100GBASE Optical Transceivers and Cables Portfolio

Product Overview

The 100G transceiver module portfolio offers a wide variety of high-density and low-power 100G connectivity options for data center, enterprise and telecom application. It includes 100G QSFP28 modules, 100G CFP/CFP2/CFP4 modules, 100G DACs/AOCs and their breakout cables. Featured products such as 100G and OTU4 QSFP28 Dual Rate Modules and 100G QSFP28 Single Lambda modules are also available for choice.

Features

- Hot pluggable to maximize uptime and simplify serviceability
- Flexible choice of compatibility, distance and interface for all need
- Tested on brand devices for performance, quality, and reliability
- Compliant with RoHs, CE, REACH, FDA and etc.

Contents

1. 100GBASE Transceiver Module Series

100G QSFP28 Transceiver Module Series include SR4, LR4, PSM4, CWDM4, 4CWDM-10, ER4, Industrial LR4, Dual Rate and Single Lambda. The series of product adopts LC or MTP/MPO connector and operates over Single Mode or Multimode optical fiber. They can be used for connections from 100m up to 40km and are suitable for 100G Ethernet or Optical Transport Network OTU4 applications.

1.1 100GBASE QSFP28 Modules

Image	Part Number	Description
	**QSFP28-SR4-100G**	100GBASE SR4 QSFP28 850nm 100m, DOM, MTP/MPO-12
	**QSFP28-LR4-100G**	100GBASE LR4 QSFP28 1310nm 10km, DOM, LC
	**QSFP28-LR4-100G-I**	100GBASE LR4 QSFP28 1310nm 10km, Industrial, DOM, LC
	**QSFP28-IR4-100G**	100GBASE CWDM4 QSFP28 1310nm 2km, DOM, LC
	**QSFP28-PIR4-100G**	100GBASE PSM4 QSFP28 1310nm 500m, DOM, MTP/MPO-12
	**QSFP28-EIR4-100G**	100GBASE 4WDM-10 QSFP28 1310nm 10km, DOM, LC
	**QSFP28-ER4-100G**	100GBASE ER4 QSFP28 1310nm 40km, DOM, LC

1.2 100G and OTU4 QSFP28 Dual Rate Modules

Image	Part Number	Description
	**QSFP28-LR4-100G**	100GBASE-LR4 and 112GBASE-OTU4 QSFP28 Dual Rate, 10km, LC

	**QSFP28-LR4-100G**	100GBASE-LR4 and 112GBASE-OTU4 QSFP28 Dual Rate, 20km, LC
	**QSFP28-LR4-100G**	100GBASE-LR4 and 112GBASE-OTU4 QSFP28 Dual Rate, 25km, LC
	**QSFP28-ER4-100G**	100GBASE-LR4 and 112GBASE-OTU4 QSFP28 Dual Rate, 30km, LC
	**QSFP28-ER4-100G**	100GBASE-LR4 and 112GBASE-OTU4 QSFP28 Dual Rate, 40km, LC

Note:

100G and OTU4 QSFP28 Dual Rate modules are designed for use in 100 Gigabit Ethernet and 4 x 28G OTN client interfaces. They are compliant with the QSFP28 MSA, IEEE 802.3ba 100GBASE-LR4, and OTU4 4I1-9D1F requirements specified in ITU-T Recommendations G.959.1/G.709 and Supplement 39 (G.sup39).

1.3 100GBASE QSFP28 Single Lambda Modules

Image	Part Number	Description
	**QSFP28-DR-100G**	100GBASE DR QSFP28 Single Lambda 1310nm 500m, DOM, LC
	**QSFP28-FR-100G**	100GBASE FR QSFP28 Single Lambda 1310nm 2km, DOM, LC
	**QSFP28-LR-100G**	100GBASE LR QSFP28 Single Lambda 1310nm 10km, DOM, LC

Note:

The optical output of 100G-DR or 100G-FR, 100G-LR module is a single 100Gbit / s PAM-4 optical signal. The 100G-DR or 100G-FR, 100G-LR module includes a gearbox chip to convert the 4 x 25G NRZ electrical signals to a 1 x 100G PAM-4 optical signal. They are in contrast to legacy QSFP100 modules (such as a CWDM4 or LR4 100G module), which have 4 x 25G NRZ optical wavelengths multiplexed onto one fiber.

1.4 100GBASE CFP/CFP2/CFP4/CXP Modules

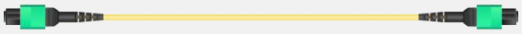
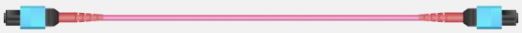
Image	Part Number	Description
	**CFP-SR10-100G**	100GBASE CFP SR10 850nm 150m, DOM, MTP/MPO-24
	**CFP-LR4-100G**	100GBASE CFP LR4 1310nm 10km, DOM, LC
	**CFP-ER4-100G**	100GBASE CFP ER4 1310nm 40km, DOM, LC
	**CFP2-LR4-100G**	100GBASE CFP2 LR4 1310nm 10km, DOM, LC
	**CFP4-LR4-100G**	100GBASE CFP4 LR4 1310nm 10km, DOM, LC
	**CXP-SR10-100G**	100GBASE CXP SR10 850nm 150m, DOM, MTP/MPO-24

1.5 100GBASE QSFP28 DACs / AOCs

Image	Part Number	Description
	**Q28-PCxx**	100G QSFP28 Passive DAC Cable, 1-5m
	**Q28-AOxx**	100G QSFP28 AOC Cable, 0.5-30m
	**Q-4S28PCxx**	100G QSFP28 to 4x25G SFP28 Passive DAC Cable, 1-5m
	**Q-4S28AOxx**	100G QSFP28 to 4x25G SFP28 AOC Cable, 1-50m

2. Product Specifications

2.1 Connector & Media

Part Number	Connector	Media	Direct Cabling Solution
QSFP28-SR4-100G	MTP/MPO-12	MMF	 OM4 (OM3) MTP-12 Fiber Type B
QSFP28-PIR4-100G	MTP/MPO-12	SMF	 OS2 MTP-12 Fiber Type B
QSFP28-LR4-100G	LC duplex	SMF	
QSFP28-IR4-100G	LC duplex	SMF	
QSFP28-EIR4-100G	LC duplex	SMF	
QSFP28-ER4-100G	LC duplex	SMF	
QSFP28-LR4-100G-I	LC duplex	SMF	OS2 LC-LC Duplex
QSFP28-DR-100G	LC duplex	SMF	
QSFP28-FR-100G	LC duplex	SMF	
QSFP28-LR-100G	LC duplex	SMF	
CFP-SR10-100G	MTP/MPO-24	MMF	
CXP-SR10-100G	MTP/MPO-24	MMF	OM4 (OM3) MTP-24 Fiber Type A

CFP-LR4-100G	LC duplex	SMF	
CFP-ER4-100G	LC duplex	SMF	
CFP2-LR4-100G	LC duplex	SMF	OS2 LC-LC Duplex
CFP4-LR4-100G	LC duplex	SMF	

Note:

100G Ethernet & OTU4 Dual Rate transceiver modules that include QSFP28-LR4-100G and QSFP28-ER4-100G also match with OS2 LC-LC Duplex single mode fiber patch cables, same as the 100G QSFP28 transceiver modules.

2.2 Optical Characteristics

100GBASE QSFP28 Modules

Part Number	Max Data Rate	Wavelength	Max Distance	Power Consumption	Tx Power (dBm)		Rx Power (dBm)	
					Min.	Max.	Min.	Max.
QSFP28-SR4-100G	103.1Gbps	850nm	100m	3.5W	-8.4	2.4	-10.3	2.4
QSFP28-LR4-100G	103.1Gbps	1310nm	10km	4W	-4.3	4.5	-10.6	4.5
QSFP28-LR4-100G-I	103.1Gbps	1310nm	10km	4.5W	-4.3	4.5	-10.6	4.5
QSFP28-IR4-100G	103.1Gbps	1271nm 1291nm 1311nm 1331nm	2km	3.5W	-6.5	2.5	-12.66	2
QSFP28-PIR4-100G	103.1Gbps	1310nm	500m	3.5W	-9.4	2	-11.5	2.5
QSFP28-EIR4-100G	103.1Gbps	1271nm 1291nm 1311nm 1331nm	10km	3.5W	-6.5	2.5	-13	2.5
QSFP28-ER4-100G	103.1Gbps	1310nm	40km	4.5W	-2.9	4.5	-20.9	4.9

100G and OTU4 QSFP28 Dual Rate Modules

Part Number	Max Data Rate	Wavelength	Max Distance	Power Consumption	Tx Power (dBm)		Rx Power (dBm)	
					Min.	Max.	Min.	Max.
QSFP28-LR4-100G	103.1Gbps	1310nm	10km	3.5W	-4.3	4.5	-10.6	4.5
	112Gbps				-0.6	4	-6.9	4
QSFP28-LR4-100G	103.1Gbps	1310nm	20km	3.5W	-1.2	4.5	/	4.5
	112Gbps				0	4	/	4
QSFP28-LR4-100G	103.1Gbps	1310nm	25km	3.5W	-1.2	4.5	/	4.5
	112Gbps				0	4	/	4
QSFP28-ER4-100G	103.1Gbps	1310nm	30km	4.5W	-2.5	4.5	-16.9	4.9
	112Gbps				-1.5	4.5	-16.9	4.9
QSFP28-ER4-100G	103.1Gbps	1310nm	40km	4.5W	-2.5	2.9	/	2
	112Gbps				-1	3.3	/	2

100GBASE QSFP28 Single Lambda Modules

Part Number	Max Data Rate	Wavelength	Max Distance	Power Consumption	Tx Power (dBm)		Rx Power (dBm)	
					Min.	Max.	Min.	Max.
QSFP28-DR-100G	103.1Gbps	1310nm	500m	4.5W	-2.9	4	-5.9	4
QSFP28-FR-100G	103.1Gbps	1310nm	2km	4.5W	-2.4	4	-6.4	4.5
QSFP28-LR-100G	103.1Gbps	1310nm	10km	4.5W	-1.4	4.5	-7.7	4.5

100GBASE CFP/CFP2/CFP4/CXP Modules

Part Number	Max Data Rate	Wavelength	Max Distance	Power Consumption	Tx Power (dBm)		Rx Power (dBm)	
					Min.	Max.	Min.	Max.
CFP-SR10-100G	112Gbps	850nm	150m	8W	-8	+1	/	/
CFP-LR4-100G	103.1Gbps	1310nm	10km	12W	-4.3	4.5	-10.6	4.5
	112Gbps				-2.5	2.9	/	4.5
CFP-ER4-100G	103.1Gbps	1310nm	40km	16W	-2.9	2.9	-20.9	4.5
	112Gbps				-2.9	2.9	-20.7	4.5
CFP2-LR4-100G	103.1Gbps	1310nm	10km	6W	-4.3	4.5	-10.6	4.5
	112Gbps				-2.5	2.9	/	4.5
CFP4-LR4-100G	111.81bps	1310nm	10km	6W	-4.3	4.5	-10.6	4.5
CXP-SR10-100G	120Gbps	850nm	150m	3.5W	-7.6	2.4	-9.5	2.4

100GBASE QSFP28 DACs / AOCs

Part Number	Max Data Rate	Connector Type	Cable Type	Cable Length	Wire AWG
Q28-PCxx	100Gbps	QSFP28 to QSFP28	Passive Copper Cable	1-5m	30AWG for 1m, 26AWG for 2/3/5m
Q-4S28PCxx	100Gbps	QSFP28 to 4SFP28	Passive Copper Cable	1-5m	30AWG for 1/2m, 28AWG for 3m, 26AWG for 5 m
Q28-AOxx	100Gbps	QSFP28 to QSFP28	Active Optical Cable	0.5-30m	/
Q-4S28AOxx	100Gbps	QSFP28 to 4SFP28	Active Optical Cable	1-50m	/

2.3 Environmental Conditions

Operating temperature range:

- Commercial temperature range: 0 to 70°C (32 to 158°F).

  Exception is **QSFP28-LR4-100G-I**: Industrial temperature range: -40 to 85°C (-40 to 185°F)

3. Application

The 100G transceiver module portfolio is applied for 100GBASE Ethernet and Data Center. Exceptions are **100G and OTU4 QSFP28 Dual Rate / QSFP28-LR4-100G-I**: 100GBASE Ethernet, Telecom

4. Standard Compliance

- SFF8665: QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28) - Rev 1.8 May 10, 2013
- SFF-8402: SFP+ 1X 28Gb/s Pluggable Transceiver Solution (SFP28) - Rev 1.1 September 13, 2014
- SFF-8436: QSFP+ 4X 10Gb/s Pluggable Transceiver - Rev 4.9 August 31, 2018
- IEEE 802.3bm Amendment of IEEE Std 802.3-2012 (D3.1, 1st August 2014)
- IEEE 802.3ba Amendment of IEEE Std 802.3-2012
- IEEE 802.3bj 100GEBASE-CR4 Specification
- OTN OTU4 4I1-9D1F
- RoHS-6

5. Certification

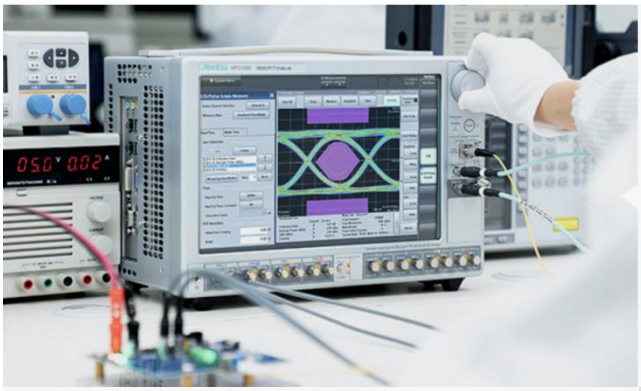
6. Warranty

- 5 Years Lifetime Warranty

7. Test Center

FS transceivers are tested on professional testing machine and brand switches for performance, quality, and reliability in our test center before shipped out.

7.1 Performance Test



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

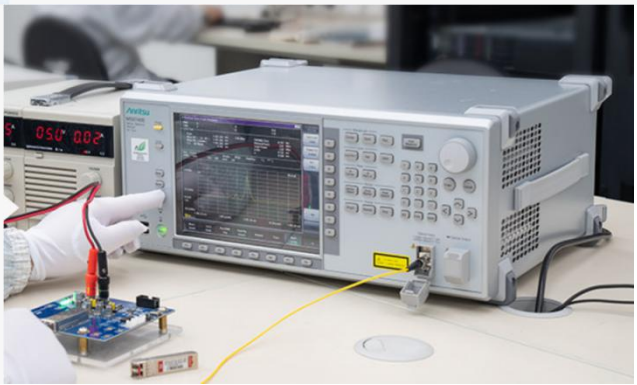
Test the actual transfer data rate and the transmission ability under different protocols with Network Master Pro.

- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI

4. Optical Spectrum Evaluation

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

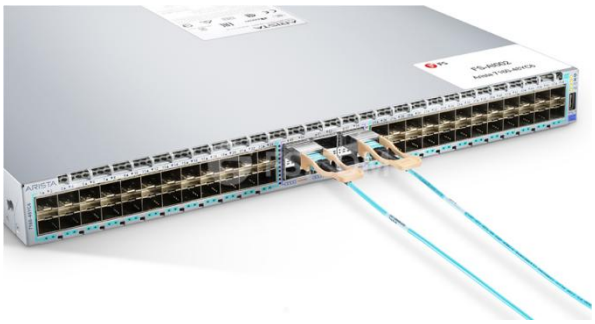
- Center Wavelength, Level
- OSNR
- SMSR
- Spectrum Width



7.2 Compatibility Test

Cisco Catalyst C9500-24Y4C

Cisco Nexus 92160YC-X



Arista 7160-48YC6

Dell EMC Networking Z9100-ON

Juniper EX4650

Huawei S6720-30L-HI-24S

See more in FS Test Assured Program at https://www.fs.com/support/test-assured-program.html.

https://www.fs.com