

100GBASE-ELR4 QSFP28 1310nm 20km DOM Optical Transceiver Module

QSFP28-ELR4-100G



Application

- 100G Ethernet
- Infiniband QDR and DDR interconnects.
- Client-side 100G Telecom connections

Features

- QSFP28 MSA compliant
- Compliant with 4WDM-20
- Digital diagnostic monitoring support
- Hot pluggable 38 pin electrical interface
- Maximum power consumption 3.5W
- Class 1 Laser
- Supports 103.125Gb/s aggregate bit rate
- Up to 20km transmission on single mode fiber
- LC duplex connector
- Single 3.3V power supply
- RoHS-6 compliant
- Operating case temperature: 0°C to 70°C

Description

100G QSFP28 ELR4 transceiver modules are designed for use in 100 Gigabit Ethernet links on up to 20km of single-mode fiber. They are compliant with the IEEE 802.3-2018 CAUI-4, QSFP28 MSA, SFF-8661 Revision 1.9, and SFF-8636 Revision 2.10a. Digital diagnostics functions are available via the I2C interface, as specified by the QSFP28 MSA, RoHS-6 compliant per Directive 2011/65/EC.

Product Specifications

I. Absolute Maximum Ratings

It has to be noted that the operation in of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.3	3.3	3.6	V	
Storage Temperature	Ts	-40		85	°C	
Relative Humidity	RH	15		85	%	1
Data Input Voltage – Differential	IVDIP-VDINI			1.0	V	
Control Input Voltage	VI	-0.3		Vcc+0.5	V	
Control Output Current	IO	-20		20	mA	

Notes:

1.Non-condensing

II. Recommended Operating Environment

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Operating Case Temperature	TOPR	0		70	°C	
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Instantaneous peak current at hot plug	ICC_IP	-	-	1400	mA	
Sustained peak current at hot plug	ICC_SP	-	-	1155	mA	
Maximum Power Dissipation	PD	-	-	3.5	W	
Maximum Power Dissipation, Low Power Mode	PDLP	-	-	1.5	W	
Aggregate Bit Rate	ABR	-	103.125	-	Gb/s	
Data Rate per Lane	DRL	-	25.78	-	Gb/s	
Data Rate per Lane	VIH	VCC*0.7	-	VCC+0.3	V	
Control Input Voltage Low	VIL	-0.3	-	VCC*0.3	V	
Two Wire Serial Interface Clock Rate				400	kHz	
Module power supply noise tolerance 10Hz - 10 MHz (peak-to-peak)				66	mVpp	
Rx Differential Data Output Load			100		ohms	
Operating Distance				20	km	1

Notes:

1. with FEC

III. Optical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Transmitter						
Data Rate, each lane			25.78125		Gbps	
Wavelength L0	λ_{C0}	1294.53	1295.56	1296.59	nm	
Wavelength L1	λ_{C1}	1299.02	1300.05	1301.09	nm	
Wavelength L2	λ_{C2}	1303.54	1304.58	1305.63	nm	
Wavelength L3	λ_{C3}	1308.09	1309.14	1310.19	nm	
Side-mode suppression ratio	SMSR	30			dB	
Total Average Optical Launch Power	POUT			10.5	dBm	
Average Launch Power Tx_Off (Each Lane)	POUT_OFF			-30	dBm	
Average Optical Launch Power (Each Lane)	POUTL	-4.3		4.5	dBm	
Extinction Ratio	ER	4		-	dB	
Optical Modulation Amplitude(Each Lane)	OMA	-1.3		4.5	dBm	
Launch Power in OMA minus TDP (Each Lane)	OMA-TDP	-2.3			dBm	
Difference in launch power between any two lanes(OMA)	DT_OMA			5	dB	
Transmitter and Dispersion Penalty(Each Lane)	TDP			2.8	dB	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter Eye Mask Definition			{0.25,0.4,0.45,0.25,0.28,0.4}			
RIN20OMA	RIN			-130	dB/Hz	
Transmitter reflectance				-26	dB	

Receiver

Data Rate, each lane			25.78125		Gbps	
Wavelength L0	λ_{C0}	1294.53	1295.56	1296.59	nm	
Wavelength L1	λ_{C1}	1299.02	1300.05	1301.09	nm	
Wavelength L2	λ_{C2}	1303.54	1304.58	1305.63	nm	
Wavelength L3	λ_{C3}	1308.09	1309.14	1310.19	nm	
Receiver Sensitivity (OMA) per Lane				-12.5	dBm	1
Stressed Receiver Sensitivity in OMA(Each Lane)				-10	dBm	
Stressed Receiver Sensitivity TestConditions:						
Stressed Eye J2 Jitter (Each Lane)			0.33		UI	
Stressed Eye J4 Jitter (Each Lane)			0.48		UI	
Vertical Eye Closure Penalty			2.5		dB	
SRS eye mask definition { X1, X2, X3, Y1, Y2, Y3}			{0.39, 0.5, 0.5, 0.39, 0.39, 0.4}			
Damage Threshold for Receiver	Pin, damage	5.5			dBm	
Average Receive Power (Each Lane)		-14.5		4.5	dBm	
Receive Power in OMA (Each Lane),Overload	OMA			4.5	dBm	
Difference in receive power between anytwo lanes (OMA)	DR_OMA			5.5	dB	
Receiver 3dB electrical upper cut-offfrequency (each lane)	F_C			31	GHz	
Receiver Reflectance	RXR			-26	dB	

Notes:

1. Measured with a PRBS231-1 test pattern @25.78125Gbps, BER \leq 5E-5

IV. Electrical Characteristics

High-Speed Signal: Compliant to CAUI-4 (IEEE 802.3bm)

Low-Speed Signal: Compliant to SFF-8679

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Power dissipation				3.5	W	
Transmitter (Module Input)						
Data Rate, each lane			25.78125		Gbps	
Differential Data Input Amplitude	V _{IN,P-P}	95		900	mVpp	1
Differential Termination Mismatch				10	%	
LPMode, Reset and ModSelL	V _{IL}	-0.3		0.8	V	
	V _{IH}	2		VCC+0.3	V	
Receiver (Module Output)						
Data Rate, each lane			25.78125		Gbps	
Differential Data Output Amplitude	V _{OUT,P-P}			900	mVpp	1
Differential Termination Mismatch				10	%	
Output Rise/Fall Time, 20%~80%	T _R	12			ps	
ModPrsL and IntL	V _{OL}	0		0.4	V	IOL=4mA
	V _{OH}	VCC-0.5		VCC+0.3	V	IOL=-4mA

Notes:

- Amplitude customization beyond these specs is dependent on validation in customer system

V. Timing

Timing for QSFP+ Soft Control and Status Functions

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Initialization Time	t_init	-	-	5	s	
Reset Init Assert Time	t_reset_init	10	-	-	μs	
Serial Bus Hardware Ready Time	t_serial	-	-	2000	ms	
Monitor Data Ready Time	t_data	-	-	2000	ms	
Reset Assert Time	t_reset	-	-	2	s	
LPMode/TxDis mode change time	t_LPMode/TxDis	-	-	100	ms	
LPMode Assert Time	ton_LPMode	-	-	100	ms	
LPMode De-assert Time	toff_LPMode	-	-	300	ms	
IntL/RxLOSL mode change time	t_IntL/RxLOSL	-	-	100	ms	
IntL Assert Time	ton_IntL	-	-	200	ms	
IntL Deassert Time	toff_IntL	-	-	500	μs	
RxLOSL Assert Time (Optional Fast Mode)	ton_f_LOS	-	-	1	ms	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}				{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}		
Mask margin		5			%	

Timing for QSFP+ Soft Control and Status Functions

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Rx Squelch Assert Time	ton_Rxsq	-	-	15	ms	
Rx Squelch Deassert Time	toff_Rxsq	-	-	15	ms	
Tx Squelch Assert Time	ton_Txsq	-	-	400	ms	
Tx Squelch Deassert Time	toff_Txsq	-	-	400	ms	
Tx Disable Assert Time	ton_txdis	-	-	100	ms	
Tx Disable Deassert Time	toff_txdis	-	-	400	ms	
Tx Disable Assert Time (OptionalFast Mode)	Ton_f_TxDis	-	-	3	ms	
Rx Squelch Assert Time	ton_Rxsq	-	-	15	ms	
Rx Squelch Deassert Time	toff_Rxsq	-	-	15	ms	
Tx Squelch Assert Time	ton_Txsq	-	-	400	ms	
Transmitter reflectance				-12	dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}				{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}		
Mask margin		5			%	

VI. Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration	Parameter
Temperature	0 to 70	±3	°C	Internal	Temperature
Voltage	0 to VCC	±3%	V	Internal	Voltage
Tx Bias Current (Each Lane)	0 to 120	10%	mA	Internal	Tx Bias Current (Each Lane)
Tx Output Power (Each Lane)	-4.3 to 4.5	±3	dB	Internal	Tx Output Power (Each Lane)
Rx Power (Each Lane)	-14.5 to 4.5	±3	dB	Internal	Rx Power (Each Lane)

VII. Pin Assignment

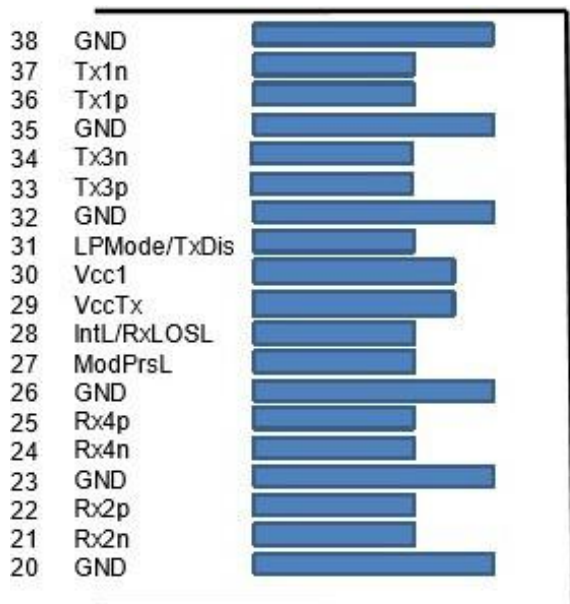
Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTTL-I	ModselL	Module Select	3	
9	LVTTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power Supply Receiver	2	2
11	LVCNOS-I/O	SCL	2-wire serial interface clock	3	
12	LVCNOS-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	
26		GND	Ground	1	1
27	LVTTTL-O	ModPrsL	Module Present	3	
28	LVTTTL-O	IntL/RxL OS L	Interrupt. Optionally configurable as RxLOSL via the management interface (SFF-8636). Interrupt. Optionally configurable as RxLOSL via the management interface(SFF-8636).	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTTL-I	LPMode/TxD is	Low Power Mode. Optionally configurable as TxDis via the management interface (SFF-8636).	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:

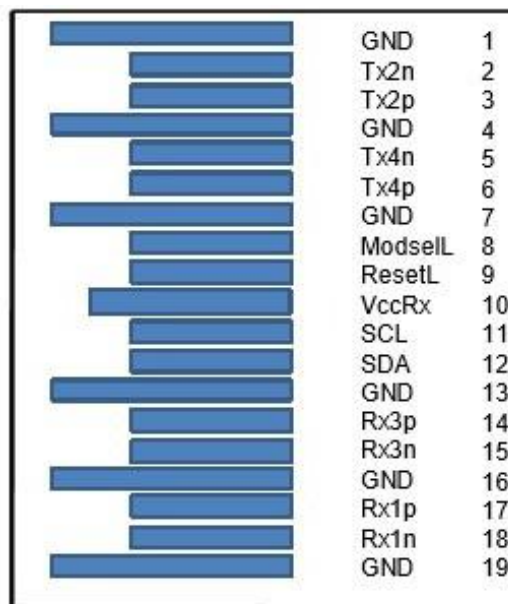
- 1.GND is the symbol for signal and supply (power) common for the module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
- 2.VccRx, Vcc1 and VccTx are applied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A

VIII. Module Pad Layout



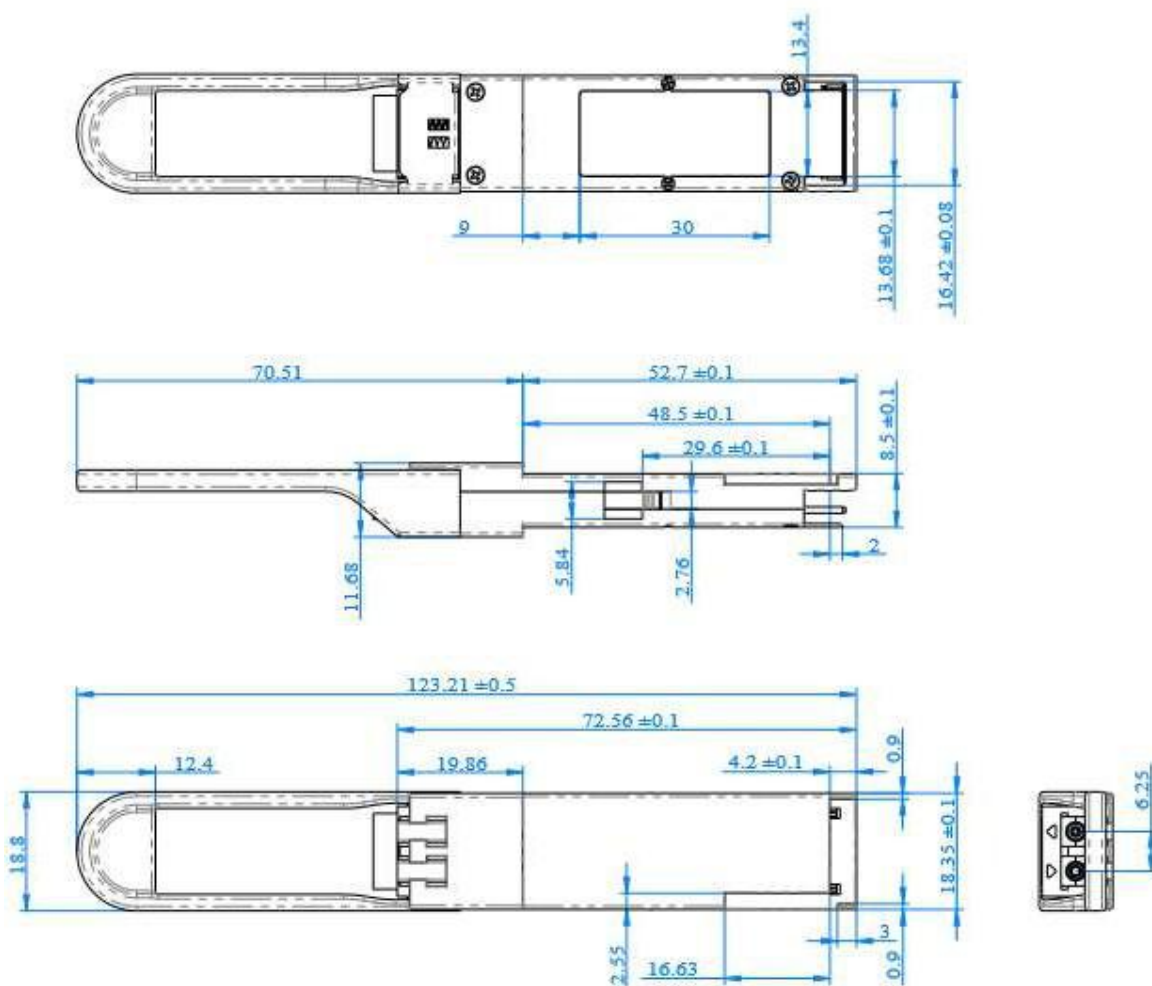
Top Side
Viewed From Top

Module Card Edge



Bottom Side
Viewed From Bottom

IX. Diagram Mechanical Drawing



Test Center

FS.COM transceivers are tested to ensure connectivity and compatibility in our test center before shipped out. FS.COM test center is supported by a variety of mainstream original brand switches and groups of professional staff, helping our customers make the most efficient use of our products in their systems, network designs and deployments.

The original switches could be found nowhere but at FS.COM test center, eg: Juniper MX960 & EX 4300 series, Cisco Nexus 9396PX & Cisco ASR 9000 Series, HP 5900 Series & HP 5406R ZL2 V3(J9996A), Arista 7050S-64, Brocade ICX7750-26Q & ICX6610-48, Avaya VSP 7000 MDA 2, etc.



Cisco ASR 9000 Series(A9K-MPA-1X40GE)



ARISTA 7050S-64(DCS-7050S-64)



Juniper MX960



Brocade ICX 7750-26Q



Extreme Networks X670V VIM-40G4X



Mellanox M3601Q



Dell N4032F



HP 5406R ZL2 V3(J9996A)



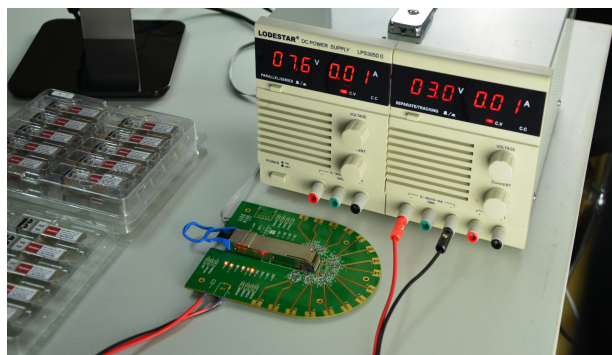
AVAYA 7024XLS(7002QQ-MDA)

Test Assured Program

FS.COM truly understands the value of compatibility and interoperability to each optics. Every module FS.COM provides must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In our test center, we care of every detail from staff to facilities—professionally trained staff, advanced test facilities and comprehensive original-brand switches, to ensure our customers to receive the optics with superior quality.



Our smart data system allows effective product management and quality control according to the unique serial number, properly tracing the order, shipment and every part.



Our in-house coding facility programs all of our parts to standard OEM specs for compatibility on all major vendors and systems such as Cisco, Juniper, Brocade, HP, Dell, Arista and so on.



With a comprehensive line of original-brand switches, we can recreate an environment and test each optics in practical application to ensure quality and distance.



The last test assured step to ensure our products to be shipped with perfect package.

Order Information

Part Number	Description
QSFP28-SR4-100G	QSFP28 100GBASE-SR4 850nm 100m Transceiver
QSFP28-PIR4-100G	QSFP28 100GBASE-PSM4 1310nm 500m Transceiver
QSFP28-IR4-100G	QSFP28 100GBASE-CWDM4 1310nm 2km Transceiver
QSFP28-EIR4-100G	QSFP28 100GBASE-eCWDM4 1310nm 10km Transceiver
QSFP28-BLR4-100G	QSFP28 100GBASE-LR4 1310nm 10km Transceiver
QSFP28-LR4-100G	QSFP28 100GBASE-LR4 1310nm 10km Transceiver for Data Center
QSFP28-ILR4-100G	QSFP28 100GBASE-LR4 1310nm 10km Transceiver (Industrial)
QSFP28-ELR4-100G	QSFP28 100GBASE-ELR4 1310nm 20km Transceiver
QSFP28-LR4-100G	QSFP28 100GBASE-LR4 and 112GBASE-OTU4 Dual Rate 1310nm 10km Transceiver
QSFP28-LR4-100G	QSFP28 100GBASE-LR4 and 112GBASE-OTU4 Dual Rate 1310nm 20km Transceiver
QSFP28-ER4-100G	QSFP28 100GBASE-ER4 and 112GBASE-OTU4 Dual Rate 1310nm 40km Transceiver
QSFP28-ER4-100G	QSFP28 100GBASE-ER4 1310nm 40km Transceiver
QSFP28-ZR4-100G	QSFP28 100GBASE-ZR4 1310nm 80km Transceiver

Notes:

100G QSFP28 transceiver module is individually tested on corresponding equipment such as Cisco, Arista, Juniper, Dell, Brocade and other brands, and passes the monitoring of FS.COM intelligent quality control system



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