QDD4-400GB-LR4-C

MSA and TAA 400GBase-LR4 QSFP-DD Transceiver (SMF, 1310nm, 10km, LC, DOM, CMIS 4.0)

Features:

- INF-8628 Compliance
- Duplex LC Connector
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free

Applications:

- 400GBase Ethernet
- Access and Enterprise

Product Description

This MSA Compliant QSFP-DD transceiver provides 400GBase-LR4 throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. 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' 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."

TAA COMPLIANT

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Power Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	Tstg	-40	85	°C
Operating Case Temperature	Tc	0	70	°C
Relative Humidity (Non-Condensing)	RH	0	85	%

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	Tc	0		70	°C	
Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Data Rate Per Lane			26.5625		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				2.4×10^{-4}		
Post-FEC Bit Error Ratio				1×10^{-12}		1
Link Distance	D	0.5		10	km	2

Notes:

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

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Consumption				12	W	
Supply Current	Icc			3.64	A	
Transmitter (Per Lane)						
Signaling Rate Per Lane	TP1	26.5625 ± 100 ppm			GBd	
Differential pk-pk Input Voltage Tolerance	TP1a	900			mVp-p	1
Differential Termination Mismatch	TP1			10	%	
Differential Input Return Loss	TP1	IEEE 802.3-2015 Equation (83E-5)			dB	
Differential to Common-Mode Input Return Loss	TP1	IEEE 802.3-2015 Equation (83E-6)			dB	
Module Stressed Input Test	TP1a	See IEEE 802.3bs 120E.3.4.1				2
Single-Ended Voltage Tolerance Range (Minimum)	TP1a	-0.4 to 3.3			V	
DC Common-Mode Input Voltage	TP1	-350		2850	mV	3
Receiver (each lane)						
Signaling Rate Per Lane	TP4	26.5625 ± 100 ppm			GBd	
Differential pk-pk Output Voltage	TP4			900	mVp-p	
AC Common-Mode Output Voltage, RMS	TP4			17.5	mV	
Differential Termination Mismatch	TP4			10	%	
Differential Output Return Loss	TP4	IEEE 802.3-2015 Equation (83E-2)				
Common to Differential-Mode Conversion Return Loss	TP4	IEEE 802.3-2015 Equation (83E-3)				
Transition Time (20% to 80%)	TP4	9.5			ps	
Near-end Eye Symmetry Mask Width (ESMW)	TP4		0.265		UI	
Near-End Eye Height (Differential)	TP4	70			mV	
Far-End Eye Symmetry Mask Width (ESMW)	TP4		0.2		UI	
Far-End Eye Height (Differential)	TP4	30			mV	
Far-End Precursor ISI Ratio	TP4	-4.5		2.5	%	
Common-Mode Output Voltage (Vcm)	TP4	-350		2850	mV	3

Notes:

1. With the exception to IEEE 802.3bs 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
2. Meets BER specified in IEEE 802.3bs 120E.1.1.
3. DC common-mode voltage generated by the host. Specification includes the effects of ground offset voltage.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Lane Wavelength	L0	1264.5	1271	1277.5	nm	
	L1	1284.5	1291	1297.5		
	L2	1304.5	1311	1317.5		
	L3	1324.5	1331	1337.5		
Transmitter						
Data Rate Per Lane			53.125 ± 100 ppm		GBd	
Modulation Format		PAM4				
Side-Mode Suppression Ratio	SMSR	30			dB	Modulated
Total Average Launch Power	PT			10	dBm	
Average Launch Power Per Lane	PAVG	-1.4		4.5	dBm	1
Outer Optical Modulation Amplitude (OMAouter) Per Lane	POMA	0.7		4.7	dBm	2
Launch Power in OMAouter Minus TDECQ, Per Lane		-0.7			dB	For ER ≥4.5dB
Launch Power in OMAouter Minus TDECQ, Per Lane		-0.6			dB	For ER <4.5dB
Transmitter and Dispersion Eye Closer for PAM4 Per Lane	TDECQ			3.4	dB	
Extinction Ratio	ER	3.5			dB	
Difference in Launch Power Between Any Two Lanes (OMAouter)				4	dB	
$RIN_{15.6}OMA$	RIN			-136	dB/Hz	
Optical Return Loss Tolerance	TOL			15.6	dB	
Transmitter Reflectance	TR			-26	dB	
Average Launch Power of OFF Transmitter Per Lane	Poff			-20	dBm	
Receiver						
Data Rate Per Lane			53.125 ± 100 ppm		GBd	
Modulation Format		PAM4				
Damage Threshold Per Lane	THd	5.5			dBm	3
Average Receive Power Per Lane		-7.7		4.5	dBm	4
Receive Power (OMAouter) Per Lane				4.7	dBm	
Difference in Receiver Power Between Any Two Lanes (OMAouter)				4.1	dB	
Receiver Sensitivity (OMAouter) Per Lane	SEN			-6.6	dBm	For BER of 2.4E-4
Stressed Receiver Sensitivity (OMAouter) Per Lane	SRS	See Figure Below			dBm	5
Receiver Reflectance				-26	dB	
LOS Assert	LOSA	-30			dBm	
LOS De-Assert	LOSD			-12	dBm	
LOS Hysteresis	LOSH	0.5			dB	

Stressed Conditions for Stress Receiver Sensitivity (Note 6)						
Stressed Eye Closure for PAM4 (SECQ) Per Lane Under Test		0.9		3.4	dB	
OMAouter of Each Aggressor Lane			1.5		dBm	

Notes:

1. Average launch power, each lane (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. Even if the TDECQ<1.4 dB for an extinction ratio of ≥4.5 dB or TDECQ<1.3 dB for an extinction ratio of <4.5 dB, the OMA_{outer} (minimum) must exceed the minimum value specified here.
3. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
4. Average receive power, each lane (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. Measured with conformance test signal for BER=2.4×10^{-4}. A compliant receiver shall have stressed receiver sensitivity (OMAouter), each lane values below the mask of the figure below, for SECQ values between 0.9 and 3.4 dB.
6. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.
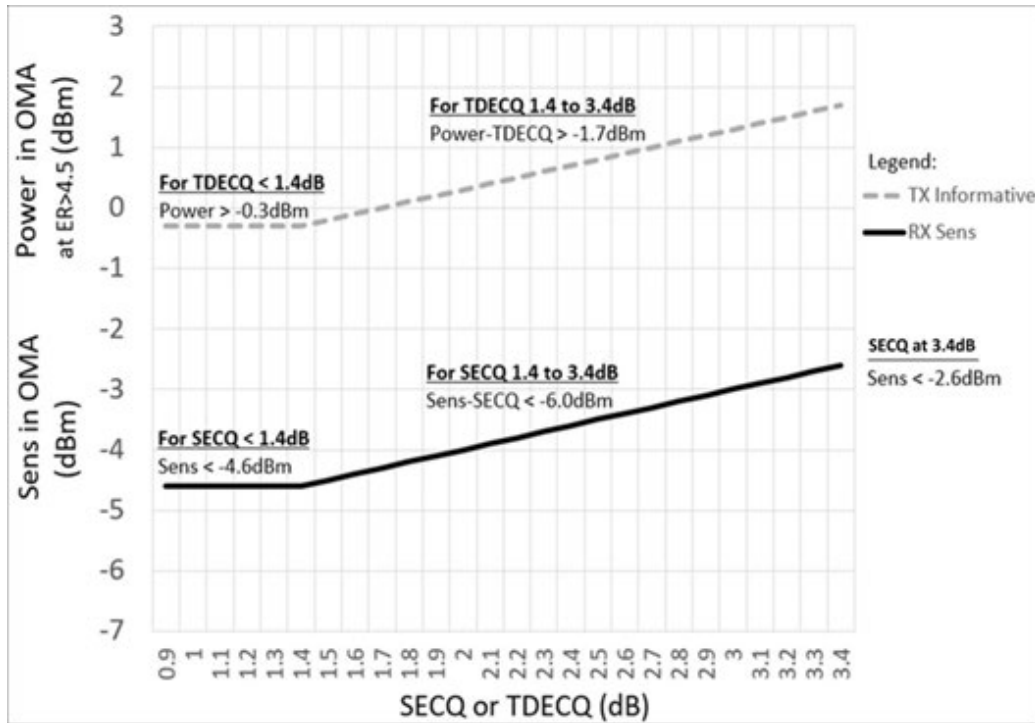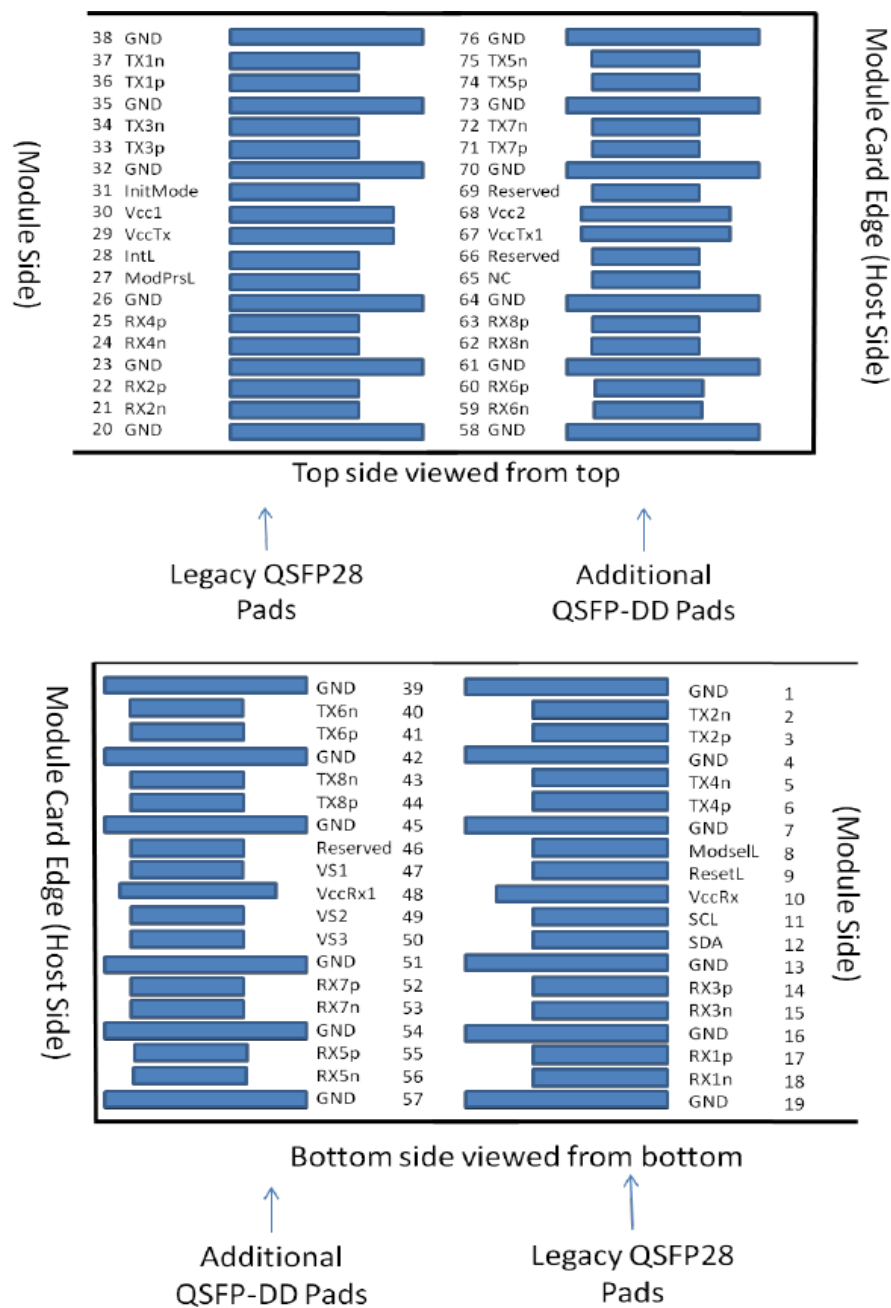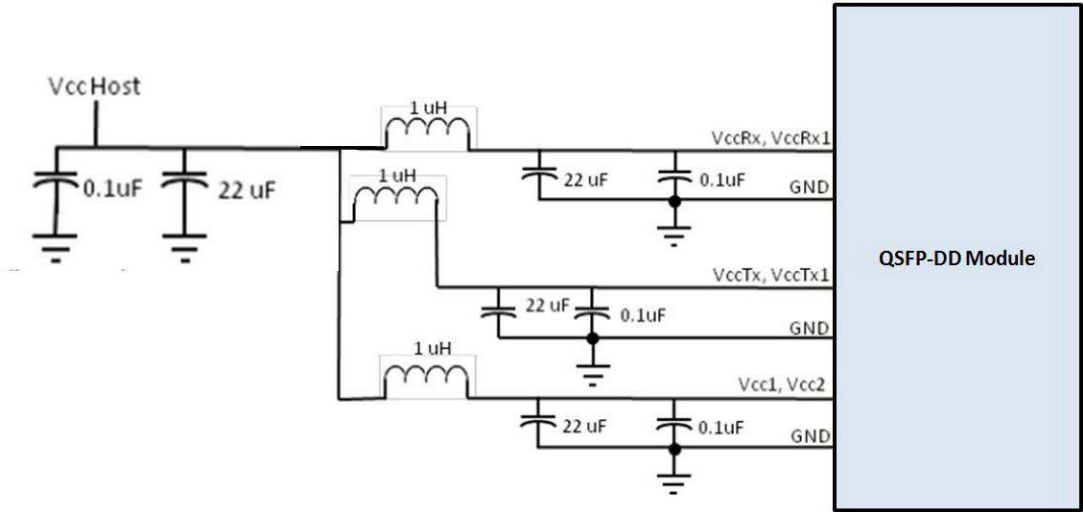
Pin Descriptions

Pin	Logic	Symbol	Name/Descriptions	Plug Sequence
1		GND	Module Ground.	1B
2	CML-I	Tx2-	Transmitter Inverted Data Input.	3B
3	CML-I	Tx2+	Transmitter Non-Inverted Data Input.	3B
4		GND	Module Ground.	1B
5	CML-I	Tx4-	Transmitter Inverted Data Input.	3B
6	CML-I	Tx4+	Transmitter Non-Inverted Data Input.	3B
7		GND	Module Ground.	1B
8	LVTTL-I	ModSelL	Module Select.	3B
9	LVTTL-I	ResetL	Module Reset.	3B
10		VccRx	+3.3V Power Supply Receiver.	2B
11	LVCMOS-I/O	SCL	2-Wire serial Interface Clock.	3B
12	LVCMOS-I/O	SDA	2-wire serial Interface Data.	3B
13		GND	Module Ground.	1B
14	CML-O	Rx3+	Receiver Non-Inverted Data Output.	3B
15	CML-O	Rx3-	Receiver Inverted Data Output.	3B
16	GND	Ground	Module Ground.	
17	CML-O	Rx1+	Receiver Non-Inverted Data Output.	3B
18	CML-O	Rx1-	Receiver Inverted Data Output.	3B
19		GND	Module Ground.	1B
20		GND	Module Ground.	1B
21	CML-O	Rx2-	Receiver Inverted Data Output.	3B
22	CML-O	Rx2+	Receiver Non-Inverted Data Output.	3B
23		GND	Module Ground.	1B
24	CML-O	Rx4-	Receiver Inverted Data Output.	3B
25	CML-O	Rx4+	Receiver Non-Inverted Data Output.	3B
26		GND	Module Ground.	1B
27	LVTTL-O	ModPrsL	Module Present.	3B
28	LVTTL-O	IntL	Interrupt.	3B
29		VccTx	+3.3V Power Supply Transmitter.	2B
30		Vcc1	+3.3V Power Supply.	2B
31	LVTTL-I	InitMode	Initialization Mode. In legacy QSFP applications, the "InitMode" pad is called LPMODE.	3B
32		GND	Module Ground.	1B
33	CML-I	Tx3+	Transmitter Non-Inverted Data Input.	3B
34	CML-I	Tx3-	Transmitter Inverted Data Input.	3B
35		GND	Module Ground.	1B
36	CML-I	Tx1+	Transmitter Non-Inverted Data Input.	3B
37	CML-I	Tx1-	Transmitter Inverted Data Input.	3B
38		GND	Module Ground.	1B
39		GND	Module Ground.	1A
40	CML-I	Tx6-	Transmitter Inverted Data Input.	3A

41	CML-I	Tx6+	Transmitter Non-Inverted Data Input.	3A
42		GND	Module Ground.	1A
43	CML-I	Tx8-	Transmitter Inverted Data Input.	3A
44	CML-I	Tx8+	Transmitter Non-Inverted Data Input.	3A
45		GND	Module Ground.	1A
46		Reserved	For Future Use.	3A
47		VS1	Module Vendor-Specific 1.	3A
48		VccRx1	+3.3V Power Supply.	2A
49		VS2	Module Vendor-Specific 2.	3A
50		VS3	Module Vendor-Specific 3.	3A
51		GND	Module Ground.	1A
52	CML-O	Rx7+	Receiver Non-Inverted Data Output.	3A
53	CML-O	Rx7-	Receiver Inverted Data Output.	3A
54		GND	Module Ground.	1A
55	CML-O	Rx5+	Receiver Non-Inverted Data Output.	3A
56	CML-O	Rx5-	Receiver Inverted Data Output.	3A
57		GND	Module Ground.	1A
58		GND	Module Ground.	1A
59	CML-O	Rx6-	Receiver Inverted Data Output.	3A
60	CML-O	Rx6+	Receiver Non-Inverted Data Output.	3A
61		GND	Module Ground.	1A
62	CML-O	Rx8-	Receiver Inverted Data Output.	3A
63	CML-O	Rx8+	Receiver Non-Inverted Data Output.	3A
64		GND	Module Ground.	1A
65		NC	No Connected.	3A
66		Reserved	For Future Use.	3A
67		VccTx1	+3.3V Power Supply Transmitter.	2A
68		Vcc2	+3.3V Power Supply.	2A
69		Reserved	For Future Use.	3A
70		GND	Module Ground.	1A
71	CML-I	Tx7+	Transmitter Non-Inverted Data Input.	3A
72	CML-I	Tx7-	Transmitter Inverted Data Input.	3A
73		GND	Module Ground.	1A
74	CML-I	Tx5+	Transmitter Non-Inverted Data Input.	3A
75	CML-I	Tx5-	Transmitter Inverted Data Input.	3A
76		GND	Module Ground.	1A

MSA Compliant Connector

(Module Side)

			Module Card Edge (Host Side)
38	GND	76	GND
37	TX1n	75	TX5n
36	TX1p	74	TX5p
35	GND	73	GND
34	TX3n	72	TX7n
33	TX3p	71	TX7p
32	GND	70	GND
31	InitMode	69	Reserved
30	Vcc1	68	Vcc2
29	VccTx	67	VccTx1
28	IntL	66	Reserved
27	ModPrsL	65	NC
26	GND	64	GND
25	RX4p	63	RX8p
24	RX4n	62	RX8n
23	GND	61	GND
22	RX2p	60	RX6p
21	RX2n	59	RX6n
20	GND	58	GND

Top side viewed from top

↑ Legacy QSFP28 Pads

↑ Additional QSFP-DD Pads

Module Card Edge (Host Side)

			(Module Side)
GND	39	GND	1
TX6n	40	TX2n	2
TX6p	41	TX2p	3
GND	42	GND	4
TX8n	43	TX4n	5
TX8p	44	TX4p	6
GND	45	GND	7
Reserved	46	ModselL	8
VS1	47	ResetL	9
VccRx1	48	VccRx	10
VS2	49	SCL	11
VS3	50	SDA	12
GND	51	GND	13
RX7p	52	RX3p	14
RX7n	53	RX3n	15
GND	54	GND	16
RX5p	55	RX1p	17
RX5n	56	RX1n	18
GND	57	GND	19

Bottom side viewed from bottom

↑ Additional QSFP-DD Pads

↑ Legacy QSFP28 Pads

Recommended Power Supply Filter


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.

Mechanical Specifications

18.45 MAX

18.35 +0.05 -0.10

93.00

128.06

3.50

8.50 ±0.10
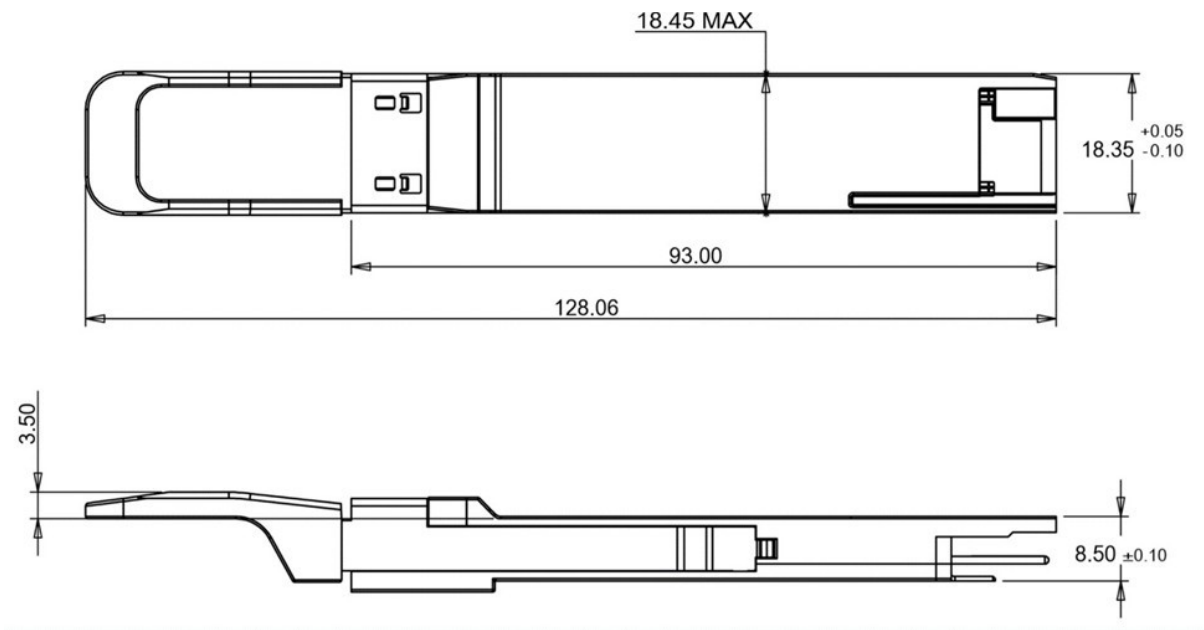
About ProLabs

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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