

Product Specification

56Gbps 60/100m QSFP+ Optical Transceiver Module

NS-QSFP+56GBase-SR4C

PRODUCT FEATURES

- Four-channel full-duplex transceiver module
- Hot Pluggable QSFP+ form factor
- Maximum link length of 60m on OM3 Multimode Fiber (MMF) and 100m on OM4 MMF
- Up to 14.0625 Gb/s per channel
- Unretimed XLPPI electrical interface
- Maximum power dissipation <1.5W
- Reliable VCSEL array technology
- Extended operating case temperature range: 0°C to 70°C
- Single 1x12 MPO receptacle
- RoHS-6 Compliant



APPLICATIONS

- Infiniband 4xFDR
- Infiniband 4xFDR10
- Infiniband 4xQDR
- SAS 2.1/3.0
- IEEE 40GBASE-SR

PRODUCT SELECTION

NS-QSFP+56GBase-SR4C

I. Pin Descriptions

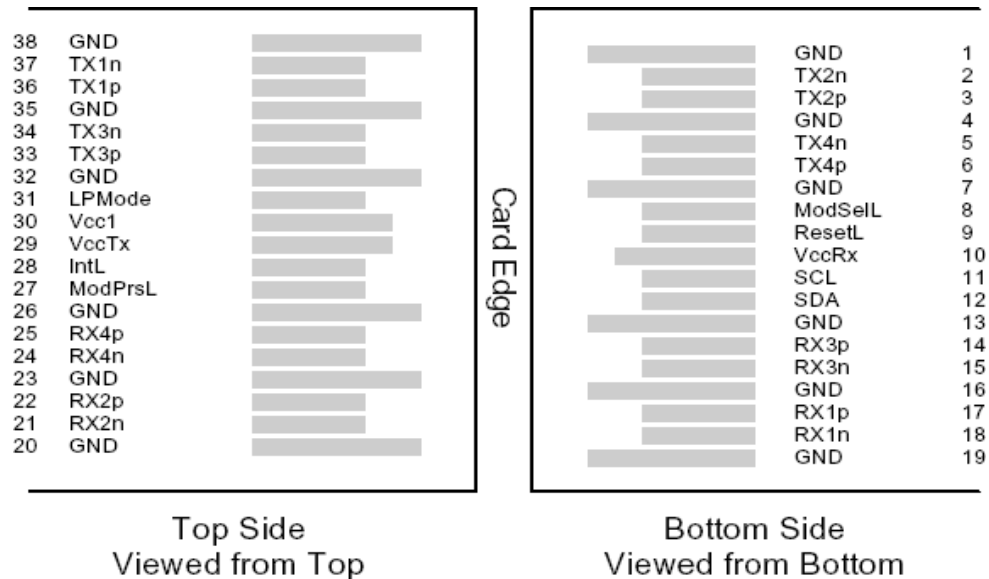


Figure 1 – QSFP+ MSA-compliant 38-pin connector

Pin	Symbol	Name/Description	Notes
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3 V Power supply receiver	
11	SCL	2-wire serial interface clock	



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12	SDA	2-wire serial interface data	
13	GND	Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1

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27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	Vcc Tx	+3.3 V Power supply transmitter	
30	Vcc1	+3.3 V Power Supply	
31	LPMode	Low Power Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Notes

1. Circuit ground is internally isolated from chassis ground.

II. General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	QSFP+		
Number of Lanes	4 Tx and 4 Rx		
Maximum Aggregate Data Rate	56.25	Gb/s	
Maximum Data Rate per Lane	14.0625	Gb/s	Higher bit rates may be supported.
Protocols Supported	40GBASE-SR4; SAS 2.1, 3.0 ; Infiniband QDR, FDR10, and FDR		
Electrical Interface and Pin-out	38-pin edge connector		Pin-out as defined by the QSFP+ MSA
Maximum Power Consumption per End	1.3	Watts	Varies with output voltage swing and pre-emphasis settings (see Figure 2)
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by the QSFP+ MSA

Data Rate Specifications	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate per Lane	BR	1.0625		14.0625	Gb/sec	
Bit Error Ratio	BER			10^{-12}		1
Link distance on OM3 MMF	d			60	meters	
Link distance on OM4 MMF	d			100	meters	

Notes:

1. Tested with a PRBS 2³¹-1 test pattern.

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III. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	V _{cc1} , V _{ccTx} , V _{ccRx}	-0.5		3.6	V	
Storage Temperature	T _S	-40		85	°C	
Case Operating Temperature	T _{OP}	0		70	°C	
Relative Humidity	RH	0		85	%	1
Damage Threshold, per Lane	DT	3.4			dBm	

Notes:

1. Non-condensing.

IV. Electrical Characteristics (T_{OP} = 0 to 70°C, V_{CC} = 3.15 to 3.45 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	V _{cc1} , V _{ccTx} , V _{ccRx}	3.135		3.465	V	
Supply Current	I _{cc}			350	mA	
Link turn-on time						
Transmit turn-on time				2000	ms	2
Transmitter (per Lane)						
Single ended input voltage tolerance	V _{inT}	-0.3		4.0	V	
Differential data input swing	V _{in,pp}	200		1200	mV _{pp}	3
Differential input threshold			50		mV	
AC common mode input voltage tolerance (RMS)		15			mV	
Differential input return loss		Per IEEE P802.3ba, Section 86A.4.1.1			dB	4
J2 Jitter Tolerance	J _{t2}	0.16			UI	
J9 Jitter Tolerance	J _{t9}	0.29			UI	
Data Dependent Pulse Width Shrinkage	DDPWS	0.07			UI	
Eye mask coordinates {X1, X2 Y1, Y2}			0.11, 0.31 95, 350		UI mV	5
Receiver (per Lane)						
Single-ended output voltage		-0.3		4.0	V	
Differential data output swing	V _{out,pp}	0		800	mV _{pp}	5,6
Differential output amplitude settings 00		200		400	mV	6
Differential output amplitude settings 01		300		600	mV	6
Differential output amplitude settings 10		400		800	mV	6
Differential output amplitude settings 11		600		1200	mV	6
Output pre-emphasis setting 00			0		mV	6
Output pre-emphasis setting 01			125		mV	6
Output pre-emphasis setting 10			175		mV	6

Output pre-emphasis setting 11		325	mV	6
AC common mode output voltage (RMS)		7.5	mV	
Termination mismatch at 1 MHz		5	%	
Differential output return loss		Per IEEE P802.3ba, Section 86A.4.2.1	dB	4

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Common mode output return loss		Per IEEE P802.3ba, Section 86A.4.2.2			dB	4
Output transition time, 20% to 80%		28			ps	
J2 Jitter output	Jo2			0.42	UI	
J9 Jitter output	Jo9			0.65	UI	
Eye mask coordinates {X1, X2 Y1, Y2} range 0		0.29, 0.5 50, 225			UI mV	7
Eye mask coordinates {X1, X2 Y1, Y2} range1		0.29, 0.5 100, 350			UI mV	7
Eye mask coordinates {X1, X2 Y1, Y2} range2		0.29, 0.5 150, 450			UI mV	7
Power Supply Ripple Tolerance	PSR	50			mVpp	

Notes:

1. Maximum total power value is specified across the full temperature and voltage range.
2. From power-on and end of any fault conditions.
3. After internal AC coupling. Self-biasing 100Ω differential input.
4. 10 MHz to 11.1 GHz range
5. AC coupled with 100Ω differential output impedance.
6. Settable via the I2C interface.
7. Hit ratio = 5 x 10E-5.

V. Optical Characteristics (T_{OP} = 0 to 70°C, V_{CC} = 3.15 to 3.45 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter (per Lane)						
Signaling Speed per Lane		1.0625		14.0625	GBd	1
Center wavelength		840		860	nm	
RMS Spectral Width	SW			0.55	nm	
Average Launch Power per Lane	TXP _x	-6.0			dBm	
Transmit OMA per Lane	TxOMA	-4.5		3.0	dBm	2
Difference in Power between any two lanes [OMA]	DP _x			2.0	dB	
Peak Power per Lane	PP _x			4.0	dBm	
Optical Extinction Ratio	ER	4.7			dB	
Optical Return Loss Tolerance	ORL			12	dB	
Encircled Flux	FLX	> 86% at 19 um < 30% at 4.5 um			dBm	
Average launch power of OFF transmitter, per lane				-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		0.23, 0.34, 0.43, 0.27, 0.35, 0.4				

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Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Receiver (per Lane)						
Signaling Speed per Lane		1.0625		14.0625	GBd	3
Center wavelength		840		860	nm	
Damage Threshold	DT	3.4			dBm	
Average Receive Power per Lane	RXP _x			2.4	dBm	
Receiver Sensitivity (OMA) per Lane	URS			-8.2	dBm	
Peak Power, per lane	PP _x			4	dBm	
Receiver Reflectance	Rfl			-12	dB	
Vertical eye closure penalty, per lane				1.9	dB	
Stressed eye J2 jitter, per Lane				0.3	UI	
Stressed eye J9 jitter, per Lane				0.47	UI	
Rx jitter tolerance: Jitter frequency and p-p amplitude		(75, 5)			kHz, UI	
		(375, 1)			kHz, UI	
LOS De-Assert	LOS _D			-12	dBm	
LOS Assert	LOS _A	-30			dBm	
LOS Hysteresis		0.5			dBm	

Notes:

1. Transmitter consists of 4 lasers operating at a maximum rate of 14.0625Gb/s each.
2. Even if TDP is <0.9dB, the OMA min must exceed this value.
3. Receiver consists of 4 photodetectors operating at a maximum rate of 14.0625Gb/s each.

VI. Memory Map and Control Registers

Compatible with SFF-8436 Rev. 4.7 (QSFP+).

VII. Environmental Specifications

NS-QSFP+56GBase-SR4C transceivers have an operating temperature range from 0°C to +70°C case temperature.

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T _{op}	0		70	°C	
Storage Temperature	T _{sto}	-40		85	°C	

VIII. Regulatory Compliance

NS-QSFP+56GBase-SR4C transceivers are RoHS-6 Compliant.

NS-QSFP+56GBase-SR4C transceiver modules are Class 1 laser eye safety compliant per IEC 60825-1.

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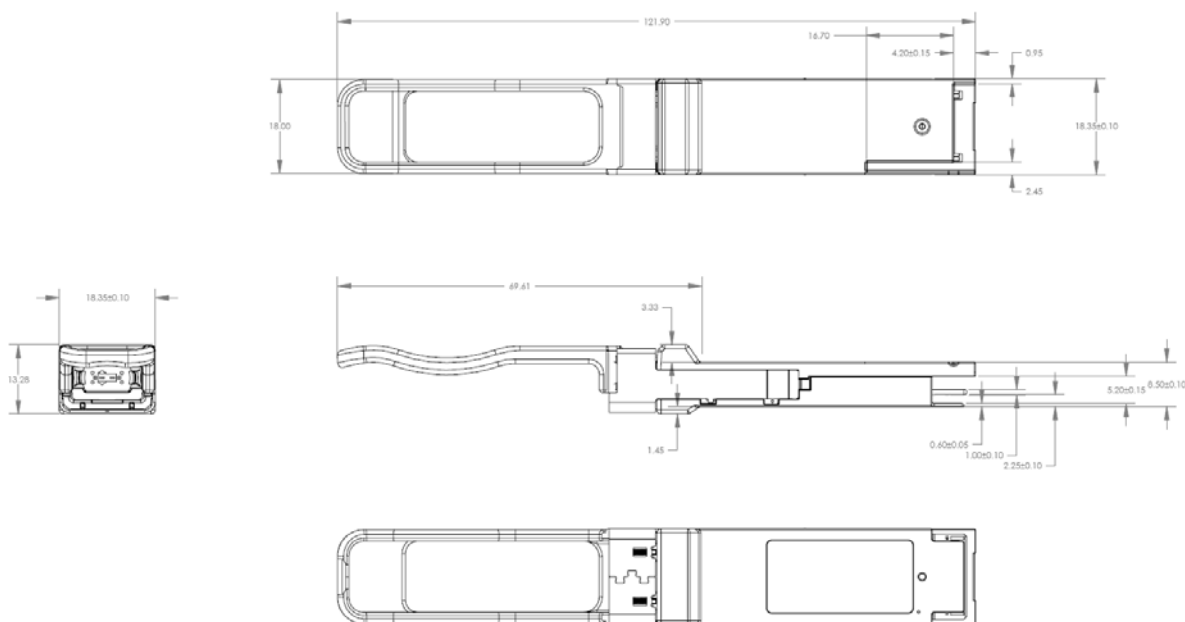


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IX. Mechanical Specifications

The NS-QSFP+56GBase-SR4C mechanical specifications are compliant to the QSFP+ MSA transceiver module specifications.



**Figure 2 – NS-QSFP+56GBase-SR4C
mechanical drawing**

[Label Image to be inserted here]

**Figure 3 – NS-QSFP+56GBase-SR4C
product label**



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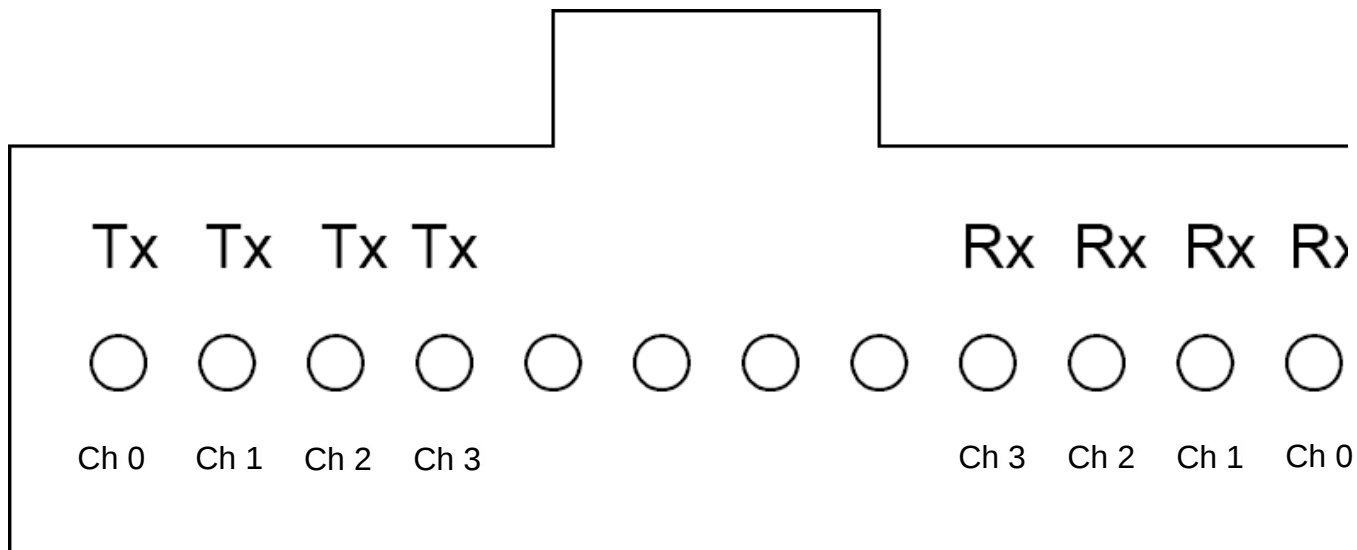


Figure 4 – NS-QSFP+56GBase-SR4C optical lane assignment (front view of MPO receptacle)

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