# Pro**Labs**

# QSFP-100GB-131143-20-E-J-C

Juniper Networks<sup>®</sup> Compatible TAA 100GBase-OWDM QSFP28 Transceiver O-Band Channel OW311 400GHz (SMF, 1311.43nm, 20km, LC, DOM, -5 to +80C)

# Features:

- Hot-pluggable QSFP28 form factor
- Compliant with QSFP28 MSA
- Supports 106.25Gb/s (PAM4)
- Duplex LC receptacles
- High Sensitivity APD Receiver
- OWDM 8 Wavelengths
- Single +3.3V power supply
- Aligned with IEEE 802.3bs and 100G Lambda MSA
- I2C management interface
- Operating temperature: -5 to +80 Celsius
- RoHS Compliant and Lead-Free



#### **Applications:**

- 100GBase Ethernet
- Access and Enterprise

# **Product Description**

This Juniper Networks<sup>®</sup> QSFP28 transceiver provides 100GBase-OWDM throughput up to 20km over single-mode fiber (SMF) using a wavelength of 1311.43nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Juniper Networks<sup>®</sup> transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



Rev. 082522

# **Regulatory Compliance**

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ESD to the LC Receptacle: compatible with IEC 61000-4-3
- EMI/EMC: compatible with FCC Part 15 Subpart B Rules, EN55022:2010
- Laser Eye Safety: compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1,2
- RoHS compliant with EU RoHS 2.0 directive 2015/863/EU

# Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	Vcc	0	3.6	V
Storage Temperature	TS	-40	85	°C
Operating Case Temperature	Тс	-5	80	°C
Relative Humidity (No Condensation)	RH	0	85	%
Damage Threshold	THd	0		dBm
Link Distance Through Mux	D		20	km
Link Distance Back-to-Back	D		40	km

# **Electrical Characteristics**

Parameter	Symbol	Min.	Тур.	Max.	Unit	Notes
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Supply Current	lcc			1.8	А	
Power Consumption			4.7 at -5°C 4.4 at 25°C 5.2 at 80°C	5.0 at -5°C 4.8 at 25°C 5.5 at 80°C	w	
Transmitter High-Speed Electrical Char	acteristics					
Signaling Rate	Rate	2	5.78125±100ppr	m	Gbps	
Input Differential Impedance	ZIN		100		Ω	
Differential Input Voltage Per Lane				900	mV	
Input Impedance Mismatch				10	%	
Input High Voltage	VIH	2		Vcc+0.3	V	
Input Low Voltage	VIL	-0.3		0.8	V	
Receiver High-Speed Electrical Charact	eristics					
Signaling Rate	Rate	25.78125 ± 100ppm		Gbps		
Common-Mode Voltage	Vcm	-350		2850	mV	
Common-Mode Noise (RMS)				17.5	mV	20-80%

Differential Termination Resistance Mismatch (At 1MHz)			10	%	
Differential Return Loss (SDD22)			Per CEI-28G- VSR	dB	
Common-Mode to Differential Conversion and Differential to Common-Mode Conversion (SDC22, SCD22)			Per CEI-28G- VSR	dB	
Common-Mode Return Loss (SCC22): From 250MHz to 30GHz			-2		
Transition Time: 20-80%		9.5		ps	
Vertical Eye Closure	VEC		6.5	dB	
Eye Width at 10-15 Probability	EW15	0.57		UI	
Eye Height at 10-15 Probability	EH15	228		mV	

# **Optical Characteristics (EOL)**

TansmitterSubstrate strate st	Parameter		Symbol	Min.	Тур.	Max.	Unit	Notes
Modulation Format     λ     initial     PAM4     Initial     Initial     Initial       Side-Mode Suppression Ratio     SMSR     30     initial	Transmitter							
Mavelength     λ     1311.03     1311.43     1311.83     nm     fight set in the set	Data Rate Per Lane				53.125 ± 100ppr	n	Gbps	
Side-Mode Suppression RatioSMSR30Image of the sector of	Modulation Format				PAM4			
Average Launch Power     Payg     0     3.4     dBm     1       Outer Optical Modulation Amplitude (0MAouter)     TP>1.4dB     3.0     6.4     dBm     4       Tarsmitter and Dispersion     Top 1.4dB     16+TDP     6.4     dBm     4       Transmitter and Dispersion     Fen 1y     TDP     6.4     dBm     4       TEQ     Fen 2y     GCO     3.4     dB     4       TEQ     FER     S.0     3.4     dB     5       TDP-TECQI (Maximum)     FER     S.0     10.5     dB     5       Totasmitter And Dispersion     FR     S.0     10.5     dB     2       Optical Return Loss Toleration     FR     S.0     10.5     dB     2       Average Lauch Power Off Transmitter     RL     GLO     10.5     dB     2       Receiver     RNN     GLO     FA     3.4     dB     2       Modulation Format     N     SIZES t100pm-te     Mon     4       Lone Vavelength     N     SIZES 41020	Wavelength		λ	1311.03	1311.43	1311.83	nm	
Outer Optical Modulation Amplitude (OMAouter)TPC-1.4dB3.06.48Bm9Tarasmitter and Dispersioner realityTDP1.6+TDP6.48Bm1Tarasmitter and Dispersioner realityTDP73.48B7Tarasmitter and Dispersioner realityTDP73.98B7TECQFECQ1.03.98B77Top-TECQ1 (Maximum)ER5.01.07.68B7Tarsmitter AffectanceRR5.01.5.68B2Average Lauch Power Off TransmitterPOff7.61.5.68B2RIN15.6 OMARINRIN1.61.5.68B2ReceiverRIN0.01.61.68B2Modulation FormatNN1.225.04"131N1Lane WavelengthN1.5.71.31.68Bm3Average Receive PowerN1.5.71.31.68Bm3Average Receive Power (OMAouter)RL1.5.71.61.68Bm5.6Stressed Receiver Sensitivity (OMAouter)SR51.61.1.68Bm5.6Stressed Receiver Sensitivity (OMAouter)RL-264Bm5.6Stressed Receiver Sensitivity (SCA)1.05H6.11.6.54Bm5.6Costines of Stress Receiver Sensitivity (SCA)1.51.61.66Bm5.6Stressed Sey Closure for MixI.55H1.5 <t< th=""><th>Side-Mode Suppression Rat</th><th>tio</th><th>SMSR</th><th>30</th><th></th><th></th><th>dB</th><th></th></t<>	Side-Mode Suppression Rat	tio	SMSR	30			dB	
Modulation Amplitude (MAAULY)TDP1-44BI.GetTDP6.46.4m6.4m6.4mTransmitter and Dispersive Transmitter and Dispersive T	Average Launch Power		Pavg	0		3.4	dBm	1
IDP 1.4dbIDP 1.4db <th></th> <th>TDP&lt;1.4dB</th> <th>POMA</th> <th>3.0</th> <th></th> <th>6.4</th> <th>dBm</th> <th></th>		TDP<1.4dB	POMA	3.0		6.4	dBm	
Transmitter and Dispersion PenaltyTDPInd3.4dBIndTECQTECQI3.9dBITECQTECQI3.9dBIITDP-TECQ1 (Maximum)ER5.0IdBIExtinction RatioER5.0IdBIOptical Return Loss ToleranceORLTII.5.6dBITransmitter ReflectanceRLI-26dBIRINI5.6 OMARINI-15dBmIReteiverData Rate Per LaneIS.125 ± 100ppmGbpsIModulation FormatIIPAMIILane WavelengthTHd0IdBm3Average Receive PowerI15.7IIIReceiverI15.7IIBmIDamage ThresholdTHdI-26IBmIReceive Power (OMAouter)RLIIBmIBm5, 6Receive Power (OMAouter)RLIIBmIBm5, 6Stressed Receive Sensitivity (OMAouter)SRSIIIIII.6IBmIII.6IDS LossertLOSA-30III.5IBmIII.6IBmIII.6IDS LossertLOSA-30III.6IBmIII.6IBmIII.6IDS Lossert Receiver Sensitivity (OMAouter)SRSIII.6III.6IBmIII.6IIII.6IDS LossertLOSA-30III		TDP>1.4dB		1.6+TDP		6.4	dBm	
IDDP-TECQ1 (Maximum)Image of the set of	• •	Penalty	TDP			3.4	dB	
Extinction RatioER5.0Image: Margin and the state of	TECQ		TECQ			3.9	dB	
Optical Return Loss ToleranceORLTImage: Constraint of the second	TDP-TECQ  (Maximum)					2.5	dB	
Transmitter ReflectanceRLIndexPedfIndexPedfIndexPedfIndexPedfIndexPedfIndexPedfIndexInde	Extinction Ratio		ER	5.0			dB	
Average Launch Power Off TransmitterPoffInternational Content of	Optical Return Loss Tolerance		ORLT			15.6	dB	
RIN15.6 OMARINIndIndIndIndIndIndReceiverData Rate Per LaneS.125 ± 100ppmGbpsIndModulation FormatImdImdImdLane Wavelength $\lambda$ ImdImdDamage ThresholdTHd0ImdIdBm3Average Receive PowerImdIndImdImdImdImdImdReceive Power (OMAouter)RLImd<	Transmitter Reflectance		RL			-26	dB	2
ReceiverData Rate Per LaneImage: PAMGbpsModulation FormatPAMGbpsLane WavelengthλPAMImage: PAMDamage ThresholdTHd0GBm3Average Receive PowerImage: Pame-3dBm4Receive Power (OMAouter)Image: Pame-2.6dBm4Receiver ReflectanceRLImage: PameGBm5, 6Stressed Receiver Sensitivity (OMAouter)SRSImage: Pame11.6dBmPer Lane MaximumSRSImage: Pame-26dBImage: PameTransmitter ReflectanceRLImage: Pame-26dBm5, 6Stressed Receiver Sensitivity (OMAouter)SRSImage: Pame-26dBmImage: PameImage: Dot SharestLOSA-30Image: PameImage: PameImage: PameImage: PameLOS AssertLOSH0.5Image: PameImage: PameImage: PameImage: PameLOS HysteresisLOSH0.5Image: PameImage: PameImage: PameImage: PameStressed Eye Closure for PAM4 (SECQ) Lane Under TestImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameLos AssertImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameLos AssertLos AssertImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameImage: PameIm	Average Launch Power Off Transmitter		Poff			-15	dBm	
Data Rate Per LaneGbpsModulation FormatPAMGbpsLane Wavelengthλ1295.04~1311.9nmDamage ThresholdTHd0dBm3Average Receive Power1Hd0-3dBm4Receive Power (OMAouter)Image-15.7-3dBm4Receiver Power (OMAouter)Ru1-2.6dBm5.6Stressed Receiver Sensitivity (OMAouter)SRSImage-11.6dBm5.6Stressed Receiver Sensitivity (OMAouter)SRSImage-11.6dBm1Per Lane MaximumLOSA-3019.5dBmImageLOS AssertLOSH0.5Image-16.5dBmImageLOS HysteresisLOSH0.5Image3.4dBImageStressed Eye Closure for PAM4 (SECQ) Lane Under TestImageImage3.4dBImage	RIN15.6 OMA		RIN			-136	dB/Hz	
Modulation FormatλPAMNmLane Wavelengthλ1295.04~1311.9nmDamage ThresholdTHd0dBm3Average Receive Power15.7-3dBm4Receive Power (OMAouter)Image15.7-3dBm4Receive Power (OMAouter)RL2.6dBm5.6Stressed Receiver Sensitivity (OMAouter)SRSImage-11.6dBm5.6Stressed Receiver Sensitivity (OMAouter)SRSImage-11.6dBm5.6Dasamter ReflectanceRLImage-26dBImageTransmitter ReflectanceRLImage-26dBImageLOS AssertLOSA-30Image-11.6dBmImageLOS HysteresisLOSH0.5Image16.5dBmImageConditions of Stress Receiver Sensitivity (SECQ)ImageImage3.4dBImageLane Under TestImageImageImageImageImageImageLane Under TestImageImageImageImageImageImageLane Under TestImageImageImageImageImageImageLane Under TestImageImageImageImageImageImageLane Under TestImageImageImageImageImageImageLane Under TestImageImageImageImageImageImageLane Under Test	Receiver							
Lane Wavelength     λ     1295.04~1311.96     nm       Damage Threshold     THd     0     dBm     3       Average Receive Power     -15.7     -3     dBm     4       Receive Power (OMAouter)     RL     -2.6     dBm     5.6       Receiver Reflectance     RL     -26     dBm     5.6       Stressed Receiver Sensitivity (OMAouter)     SRS     111.6     dBm     5.6       Stressed Receiver Sensitivity (OMAouter)     SRS     -26     dB     -26       Iterative Maximum     SRS     -11.6     dBm     5.6       Stressed Receiver Sensitivity (OMAouter)     SRS     -26     dB     -26       Iterative Maximum     SRS     -11.6     dBm     2.6       Transmitter Reflectance     RL     -26     dB     -26       LOS Assert     LOSA     -30     -19.5     dBm     -26       LOS Hysteresis     LOSH     0.5     dBm     -26     dB     -26       LOS Hysteresis     LOSH     0.5     dBm     -26 <th>Data Rate Per Lane</th> <th></th> <th></th> <th></th> <th>53.125 ± 100ppr</th> <th>n</th> <th>Gbps</th> <th></th>	Data Rate Per Lane				53.125 ± 100ppr	n	Gbps	
Damage ThresholdTHd0Image of the sholddBm3Average Receive PowerImage of the shold-15.7-3dBm4Receive Power (OMAouter)Image of the shold-2.6dBmImage of the shold-2.6dBmImage of the sholdReceiver ReflectanceRLImage of the shold-2.6dBm5.6Image of the sholdJmage of the shold	Modulation Format				PAM			
Average Receive PowerImage: Boot of the section of the s	Lane Wavelength		λ		1295.04~1311.9	6	nm	
Receiver Power (OMAouter)Image: Constraint of the section of the sectio	Damage Threshold		THd	0			dBm	3
Receiver ReflectanceRLImage: Constraint of the section of the				-15.7			dBm	4
Receiver Sensitivity (OMAouter)SRSImage: Constraint of the sensitivity (OMAouter)SRSPer Lane MaximumSRSImage: Constraint of the sensitivity (OMAouter)SRSImage: Constraint of the sensitivity (OMAouter)Per Lane MaximumRLImage: Constraint of the sensitivity (OMAouter)RLImage: Constraint of the sensitivity (OMAouter)Transmitter ReflectanceRLImage: Constraint of the sensitivity (OMAouter)RLImage: Constraint of the sensitivity (OMAouter)LOS AssertLOSA-30Image: Constraint of the sensitivity (OMAouter)Image: Constraint of the sensitivity (OMAouter)Image: Constraint of the sensitivity (OMAouter)LOS HysteresisLOSH0.5Image: Constraint of the sensitivity (OMAouter)Image: Constraint of the sensitivity (OMAouter)Stressed Eye Closure for PAM4 (SECQ) Lane Under TestImage: Constraint of the sensitivity (SECQ)Image: Constraint of the sensitivity (SECQ)Image: Constraint of the sensitivity (SECQ)						-	-	
Stressed Receiver Sensitivity (OMAouter) Per Lane MaximumSRS-11.6dBmTransmitter ReflectanceRL-26dBLOS AssertLOSA-30-19.5dBmLOS De-AssertLOSD-16.5dBmLOS HysteresisLOSH0.5Image: Conditions of Stress Receiver Sensitivity TestStressed Eye Closure for PAM4 (SECQ) Lane Under TestAAA			RL			-26		
Per Lane MaximumImage: Constraint of the second								5, 6
LOS AssertLOSA-30-19.5dBmLOS De-AssertLOSD-16.5dBmLOS HysteresisLOSH0.5dBmConditions of Stress Receiver Sensitivity TestStressed Eye Closure for PAM4 (SECQ) Lane Under Test3.4dB			SRS			-11.6	dBm	
LOS De-AssertLOSD-16.5dBmLOS HysteresisLOSH0.5dBConditions of Stress Receiver Sensitivity Test-16.5dBStressed Eye Closure for PAM4 (SECQ) Lane Under Test3.4dB	Transmitter Reflectance		RL			-26	dB	
LOS Hysteresis LOSH 0.5 dB   Conditions of Stress Receiver Sensitivity Test stressed Eye Closure for PAM4 (SECQ) Lane Under Test 3.4 dB	LOS Assert		LOSA	-30		-19.5	dBm	
Conditions of Stress Receiver Sensitivity Test   Stressed Eye Closure for PAM4 (SECQ) Lane Under Test						-16.5	dBm	
Stressed Eye Closure for PAM4 (SECQ) 3.4 dB   Lane Under Test 3.4 dB	LOS Hysteresis		LOSH	0.5			dB	
Lane Under Test	Conditions of Stress Receiv	er Sensitivity Tes	t					
		M4 (SECQ)				3.4	dB	
		e Under Test				3.4	dB	

# Notes:

- Average launch power (minimum) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
- 2. Transmitter Reflectance is defined looking into the transmitter.
- 3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane.
- 4. Average receive power (minimum) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
- 5. Receiver Sensitivity (OMAouter) (maximum) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB for 100G ER1 O-Band WDM.
- 6. Measured with a conformance test signal at TP3 (see 3.11) for the BER specified in IEEE Std 802.3.

criptions Symbol	Name / Descriptions	D-f
		Ref.
GND	Transmitter Ground (Common with Receiver Ground).	1
Tx2-	Transmitter Inverted Data Input.	
Tx2+	Transmitter Non-Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
Tx4-	Transmitter Inverted Data Input.	
Tx4+	Transmitter Non-Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
ModSelL	Module Select.	2
ResetL	Module Reset.	2
VccRx	+3.3V Power Supply Receiver.	
SCL	2-Wire Serial Interface Clock.	2
SDA	2-Wire Serial Interface Data.	2
GND	Transmitter Ground (Common with Receiver Ground).	1
Rx3+	Receiver Non-Inverted Data Output.	
Rx3-	Receiver Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
Rx1+	Receiver Non-Inverted Data Output.	
Rx1-	Receiver Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
GND	Transmitter Ground (Common with Receiver Ground).	1
Rx2-	Receiver Inverted Data Output.	
Rx2+	Receiver Non-Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
Rx4-	Receiver Inverted Data Output.	1
Rx4+	Receiver Non-Inverted Data Output.	
GND	Transmitter Ground (Common with Receiver Ground).	1
ModPrsl	Module Present.	
IntL	Interrupt.	2
VccTx		
Vcc1		
LPMode	Low-Power Mode.	2
		1
Tx3-	Transmitter Inverted Data Output.	
	Symbol       GND       Tx2-       Tx2+       GND       Tx4-       GND       ModSelL       ResetL       VccRx       SDA       GND       SCL       SDA       GND       Rx3+       Rx3+       GND       Rx1+       Rx1+       Rx1+       Rx1+       GND       GND       ModSelL       IntL       VccTx       VCC1       LPMode       GND	SymbolName/DescriptionsGNDTransmitter Ground (Common with Receiver Ground).Tx2-Transmitter Inverted Data Input.Tx2+Transmitter Ground (Common with Receiver Ground).Tx4-Transmitter Inverted Data Input.Tx4+Transmitter Inverted Data Output.GNDTransmitter Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).ModSellModule Select.ResetLModule Reset.VccRx+3.3V Power Supply Receiver.SCL2-Wire Serial Interface Clock.SDA2-Wire Serial Interface Clock.SDA2-Wire Serial Interface Data Output.Rx3+Receiver Non-Inverted Data Output.Rx3+Receiver Non-Inverted Data Output.Rx1+Receiver Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).Rx1+Receiver Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).GNDTransmitter Ground (Common with Receiver Ground).Rx1+Receiver Inverted Data Output.Rx2-Receiver Inverted Data Output.Rx2+Receiver Inverted Data Output.Rx4+Receiver Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).Rx4+Receiver Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).Rx4+Receiver Inverted Data Output.GNDTransmitter Ground (Common with Receiver Ground).ModPrslModule Present.Intl

35	GND	Transmitter Ground (Common with Receiver Ground).	1
36	Tx1+	Transmitter Non-Inverted Data Input.	
37	Tx1-	Transmitter Inverted Data Output.	
38	GND	Transmitter Ground (Common with Receiver Ground).	1

# Notes:

- 1. The module signal grounds are isolated from the module case.
- 2. This is an open collector/drain output that, on the host board, requires a 4.7KΩ to 10KΩ pull-up resistor to Host\_Vcc.

# **Electrical Pin-Out Details**



Top Side

Bottom Side

# **Recommended Host Board Power Supply Filter Network**



**Block Diagram** 



# **Mechanical Specifications**





# **About ProLabs**

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## **Complete Portfolio of Network Solutions**

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

# **Trusted Partner**

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.

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