

## QDD4-400GB-ER4L-C-C

Cisco® Compatible TAA 400GBase-ER4L PAM4 QSFP-DD Transceiver (SMF, 1310nm, 30km, LC, DOM, CMIS 4.0)

### Features:

- Compliant to QSFP-DD MSA
- 4 Narrow LWDM Lanes, MUX/DEMUX Design
- 8x53.125Gbps Electrical Interface (400GAUI-8)
- Up to 30km Transmission on Single-Mode Fiber (SMF) with FEC
- Power Consumption: 12W
- Duplex LC Connector
- Operating Temperature: 0 to 70 Celsius
- RoHS Compliant and Lead-Free
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### Applications:

- 400GBase Ethernet
- Access and Enterprise

### Product Description

This Cisco® compatible QSFP-DD transceiver provides 400GBase-ER4L throughput up to 30km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Cisco® 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. It is built to meet or exceed the specifications of Cisco® to ensure seamless network integration. 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.")



## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate Per Lane			26.5625		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Operating Case Temperature	Tc	0		70	°C	
Storage Temperature	Tstg	-40		85	°C	
Maximum Voltage	Vcc	-0.5		3.6	V	
Relative Humidity (Non-Condensing)	RH	0		85	%	
Damage Threshold Per Lane	THd	-2.4			dBm	
Pre-FEC Bit Error Ratio				2.4x10 <sup>-4</sup>		
Post-FEC Bit Error Ratio				1x10 <sup>-12</sup>		1
Link Distance	D	0.002		30	km	2

### Notes:

1. FEC is provided by the host system.
2. Additional attenuation is required to support short distances. Ensure that the receiver input power does not exceed the overload point or damage the receiver (APD).

## Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Supply Current	Icc			3.64	A	
Power Consumption				12	W	
<b>Transmitter</b>						
Signaling Rate Per Lane	TP1	26.5625 ± 100ppm			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
<b>Receiver</b>						
Signaling Rate Per Lane	TP4	26.5625 ± 100ppm			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 (20-80%)	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 Pre-Cursor 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
<b>Transmitter</b>						
Wavelength	L0	1304.06	1304.58	1305.10	nm	
	L1	1306.33	1306.85	1307.38	nm	
	L2	1308.61	1309.14	1309.66	nm	
	L3	1310.90	1311.43	1311.96	nm	
Data Rate Per Lane		53.125 ± 100ppm			GBd	
Modulation Format		PAM4				
Side-Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	PT			11.6	dBm	
Average Launch Power Per Lane	PAVG	0		5.6	dBm	
Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ) Per Lane	TDECQ<1.4dB 1.4dB≤TDECQ≤3.9dB	POMA	3	6.4	dBm	
			1.6+TDECQ			
Difference in Launch Power Between Any Two Lanes (OMA <sub>outer</sub> )				3	dB	
Transmitter and Dispersion Eye Closure for PAM4 Per Lane	CD  <16ps/nm  CD  >16ps/nm	TDECQ		3.5	dB	
				3.9		
Transmitter Eye Closure for PAM4 Per Lane		TECQ		3.5	dB	
TDECQ-TECQ  Per Lane	CD  <16ps/nm  CD  >16ps/nm			2.3	dB	
				2.7		
Average Launch Power of Off Transmitter Per Lane		Poff		-15	dBm	

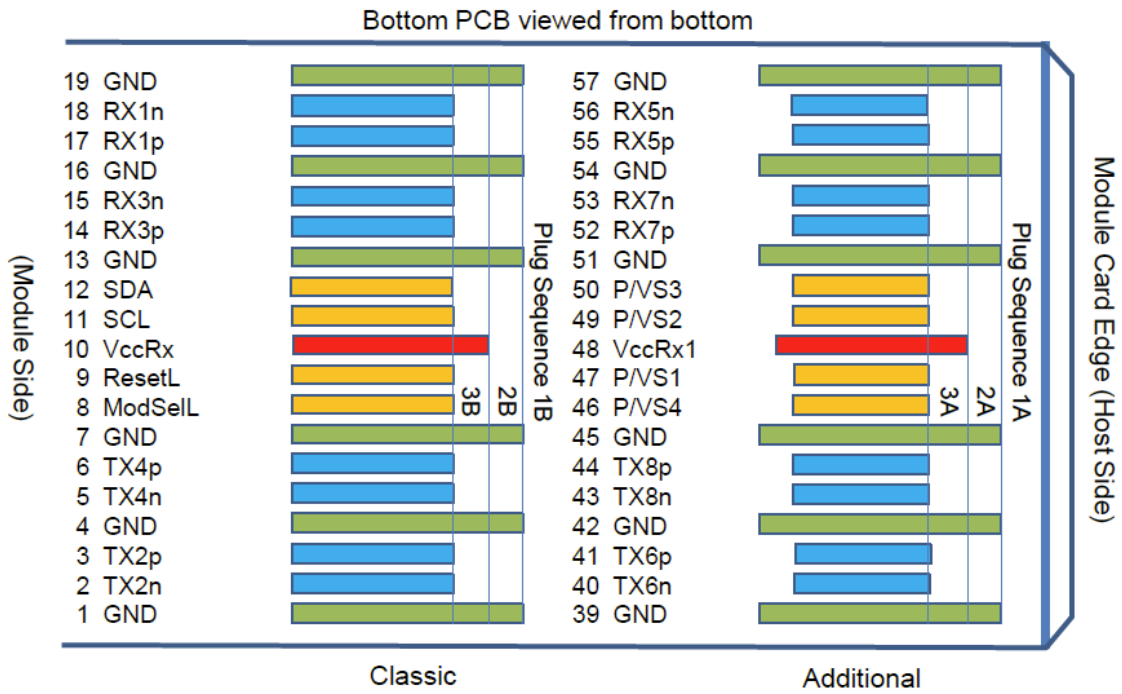
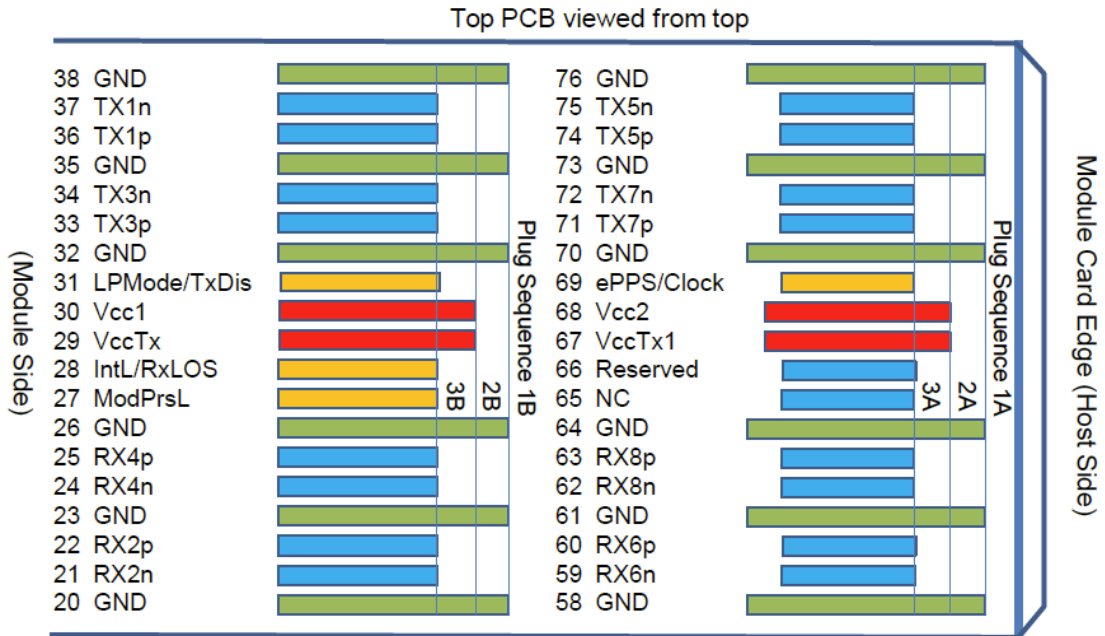
<b>Extinction Ratio</b>	ER	5				dB	
<b>Transmitter Transition Time</b>					17	ps	
<b>Transmitter Over/Under-Shoot</b>					22	%	
<b>Transmitter Power Excursion</b>					3.9	dB	
<b>RIN<sub>15</sub>OMA</b>	RIN				-136	dB/Hz	
<b>Optical Return Loss Tolerance</b>	ORLT				15	dB	
<b>Transmitter Reflectance</b>	TR				-26	dB	
<b>Receiver</b>							
<b>Wavelength</b>	L0	1304.06	1304.58	1305.10		nm	
	L1	1306.33	1306.85	1307.38		nm	
	L2	1308.61	1309.14	1309.66		nm	
	L3	1310.90	1311.43	1311.96		nm	
<b>Data Rate Per Lane</b>	53.125 ± 100ppm						GBd
<b>Modulation Format</b>	PAM4						
<b>Damage Receiver Power Per Lane</b>		-2.4				dBm	
<b>Average Receiver Power Per Lane</b>		-14.7			-3.4	dBm	
<b>Receiver Power (OMA<sub>outer</sub>) Per Lane</b>					-2.6	dBm	
<b>Difference in Receiving Power Between Any Two Lanes (OMA<sub>outer</sub>)</b>					3.6	dB	
<b>Receiver Reflectance</b>	RR				-26	dB	
<b>Receiver Sensitivity (OMA<sub>outer</sub>) Per Lane</b>	TDECQ<1.4dB	Sen			-12.5	dBm	
	1.4dB≤TDECQ≤3.9dB				-13.9+TECQ		
<b>Stress Receiver Sensitivity (OMA<sub>outer</sub>) Per Lane</b>					-10.0	dBm	
<b>Conditions of Stressed Receiver Sensitivity Test</b>							
<b>Stressed Eye Closure for PAM4 (SECQ) Per Lane Under Test</b>			3.9			dB	
<b>OMA<sub>outer</sub> of Each Aggressor Lane</b>			-6.4			dBm	

## Pin Descriptions

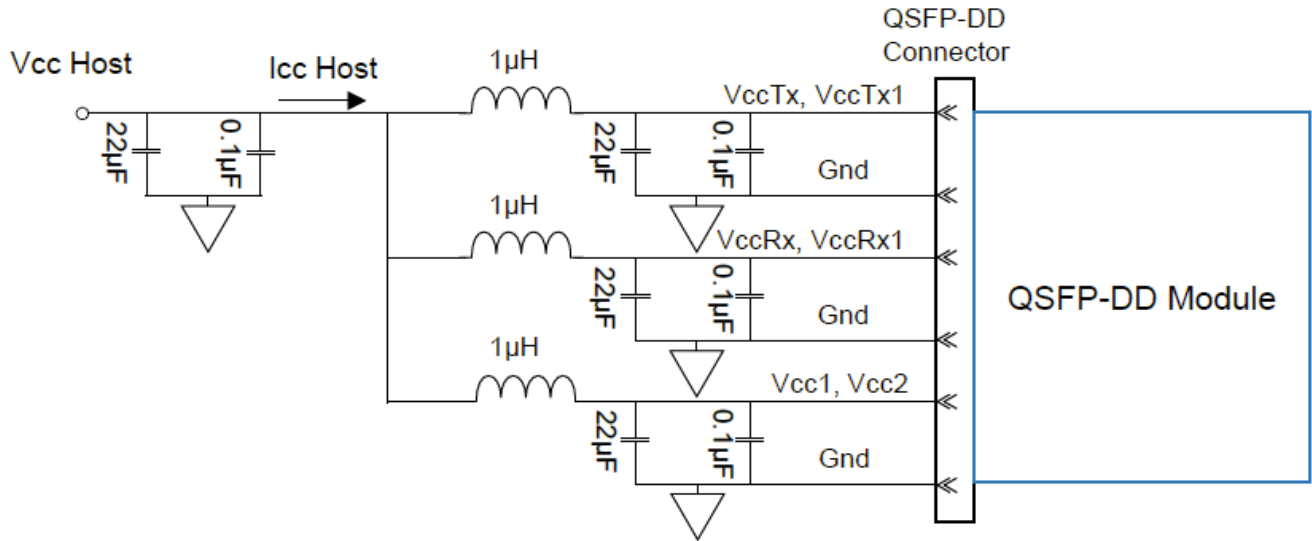
Pin	Logic	Symbol	Name/Description	Plug Seq.
1		GND	Module Ground.	1B
2	CML-I	Tx2-	Transmitter Inverted Data Input.	3B
3	CML-I	Tx2+	Transmitter Non-Inverted Data Input.	3B
4		GND	Module Ground.	1B
5	CML-I	Tx4-	Transmitter Inverted Data Input.	3B
6	CML-I	Tx4+	Transmitter Non-Inverted Data Input.	3B
7		GND	Module Ground.	1B
8	LVTTL-I	ModSelL	Module Select.	3B
9	LVTTL-I	ResetL	Module Reset.	3B
10		VccRx	+3.3V Receiver Power Supply.	2B
11	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock.	3B
12	LVC MOS-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	Module Ground.	1B
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 Transmitter Power Supply.	2B
30		Vcc1	+3.3V Power Supply.	2B
31	LVTTL-I	InitMode	Initialization Mode. In legacy QSFP applications, 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 Receiver 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	Not Connected.	3A
66		Reserved	For Future Use.	3A
67		VccTx1	+3.3V Transmitter Power Supply.	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

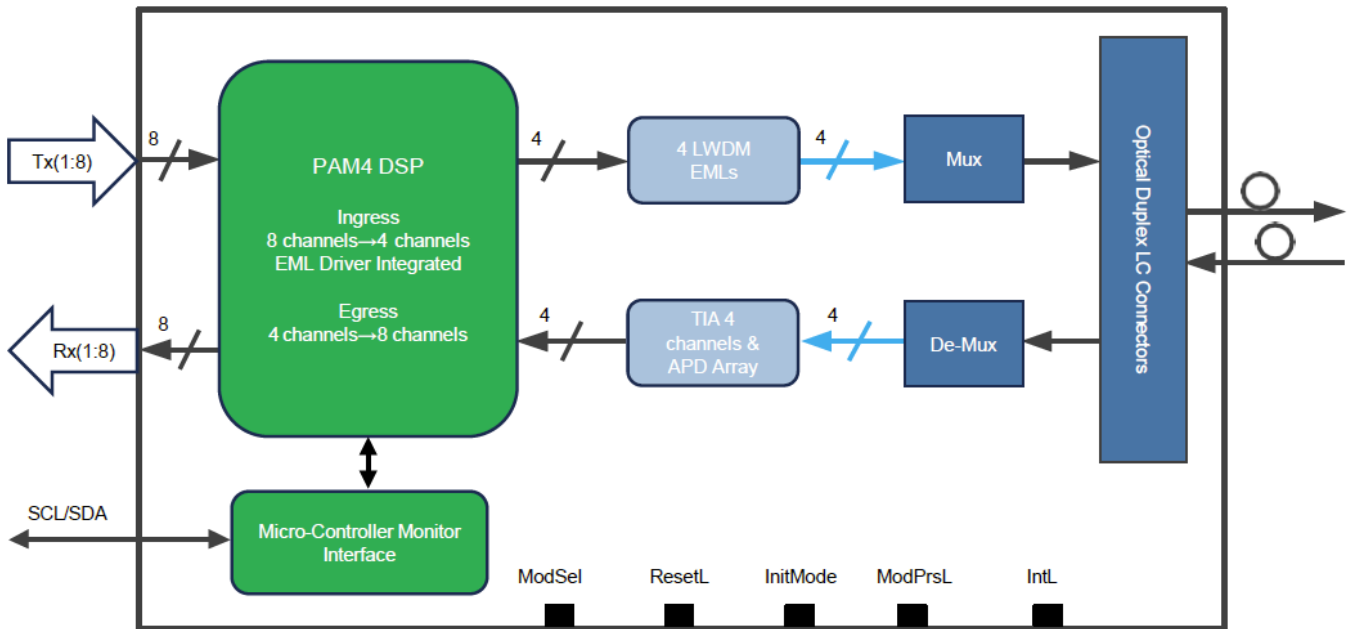
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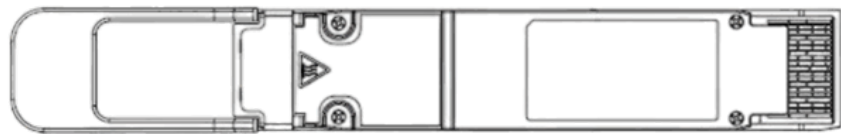
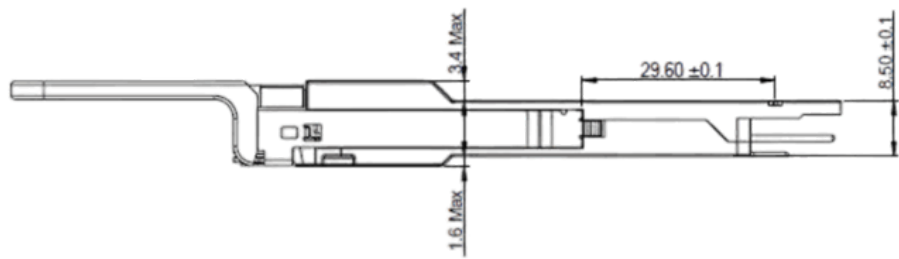
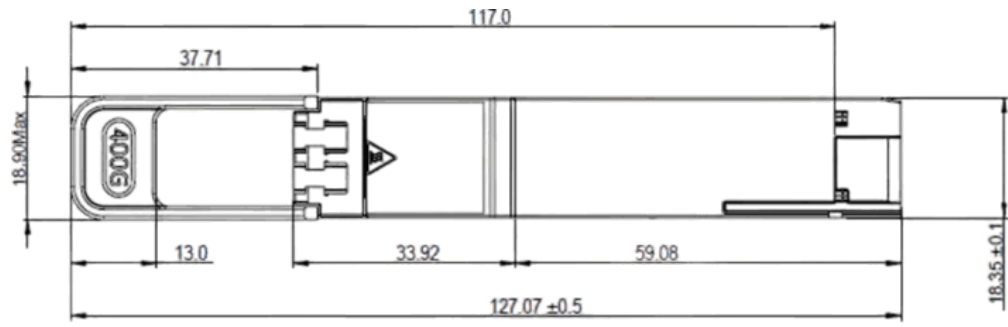
### Recommended Power Supply Filter



### Block Diagram of Transceiver



# Mechanical Specifications



## About ProLabs

Our extensive experience comes as standard. For over 20 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 more than 100 optical switching and transport platforms.

## A 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 1.6T 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.

## The Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure compatible products, and immediate answers to your questions. 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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