800Gb/s OSFP DR8 500M SMF Optical Transceiver

POOS80DR8

Product Specification

Preliminary

Features

- OSFP MSA Compliant
- CMIS 4.0 Fully compliant
- Parallel 8 Optical Lanes
- 100G Lambda MSA 100G-FRSpecification compliant
- Up to 500m transmission on single mode fiber (SMF) with FEC
- Operating case temperature: 0 to 70C
- Electrical interface: compliant with 800GAUI-8 (8x106.25Gb/s) interfacedefined in IEEE 802.3ck
- Rate Date operation at 106.25Gbps(PAM4) per channel
- Maximum power consumption 16W

Applications

- 800G Ethernet
- Infiniband interconnects
- Datacenter Enterprise networking

Part Number Ordering Information

POOS80DR8	800G OSFP DR8 500m optical transceiver with full real-timedigital diagnostic monitoring and pull tab

http://www.pro-optics.com

sales@pro-optics.com

1. General Description

This product is an 800Gb/s Octal Small Form-factor Pluggable (OSFP) optical module designed for 500m optical communication applications. The module converts 8 channels of 100Gb/s (PAM4) electrical input data to 8 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 800Gb/s. Reversely, on the receiver side, the module converts 8 channels of parallel optical signals of 100Gb/s each channel for an aggregate data rate of 800Gb/s into 8 channels of 100Gb/s (PAM4) electrical output data.

An optical fiber cable with an APC/MPO-16 connector can be plugged into the OSFP DR8 module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through an OSFP MSA-compliant edge type connector.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the OSFP Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

2. Functional Description

The module incorporates 8 parallel channels on 1310nm center wavelength, operating at 100G per channel. The transmitter path incorporates a quad channel EML driver integrated in the DSP together with 8 parallel EMLs. On the receiver path, a PD array is connected with 2 quad channel TIAs to convert the parallel 800Gb/s optical input into 8 channels of parallel 100Gb/s (PAM4) electrical signals. A DSP basis gearbox is used to convert 8 channels of 50GBaud PAM4 signals into 8 channels of 50GBaud PAM4 signals and also an 8-channel retimer and FEC block are integrated in this DSP. The electrical interface is compliant with IEEE 802.3ck and OSFP MSA in the transmitting and receiving directions, and the optical interface is compliant to OSFP MSA with MPO-16 connector.

A single +3.3V power supply is required to power up this product. As per MSA specifications the module offers 4 low speed hardware control pins: SCL, SDA, INT/RSTn and LPWn/PRSn

SCL and SDA are a 2-wire serial interface between the host and module using the I2C protocol. SCL is defined as the serial interface clock signal and SDA as the serial interface data signal. Both signals are open-drain and require pull-up resistors to

+3.3V on the host. The pull-up resistor value can be 2.2k ohms to 4.7k ohms.

INT/RSTn is a dual function signal that allows the module to raise an interrupt to the host and also allows the host to reset the module. Reset is an active-low signal on the host which is translated to an active-low signal on the module. Interrupt is an active-high signal on the module which gets translated to an active-low signal on the host. The INT/RSTn signal operates in 3 voltage zones to indicate the state of Reset for the module and Interrupt for the host. Figure 1 shows these 3 zones.

LPWn/PRSn is a dual function signal that allows the host to signal Low Power mode and the module to indicate Module Present. Low Power mode is an active-low signal on the host which gets converted to an active-low signal on the module. Module Present is controlled by a pull-down resistor on the module which gets converted to an active-low logic signal on the host. The LPWn/PRSn signal operates in 3 voltage zones to indicate the state of Low Power mode for the module and Module Present for the host. Figure 1 shows these 3 zones.

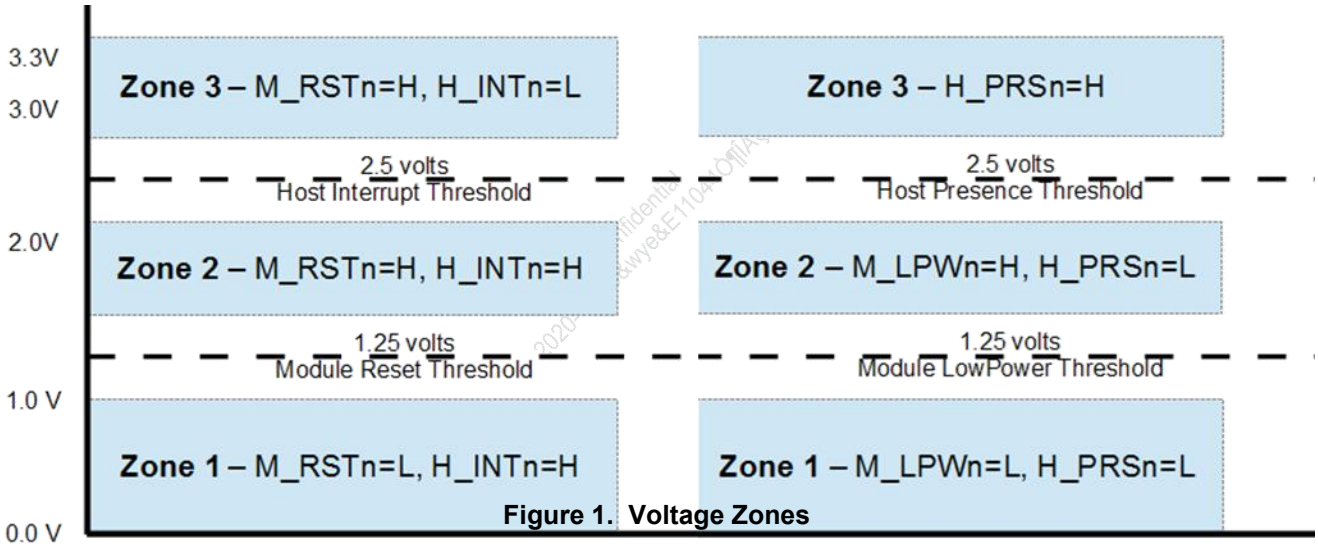

Figure 1. Voltage Zones

http://www.pro-optics.com

sales@pro-optics.com

3. Transceiver Block Diagram

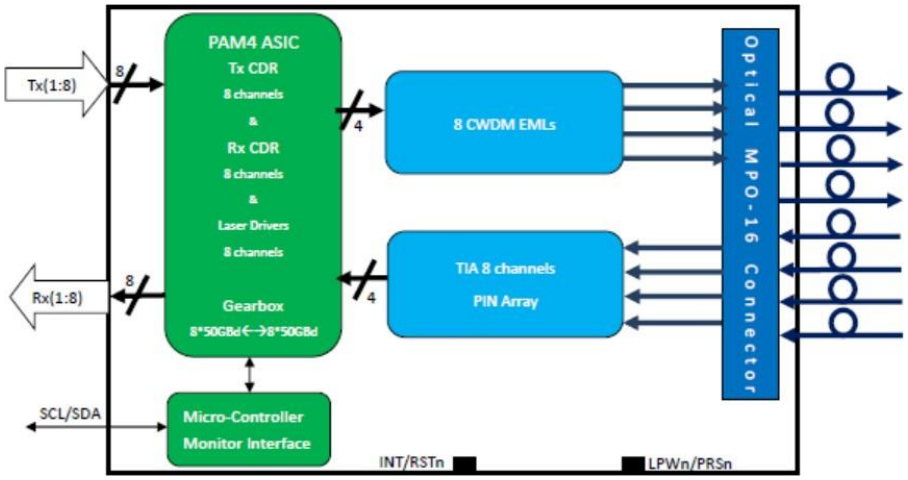

Figure 2. Transceiver Block Diagram

4. Pin Assignment and Description

The electrical pinout of the OSFP module is shown in Figure 3 below.

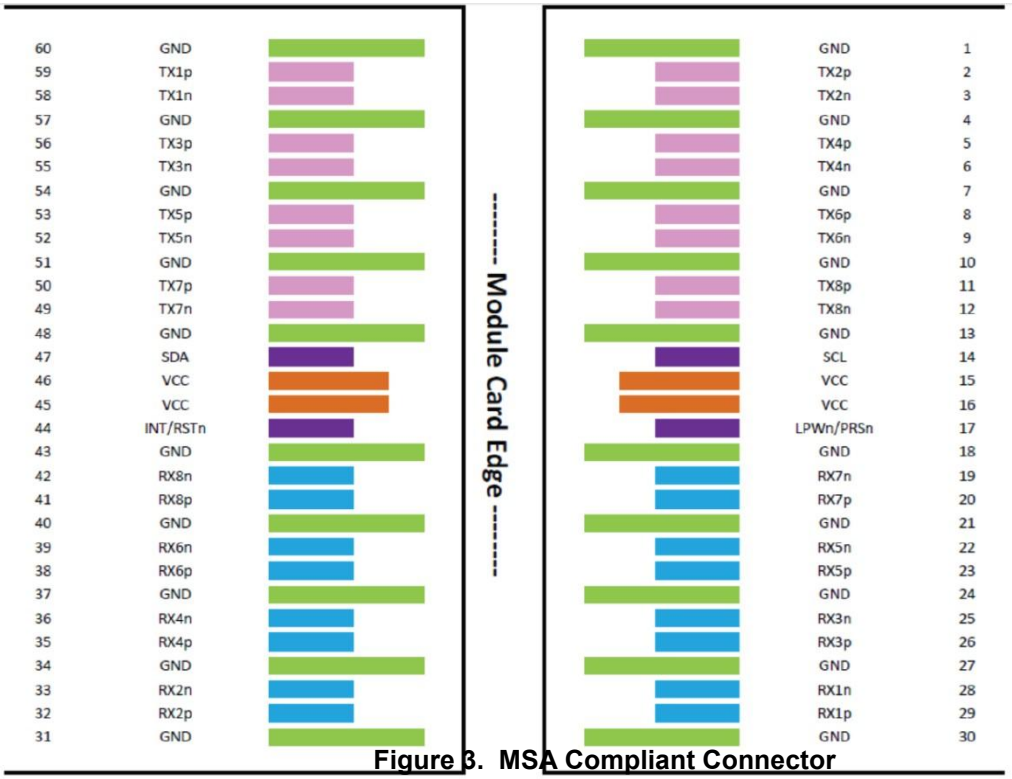

Figure 3. MSA Compliant Connector

http://www.pro-optics.com
sales@pro-optics.com

Pin Definition

Pin#	Symbol	Description	Logic	Direction	Plug Sequence
1	GND		Ground		1
2	TX2p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
3	TX2n	Transmitter Data Inverted	CML-I	Input from Host	3
4	GND		Ground		1
5	TX4p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
6	TX4n	Transmitter Data Inverted	CML-I	Input from Host	3
7	GND		Ground		1
8	TX6p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
9	TX6n	Transmitter Data Inverted	CML-I	Input from Host	3
10	GND		Ground		1
11	TX8p	Transmitter Data Non-Inverted	CML-I	Input from Host	3
12	TX8n	Transmitter Data Inverted	CML-I	Input from Host	3
13	GND		Ground		1
14	SCL	2-wire Serial interface clock	LVCMOS-I/O	Bi-directional	3
15	VCC	+3.3V Power		Power from Host	2
16	VCC	+3.3V Power		Power from Host	2
17	LPWn/PRSn	Low-Power Mode / Module Present	Multi-Level	Bi-directional	3
18	GND		Ground		1
19	RX7n	Receiver Data Inverted	CML-O	Output to Host	3
20	RX7p	Receiver Data Non-Inverted	CML-O	Output to Host	3
21	GND		Ground		1
22	RX5n	Receiver Data Inverted	CML-O	Output to Host	3
23	RX5p	Receiver Data Non-Inverted	CML-O	Output to Host	3
24	GND		Ground		1
25	RX3n	Receiver Data Inverted	CML-O	Output to Host	3
26	RX3p	Receiver Data Non-Inverted	CML-O	Output to Host	3
27	GND		Ground		1
28	RX1n	Receiver Data Inverted	CML-O	Output to Host	3
29	RX1p	Receiver Data Non-Inverted	CML-O	Output to Host	3
30	GND		Ground		1
31	GND		Ground		1
32	RX2p	Receiver Data Non-Inverted	CML-O	Output to Host	3
33	RX2n	Receiver Data Inverted	CML-O	Output to Host	3
34	GND		Ground		1

Confidential

http://www.pro-optics.com
sales@pro-optics.com

35	RX4p	Receiver Data Non–Inverted	CML–O	Output to Host	3
36	RX4n	Receiver Data Inverted	CML–O	Output to Host	3
37	GND		Ground		1
38	RX6p	Receiver Data Non–Inverted	CML–O	Output to Host	3
39	RX6n	Receiver Data Inverted	CML–O	Output to Host	3
40	GND		Ground		1
41	RX8p	Receiver Data Non–Inverted	CML–O	Output to Host	3
42	RX8n	Receiver Data Inverted	CML–O	Output to Host	3
43	GND		Ground		1
44	INT/RSTn	Module Interrupt / Module Reset	Multi–Level	Bi–directional	3
45	VCC	+3.3V Power		Power from Host	2
46	VCC	+3.3V Power		Power from Host	2
47	SDA	2–wire Serial interface data	LVCMOS–I/O	Bi–directional	3
48	GND		Ground		1
49	TX7n	Transmitter Data Inverted	CML–I	Input from Host	3
50	TX7p	Transmitter Data Non–Inverted	CML–I	Input from Host	3
51	GND		Ground		1
52	TX5n	Transmitter Data Inverted	CML–I	Input from Host	3
53	TX5p	Transmitter Data Non–Inverted	CML–I	Input from Host	3
54	GND		Ground		1
55	TX3n	Transmitter Data Inverted	CML–I	Input from Host	3
56	TX3p	Transmitter Data Non–Inverted	CML–I	Input from Host	3
57	GND		Ground		1
58	TX1n	Transmitter Data Inverted	CML–I	Input from Host	3
59	TX1p	Transmitter Data Non–Inverted	CML–I	Input from Host	3
60	GND		Ground		1

5. Recommended Power Supply Filter

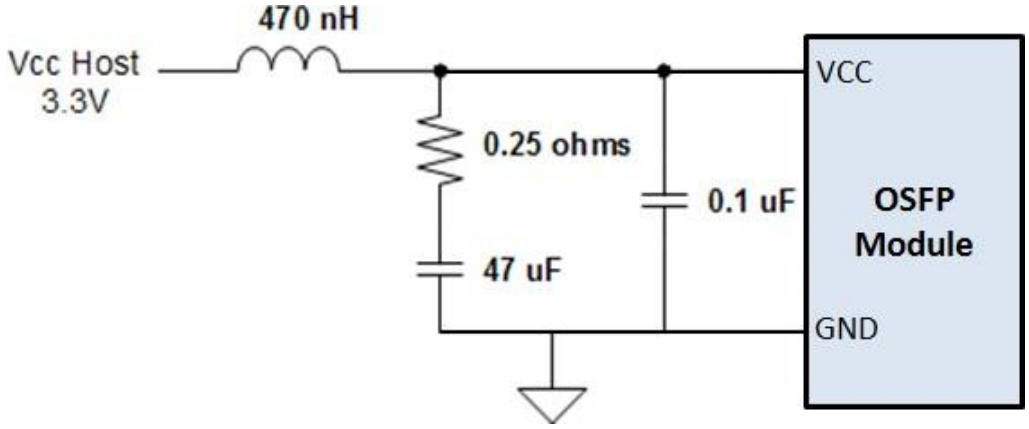

Figure 4. Recommended Power Supply Filter

6. Absolute Maximum Ratings

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

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	T_S	-40	85	degC	
Operating Case Temperature	T_{OP}	20	60	degC	
Power Supply Voltage	V_{CC}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	

7. Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Units	Notes
Operating Cas eTemperature	T_{OP}	20		60	degC	
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate, each Lane			53.125		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4x10^{-4}$		
Post-FEC Bit Error Ratio				$1x10^{-15}$		1
Link Distance	D			500	m	2

Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

http://www.pro-optics.com

sales@pro-optics.com

8. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Test Point	Min	Typical	Max	Units	Notes
Power Consumption				16	W	
Supply Current	Icc			4.84	A	
Transmitter (each Lane)						
Signaling Rate, each Lane	TP1	53.125 ± 100 ppm			GBd	
DC Common-mode input Voltage	TP1	-0.3		2.8	V	
Single-ended input Voltage	TP1	-0.4		3.3	V	
AC Common-mode RMS input Voltage	TP1			17.5	mV	
Differential Peak-to-Peak input Voltage	TP1			870	mV	
Eye Symmetry Mask Width(ESMW)	TP1		TBD		UI	
Differential input Eye Height	TP1	15			mV	
Differential input Vertical Eye Closure	TP1			9	dB	
Common to Different Mode input Return Loss	TP1	IEEE802.3ck Equation 120G-1				
Effective input Return Loss	TP1		TBD			
Differential input Termination Mismatch	TP1			10	%	
Input Transition time (20% to 80%)	TP1		TBD		ps	
Receiver (each Lane)						
Signaling Rate, each lane	TP4	53.125 ± 100 ppm			GBd	
Differential Peak-to-Peak Output Voltage	TP4			900	mV	
AC Common Mode Output Voltage, RMS	TP4			17.5	mV	
Differential Termination Mismatch	TP4			10	%	
Near-end output ESMW	TP4	IEEE802.3ck 120E.4.2			UI	

http://www.pro-optics.com
sales@pro-optics.com

Differential Near-end output Eye Height	TP4	IEEE802.3ck 120E.4.2			mV	
Far-end output ESMV	TP4	IEEE802.3ck 120E.4.2			UI	
Differential Far-end output Eye Height	TP4	IEEE802.3ck 120E.3.3.2.1			mV	
Far-end output Pre-Cursor ISIRatio	TP4	IEEE802.3ck 120E.3.3.1.2				
Common-mode to Differential mode output Return Loss	TP4	IEEE802.3ck Equation 120G-1			dB	
Effective output Return Loss	TP4		TBD		dB	
Output Transition time (20% to 80%)	TP4		TBD		ps	
DC Common-mode output Voltage	TP4	-350		2850	mV	

9. Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Units	Notes
Center Wavelength	λc	1304.5	1310	1317.5	nm	
Transmitter						
Data Rate, each Lane		53.125 ± 100 ppm			GBd	
Modulation Format		PAM4				
Side-mode Suppression Ratio	SMSR	30			dB	
Average Launch Power, eachLane	P_{AVG}	-2.9		4	dBm	1
Outer Optical Modulation Amplitude (OMA_{outer}), each Lane	P_{OMA}	-0.8		4.2	dBm	2
Launch Power in OMA_{outer} minus TDECQ), each Lane for ER ⩾ 5dB for ER < 5dB		 -2.2 -1.9			dB	
Transmitter and Dispersion Eye Closure for PAM4, each Lane	TDECQ			3.4	dB	

http://www.pro-optics.com
sales@pro-optics.com

TDECQ – 10*log$_{10}$(C_{eq}), eachLane				3.4	dB	3
Extinction Ratio	ER	3.5			dB	
$RIN_{21.4}$OMA	RIN			−136	dB/Hz	
Optical Return Loss Tolerance	TOL			21.4	dB	
Transmitter Reflectance	T_R			-26	dB	
Transmitter Transition Time				17	ps	
Average Launch Power of OFFTransmitter, each Lane	P_{off}			-15	dBm	
Receiver						
Data Rate, each Lane		53.125 ± 100 ppm			GBd	
Modulation Format		PAM4				
Damage Threshold, each Lane	TH_d	5			dBm	4
Average Receive Power, eachLane		-5.9		4	dBm	5
Receive Power (OMA_{outer}), eachLane				4.2	dBm	
Receiver Sensitivity (OMA_{outer}), each Lane	SEN			Equation (1)	dBm	6
Stressed Receiver Sensitivity(OMA_{outer}), each Lane	SRS			-1.9	dBm	7
Receiver Reflectance	R_R			-26	dB	
LOS Assert	LOSA	-15			dBm	
LOS De-assert	LOSD			-8.9	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Stressed Conditions for Stress Receiver Sensitivity (Note 8)						

http://www.pro-optics.com
sales@pro-optics.com

Stressed Eye Closure for PAM4(SECQ), Lane under Test			3.4		dB	
SECQ – $10*\log_{10}(C_{eq})$, Laneunder Test				3.4	dB	
OMA_{outer} of each Aggressor Lane			4.2		dBm	

Notes:

1. Average launch power, each lane (min) 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. Even if the TDECQ < 1.4dB for an extinction ratio of ⩾ 5dB or TDECQ < 1.1dB for an extinction ratio of < 5dB, the OMA_{outer} (min) must exceed the minimum value specified here.
3. C_{eq} is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts forreference equalizer noise enhancement.
4. Average receive power, each lane (min) is informative and not the principal indicator of
signal strength. A received power below this value cannot be compliant; however, avalue above this does not ensure compliance.
5. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
6. Receiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. It should meet Equation (1), which isillustrated in Figure 4.

$$RS = \max(-3.9, SECQ - 5.3)\ dBm \quad (1)$$

Where:

RS is the receiver sensitivity, and

SECQ is the SECQ of the transmitter used to measure the receiversensitivity.

7. Measured with conformance test signal at TP3 for the BER equal to 2.4×10^{-4}.
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

http://www.pro-optics.com
sales@pro-optics.com

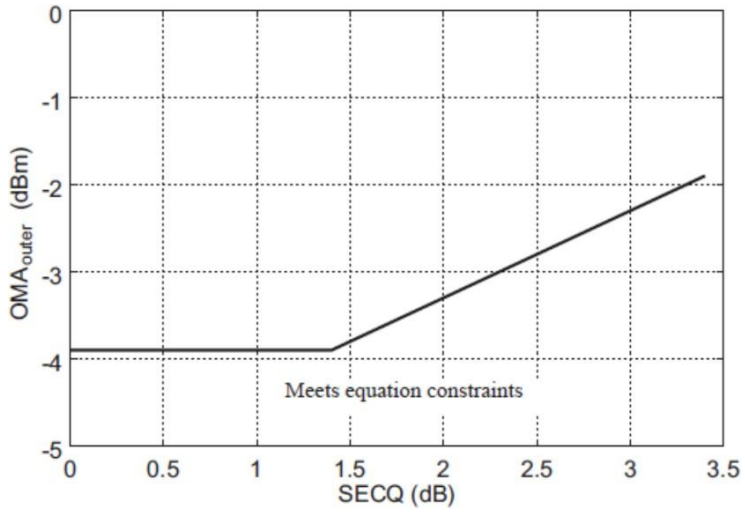

Figure 5. Illustration of Receiver Sensitivity Mask for 800G-DR8

10. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI _VCC	-0.1	0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

http://www.pro-optics.com
sales@pro-optics.com

11. Mechanical Dimensions

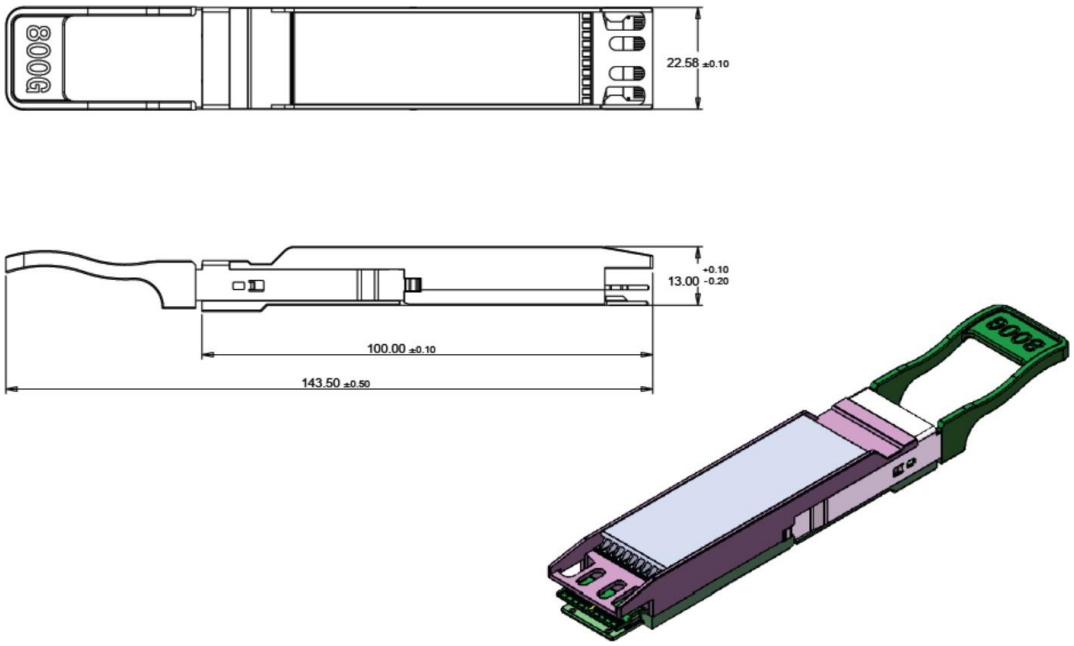

Figure 5. Mechanical Outline

12. ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

13. Laser Safety

This is a Class I Laser Product, or Class 1 Laser Product according to IEC/EN 60825-1:2014.

This product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.