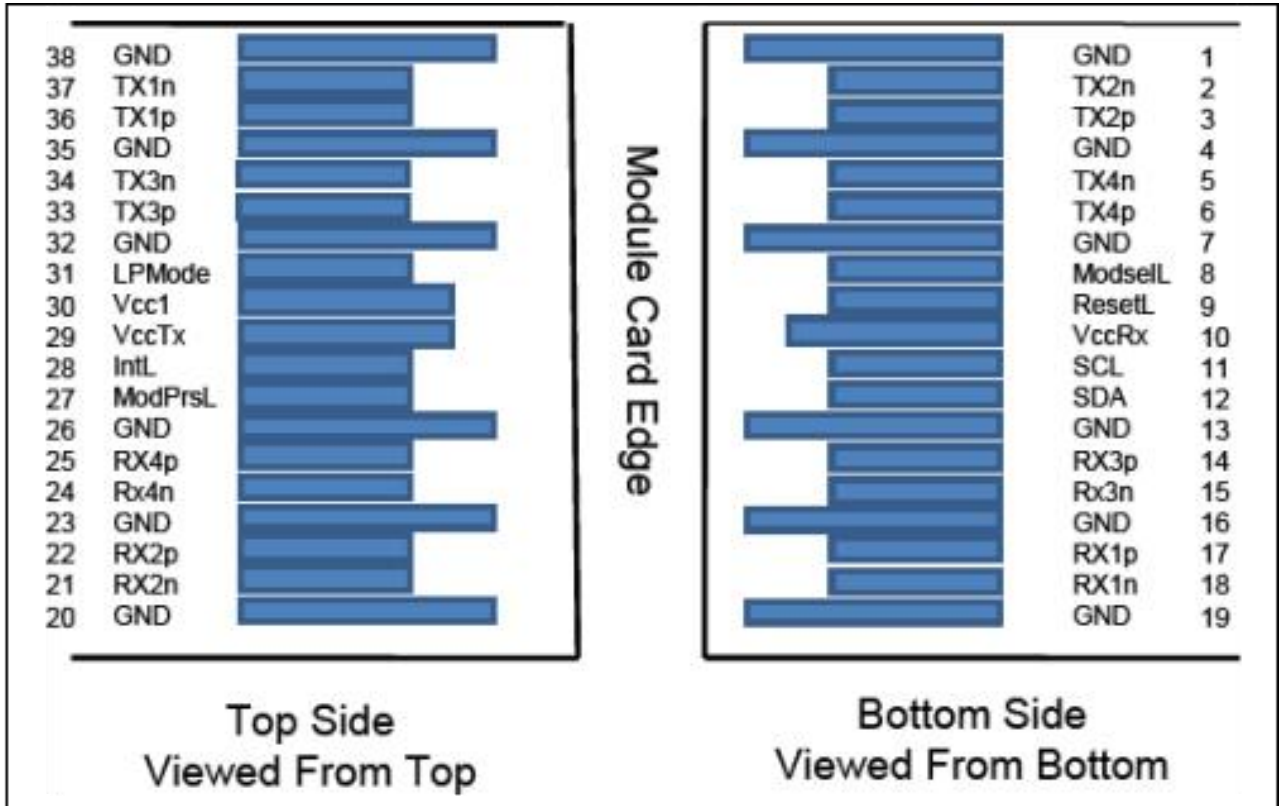
1. Timing for QSFP+ Soft Control and Status Functions

Parameter	Symbol	Max.	Units
Initialization Time	t_init	2000	ms
Reset Init Assert Time	t_reset_init	2	μs
Serial Bus Hardware Ready Time	t_serial	2000	ms
Monitor Data Ready Time	t_data	2000	ms
Reset Assert Time	t_reset	2000	ms
LPMODE Assert Time	ton_LPMODE	100	μs
LPMODE De-assert Time	toff_LPMODE	300	us
IntL Assert Time	ton_IntL	200	ms
IntL De-assert Time	toff_IntL	500	μs
Rx LOS Assert Time	ton_lol	100	ms
Tx Fault Assert Time	ton_Txfault	200	ms
Flag Assert Time	ton_flag	200	ms
Mask Assert Time	ton_mask	100	ms
Mask De-assert Time	toff_mask	100	ms
Application or Rate Select Change Time	t_ratesel	100	ms
Power_over-ride or Power-set Assert Time	ton_Pdown	100	ms
Power_over-ride or Power-set De-assert Time	toff_Pdown	300	ms

2. I/O Timing for Squelch & Disable

Parameter	Symbol	Max.	Units
Rx Squelch Assert Time	ton_Rxsq	80	μs
Rx Squelch De-assertTime	toff_Rxsq	80	μs
Tx Squelch Assert Time	ton_Txsq	400	ms
Tx Squelch De-assert Time	toff_Txsq	400	ms
Tx Disable Assert Time	ton_txdis	100	ms
Tx Disable De-assert Time	toff_txdis	400	ms
Rx Output Disable Assert Time	ton_rxdis	100	ms
Rx Output Disable De-assert Time	toff_rxdis	100	ms
Squelch Disable Assert Time	ton_sqdis	100	ms
Squelch Disable De-assert Time	toff_sqdis	100	ms

VI. Pin Definitions



Pin	Logic	Symbol	Name/Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1

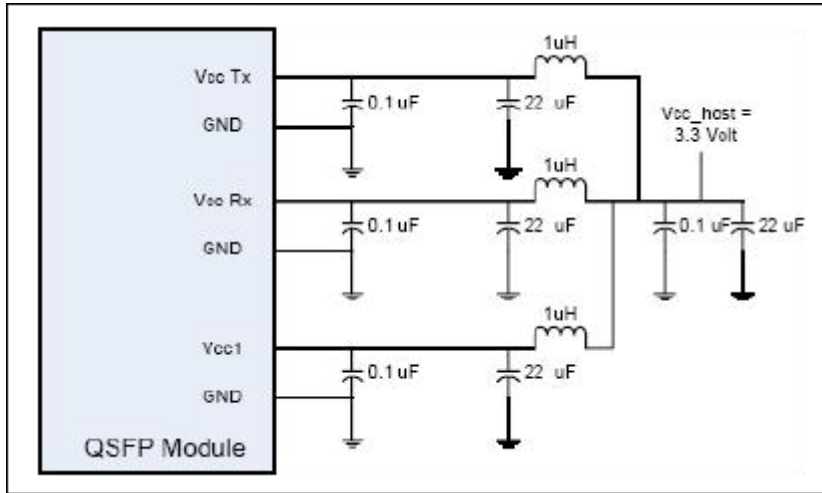
Pin	Logic	Symbol	Name/Description	Plug Sequence	Notes
8	LVTTL-I	ModselL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		V _{CC} Rx	3.3V Power Supply Receiver	2	2
11	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	3	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data	3	
13		GND	Ground	1	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	

Pin	Logic	Symbol	Name/Description	Plug Sequence	Notes
26		GND	Ground	1	1
27	LVTTTL-O	ModPrsL	Module Present	3	
28	LVTTTL-O	IntL	Interrupt	3	
29		V _{CC} Tx	3.3V Power Supply Transmitter	2	2
30		V _{CC} 1	3.3V Power Supply	2	2
31	LVTTTL-I	LPMode	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

Notes:

1. GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. V_{CC}Rx, V_{CC}1 and V_{CC}Tx are the receiver and transmitter power supplies and shall be applied concurrently.

VII. Principle Diagram

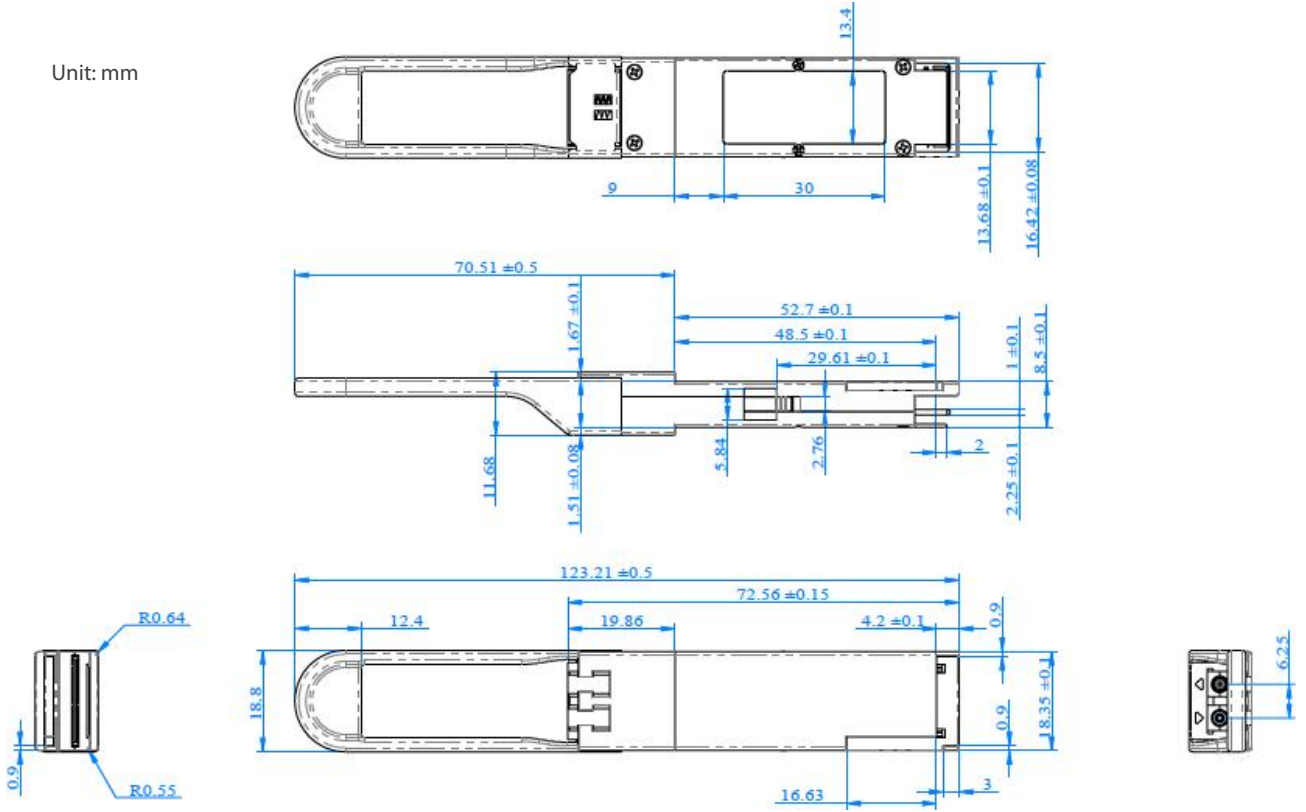


VIII. Digital Diagnostic Specifications

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	±3	°C	Internal
Voltage	0 to V _{CC}	0.1	V	Internal
Tx Bias Current (each Lane)	0 to 80	10%	mA	Internal
Tx Output Power	-15 to 4	±3	dB	Internal
Rx Power (each Lane)	-13.7 to 2.3	±3	dB	Internal

IX. Mechanical Specifications

Unit: mm



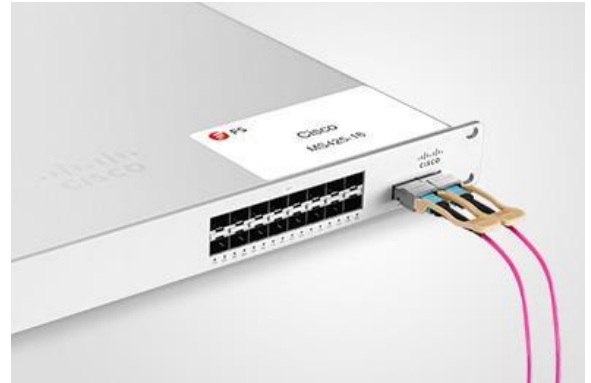
Test Center

I. Compatibility Testing

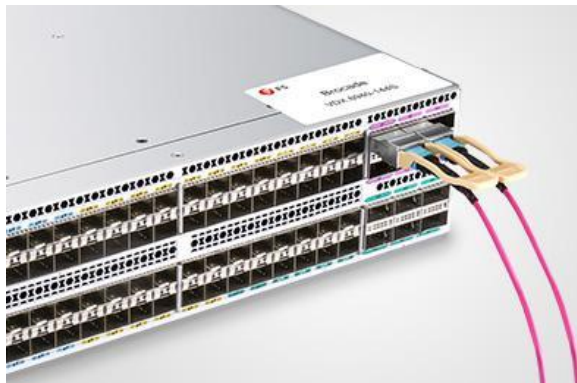
Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.



Cisco Catalyst C9500-24Y4C



Cisco MS425-16



Brocade VDX 6940-144S



Dell EMC Networking Z9100-ON



Force10 S60-44T

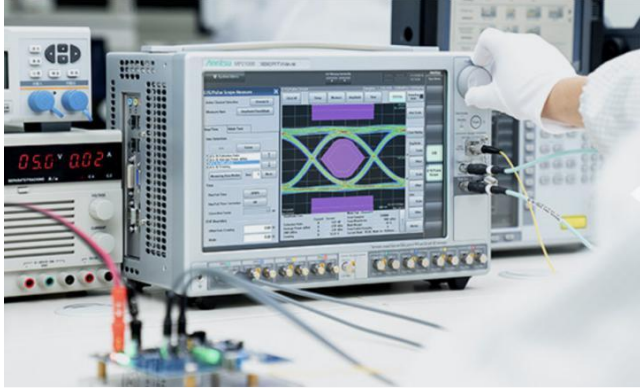


HUAWEI S6720-30L-HI-24S

Above is part of our test bed network equipment. For more information, please click the Test Bed PDF. It will be updated in real time as we expand our portfolio.

II. Performance Testing

Each fiber optical transceiver has been fully tested in FS Assured Program equipped with world's most advanced analytical equipment to ensure that our transceivers work perfectly on your device.



1. TX/RX Signal Quality Testing

Equipped with the all-in-one tester integrated 4ch BERT & sampling oscilloscope, and variable optical attenuator to ensure the input and output signal quality.

- Eye Pattern Measurements: jitter, Mask Margin, etc
- Average Output Power
- OMA
- Extinction Ratio
- Receiver Sensitivity
- BER Curve

2. Reliability and Stability Testing

Subject the transceivers to dramatic changes in temperature on the thermal shock chamber to ensure reliability and stability of the transceivers.

- Commercial: 0 °C to 70 °C
- Extended: -5 °C to 85 °C
- Industrial: -40 °C to 85 °C



3. Transfer Rate and Protocol Testing

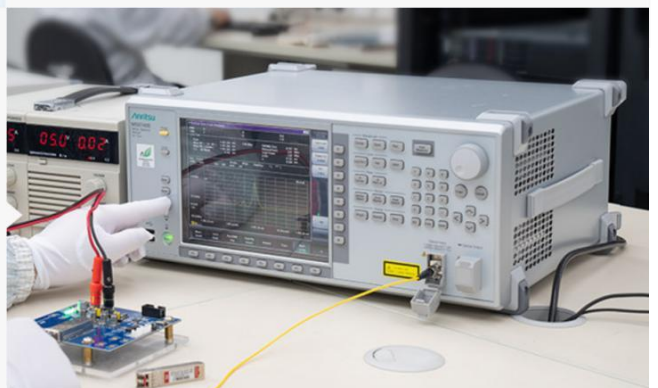
Test the actual transfer data rate and the transmission ability under different protocols with Network Master Pro.

- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI

4. Optical Spectrum Evaluation

Evaluate various important parameters with the Optical Spectrum Analyzer to meet the industry standards.

- Center Wavelength, Level
- OSNR
- SMSR
- Spectrum Width



Order Information

Part Number	Description
QSFP-SR4-40G	40GBASE-SR4 QSFP+ 850nm 150m MTP/MPO Transceiver for MMF
QSFP-CSR4-40G	40GBASE-CSR4 QSFP+ 850nm 400m MTP/MPO Transceiver for MMF
QSFP-PIR4-40G	40GBASE-PLRL4 QSFP+ 1310nm 1.4km MTP/MPO Transceiver for SMF
QSFP-LX4-40G	40GBASE-UNIV QSFP+ 1310nm 2km LC Transceiver for SMF&MMF
QSFP-IR4-40G	40GBASE-LR4L QSFP+ 1310nm 2km LC Transceiver for SMF
QSFP-LR4-40G	40GBASE-LR4 and OTU3 QSFP+ 1310nm 10km LC Transceiver for SMF
QSFP-LR4-40G	40GBASE-LR4 QSFP+ 1310nm 10km LC Transceiver for SMF, InfiniBand FDR
QSFP-LR4-40G-20	40GBASE-LR4 QSFP+ 1310nm 20km LC Transceiver for SMF
QSFP-PLR4-40G	40GBASE-PLR4 QSFP+ 1310nm 10km MTP/MPO Transceiver for SMF
QSFP-ER4-40G	40GBASE-ER4 and OTU3 QSFP+ 1310nm 40km LC Transceiver for SMF
QSFP-BD-40G	40GBASE-SR Bi-Directional QSFP LC Duplex Transceiver for MMF
QSFP-BIDI-40G	40GBASE Bi-Directional QSFP+ 850nm 300m DOM LC Transceiver for MMF
QSFP-PLR4-40G-I	40GBASE-PLR4 QSFP+ PSM4 1310nm 10km Industrial MTP/MPO Transceiver for SMF



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