

#### 1445500F1C-C

ADTRAN® 1445500F1C Compatible TAA Compliant 40GBase-SR4 QSFP+ Transceiver (MMF, 850nm, 100m, MPO, DOM)

## **Features:**

- SFF-8436 Compliance
- MPO Connector
- Multi-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



## **Applications:**

- 40GBase Ethernet
- Access and Enterprise

### **Product Description**

This ADTRAN® 1445500F1C compatible QSFP+ transceiver provides 40GBase-SR4 throughput up to 100m over multi-mode fiber (MMF) using a wavelength of 850nm via an MPO connector. It is guaranteed to be 100% compatible with the equivalent ADTRAN® 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' 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.	Тур.	Max.	Unit
Supply Voltage	Vcc	-0.5		4.0	V
Storage Temperature	Tstg	-40		85	°C
Operating Case Temperature	Тс	0	25	70	°C
Relative Humidity	RH	5		95	%
Data Rate Per Channel			10.3125		Gbps

# **Electrical Characteristics**

Parameter	Symbol	Min.	Тур.	Max.	Unit	Notes	
Supply Voltage	Vcc	3.135	3.3	3.465	V		
Module Supply Current	Icc			430	mA		
Power Dissipation	P <sub>DISS</sub>			1.5	W		
Transmitter							
Input Differential Impedance	ZIN		100		Ω		
Differential Data Input Swing	VIN,pp	180		900	mVp-p		
Receiver							
Output Differential Impedance	ZOUT		100		Ω		
Differential Data Output Swing	VOUT,pp	300		850	mVp-p	1	
Data Output Rise Time/Fall Time	Tr/Tf	28			ps	2	

## Notes:

- 1. Internally AC coupled but requires an external  $100\Omega$  differential load termination.
- 2. 20 80 %.

# **Optical Characteristics**

Parameter	Symbol	Min.	Тур.	Max.	Unit	Notes	
Transmitter							
Launch Optical Power	Po	-7.6		+2.4	dBm	1	
Center Wavelength Range	λC	830	850	860	nm		
Extinction Ratio	ER	3			dB	2	
Spectral Width (RMS)	Δλ			0.65	nm		
Transmitter and Dispersion Penalty	TDP			3.2	dB		
Optical Return Loss Tolerance	ORLT			12	dB		
Eye Diagram	IEEE Std 802.3ba Compatible						
Receiver							
Center Wavelength	λC	830	850	860	nm		
Receiver Sensitivity (Pavg)	S			-9.5	dBm	3	
Damage Threshold	P <sub>OL</sub>	2.5			dBm	3	
Optical Return Loss	ORL	12			dB		
LOS Assert	LOSA	-30			dBm		
LOS De-Assert	LOSD			-11	dBm		
LOS Hysteresis		0.5			dB		

## Notes:

- 1. The optical power is launched into OM3 MMF.
- 2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps.
- 3. Measured with PRBS  $2^{31}$ -1 test pattern, 10.3125Gbps, and BER<10<sup>-12</sup>.

**Pin Descriptions** 

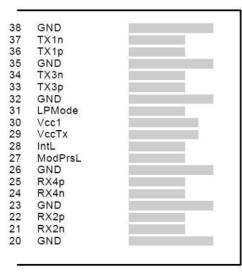
Notes   Notes   Notes   Name		scriptions					
CML-I   Tx2-	Pin	Logic	Symbol	Name/Descriptions			
CML-I   Tx2+	1		GND	Module Ground.			
4         GND         Module Ground.         1           5         CML-I         Tx4-         Transmitter Inverted Data Input.           6         CML-I         Tx4+         Transmitter Non-Inverted Data Input.           7         GND         Module Ground.         1           8         LVTTL-I         ModSelL         Module Select.         2           9         LVTTL-I         ResetL         Module Reset.         2           10         VCCRX         +3.3V Receiver Power Supply.         2           11         LVCMOS-II         SCL         -2-Wire Serial Interface Clock.         2           12         LVCMOS-I/O         SDA         2-Wire Serial Interface Data.         2           13         GND         Module Ground.         1           14         CML-O         Rx3+         Receiver Non-Inverted Data Output.           15         CML-O         Rx3-         Receiver Inverted Data Output.           16         GND         Module Ground.         1           17         CML-O         Rx1+         Receiver Inverted Data Output.         1           19         GND         Module Ground.         1         1           20         GND         Module Gr	2	CML-I	Tx2-	Transmitter Inverted Data Input.			
5         CML-I         Tx4-         Transmitter Inverted Data Input.           6         CML-I         Tx4+         Transmitter Non-Inverted Data Input.           7         GND         Module Ground.         1           8         LVTTL-I         ModSell.         Module Reset.         2           9         LVTTL-I         Resett.         Module Reset.         2           10         VCxRx         +3.3V Receiver Power Supply.         2           11         LVCMOS-I         SCL         2-Wire Serial Interface Clock.         2           12         LVCMOS-I/O         SDA         2-Wire Serial Interface Data.         2           13         GND         Module Ground.         1           14         CML-O         Rx3+         Receiver Inverted Data Output.           15         CML-O         Rx3-         Receiver Inverted Data Output.           16         GND         Module Ground.         1           17         CML-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Outp	3	CML-I	Tx2+	Transmitter Non-Inverted Data Input.			
6 CML-I Tx4+ Transmitter Non-Inverted Data Input. 7 SND Module Ground. 1 8 LYTIL-I ModSell Module Select. 2 9 LYTIL-I ResetL Module Reset. 2 10 VccRx +3.3V Receiver Power Supply. 2 11 LVCMOS-I SCL 2-Wire Serial Interface Clock. 2 12 LVCMOS-I/O SDA 2-Wire Serial Interface Data. 2 13 GND Module Ground. 1 14 CML-O Rx3+ Receiver Non-Inverted Data Output. 1 15 CML-O Rx3- Receiver Inverted Data Output. 1 16 GND Module Ground. 1 17 CML-O Rx1+ Receiver Non-Inverted Data Output. 1 18 CML-O Rx1- Receiver Inverted Data Output. 1 19 GND Module Ground. 1 20 GND Module Ground. 1 21 CML-O Rx2- Receiver Inverted Data Output. 1 22 CML-O Rx2- Receiver Inverted Data Output. 1 23 GND Module Ground. 1 24 CML-O Rx4- Receiver Inverted Data Output. 1 25 CML-O Rx4- Receiver Inverted Data Output. 1 26 GND Module Ground. 1 27 LYTIL-O ModPrst Receiver Non-Inverted Data Output. 1 28 LVTIL-O Rx4- Receiver Inverted Data Output. 1 29 VccTx +3.3V Transmitter Power Supply. 1 30 Vcc1 +3.3V Power Supply. 1 31 LVTIL-I LPMode Low-Power Mode. 2 32 GND Module Ground. 2 33 CML-I Tx3+ Transmitter Power Supply. 1	4		GND	Module Ground.	1		
7         GND         Module Ground.         1           8         LVTTL-I         ModSelL         Module Select.         2           9         LVTTL-I         Resett.         Module Reset.         2           10         VCCRX         +3.3V Receiver Power Supply.         2           11         LVCMOS-I         SCL         2-Wire Serial Interface Clock.         2           12         LVCMOS-I/O         SDA         2-Wire Serial Interface Data.         2           13         GND         Module Ground.         1           14         CML-O         Rx3+         Receiver Non-Inverted Data Output.           15         CML-O         Rx3-         Receiver Inverted Data Output.           16         GND         Module Ground.         1           17         CML-O         Rx1+         Receiver Inverted Data Output.         1           18         CML-O         Rx1-         Receiver Inverted Data Output.         1           19         GND         Module Ground.         1         1           20         GND         Module Ground.         1         1           21         CML-O         Rx2+         Receiver Non-Inverted Data Output.         1	5	CML-I	Tx4-	Transmitter Inverted Data Input.			
8         LVTTL-I         ModSelL         Module Select.         2           9         LVTTL-I         Resett         Module Reset.         2           10         VCcRX         +3.3V Receiver Power Supply.         2           11         LVCMOS-I         SCL         2-Wire Serial Interface Clock.         2           12         LVCMOS-I/O         SDA         2-Wire Serial Interface Data.         2           13         GND         Module Ground.         1           14         CML-O         Rx3+         Receiver Non-Inverted Data Output.         1           15         CML-O         Rx3-         Receiver Inverted Data Output.         1           16         GND         Module Ground.         1           17         CML-O         Rx1+         Receiver Inverted Data Output.         1           19         GND         Module Ground.         1         1           20         GND         Module Ground.         1         1           21         CML-O         Rx2-         Receiver Inverted Data Output.         1           22         CML-O         Rx4+         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receive	6	CML-I	Tx4+	Transmitter Non-Inverted Data Input.			
10	7		GND	Module Ground.	1		
10	8	LVTTL-I	ModSelL	Module Select.	2		
11	9	LVTTL-I	ResetL	Module Reset.	2		
12	10		VccRx	+3.3V Receiver Power Supply.			
1	11	LVCMOS-I	SCL	2-Wire Serial Interface Clock.	2		
14         CMI-O         Rx3+         Receiver Non-Inverted Data Output.           15         CMI-O         Rx3-         Receiver Inverted Data Output.           16         GND         Module Ground.         1           17         CMI-O         Rx1+         Receiver Non-Inverted Data Output.           18         CMI-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CMI-O         Rx2-         Receiver Inverted Data Output.         1           22         CMI-O         Rx2+         Receiver Non-Inverted Data Output.         1           23         GND         Module Ground.         1           24         CMI-O         Rx4-         Receiver Inverted Data Output.         1           25         CMI-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTIL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         Inttl.         Interrupt Output. Should be pulled up on the host board.         2 <tr< th=""><td>12</td><td>LVCMOS-I/O</td><td>SDA</td><td>2-Wire Serial Interface Data.</td><td>2</td></tr<>	12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data.	2		
15         CML-O         Rx3-         Receiver Inverted Data Output.         1           16         GND         Module Ground.         1           17         CML-O         Rx1+         Receiver Non-Inverted Data Output.           18         CML-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTIL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         Intl.         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.           30         VccTx	13		GND	Module Ground.	1		
16         GND         Module Ground.         1           17         CML-O         Rx1+         Receiver Non-Inverted Data Output.           18         CML-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.         2           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.         1           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTIL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTIL-O         Intl.         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.         2           30         Vcc1         +3.3V Power Supply.         2           31	14	CML-O	Rx3+	Receiver Non-Inverted Data Output.			
17         CML-O         Rx1+         Receiver Non-Inverted Data Output.           18         CML-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTTL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         IntL         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.           30         VccT         +3.3V Power Supply.           31         LVTIL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.<	15	CML-O	Rx3-	Receiver Inverted Data Output.			
18         CML-O         Rx1-         Receiver Inverted Data Output.           19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.            22         CML-O         Rx2+         Receiver Non-Inverted Data Output.         1           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTTL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         IntL         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.         30           30         Vcc1         +3.3V Power Supply.         2           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33	16		GND	Module Ground.	1		
19         GND         Module Ground.         1           20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTTL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         IntL         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.         2           30         Vcc1         +3.3V Power Supply.         2           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33         CML-I         Tx3+         Transmitter Non-Inverted Data Input.	17	CML-O	Rx1+	Receiver Non-Inverted Data Output.			
20         GND         Module Ground.         1           21         CML-O         Rx2-         Receiver Inverted Data Output.           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.         1           26         GND         Module Ground.         1           27         LVTTL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         IntL         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.         2           30         Vcc1         +3.3V Power Supply.         3           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33         CML-I         Tx3+         Transmitter Non-Inverted Data Input.	18	CML-O	Rx1-	Receiver Inverted Data Output.			
21         CML-O         Rx2-         Receiver Inverted Data Output.           22         CML-O         Rx2+         Receiver Non-Inverted Data Output.           23         GND         Module Ground.         1           24         CML-O         Rx4-         Receiver Inverted Data Output.         1           25         CML-O         Rx4+         Receiver Non-Inverted Data Output.           26         GND         Module Ground.         1           27         LVTTL-O         ModPrsL         Module Present. Internally pulled down to GND.           28         LVTTL-O         IntL         Interrupt Output. Should be pulled up on the host board.         2           29         VccTx         +3.3V Transmitter Power Supply.           30         Vcc1         +3.3V Power Supply.           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33         CML-I         Tx3+         Transmitter Non-Inverted Data Input.	19		GND	Module Ground.	1		
22CML-ORx2+Receiver Non-Inverted Data Output.23GNDModule Ground.124CML-ORx4-Receiver Inverted Data Output.125CML-ORx4+Receiver Non-Inverted Data Output.126GNDModule Ground.127LVTTL-OModPrsLModule Present. Internally pulled down to GND.28LVTTL-OIntLInterrupt Output. Should be pulled up on the host board.229VccTx+3.3V Transmitter Power Supply.30Vcc1+3.3V Power Supply.31LVTTL-ILPModeLow-Power Mode.232GNDModule Ground.133CML-ITx3+Transmitter Non-Inverted Data Input.	20		GND	Module Ground.			
GND Module Ground. 1  24 CML-O Rx4- Receiver Inverted Data Output. 1  25 CML-O Rx4+ Receiver Non-Inverted Data Output. 1  26 GND Module Ground. 1  27 LVTTL-O ModPrsL Module Present. Internally pulled down to GND. 1  28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board. 2  29 VccTx +3.3V Transmitter Power Supply. 1  30 Vcc1 +3.3V Power Supply. 1  31 LVTTL-I LPMode Low-Power Mode. 2  32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	21	CML-O	Rx2-	Receiver Inverted Data Output.			
24 CML-O Rx4- Receiver Inverted Data Output. 1  25 CML-O Rx4+ Receiver Non-Inverted Data Output. 1  26 GND Module Ground. 1  27 LVTTL-O ModPrsL Module Present. Internally pulled down to GND. 1  28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board. 2  29 VccTx +3.3V Transmitter Power Supply. 1  30 Vcc1 +3.3V Power Supply. 1  31 LVTTL-I LPMode Low-Power Mode. 2  32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	22	CML-O	Rx2+	Receiver Non-Inverted Data Output.			
25 CML-O Rx4+ Receiver Non-Inverted Data Output.  26 GND Module Ground.  27 LVTTL-O ModPrsL Module Present. Internally pulled down to GND.  28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board.  29 VccTx +3.3V Transmitter Power Supply.  30 Vcc1 +3.3V Power Supply.  31 LVTTL-I LPMode Low-Power Mode.  2 GND Module Ground.  32 GND Module Ground.  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	23		GND	Module Ground.			
26 GND Module Ground. 1  27 LVTTL-O ModPrsL Module Present. Internally pulled down to GND.  28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board. 2  29 VccTx +3.3V Transmitter Power Supply.  30 Vcc1 +3.3V Power Supply.  31 LVTTL-I LPMode Low-Power Mode. 2  32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	24	CML-O	Rx4-	Receiver Inverted Data Output.			
27 LVTTL-O ModPrsL Module Present. Internally pulled down to GND.  28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board.  29 VccTx +3.3V Transmitter Power Supply.  30 Vcc1 +3.3V Power Supply.  31 LVTTL-I LPMode Low-Power Mode.  2 GND Module Ground.  32 GNL-I Tx3+ Transmitter Non-Inverted Data Input.	25	CML-O	Rx4+	Receiver Non-Inverted Data Output.			
28 LVTTL-O IntL Interrupt Output. Should be pulled up on the host board. 2  29 VccTx +3.3V Transmitter Power Supply.  30 Vcc1 +3.3V Power Supply.  31 LVTTL-I LPMode Low-Power Mode. 2  32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	26		GND	Module Ground.			
29         VccTx         +3.3V Transmitter Power Supply.           30         Vcc1         +3.3V Power Supply.           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33         CML-I         Tx3+         Transmitter Non-Inverted Data Input.	27	LVTTL-O	ModPrsL	Module Present. Internally pulled down to GND.			
30         Vcc1         +3.3V Power Supply.           31         LVTTL-I         LPMode         Low-Power Mode.         2           32         GND         Module Ground.         1           33         CML-I         Tx3+         Transmitter Non-Inverted Data Input.	28	LVTTL-O	IntL	Interrupt Output. Should be pulled up on the host board.			
31 LVTTL-I LPMode Low-Power Mode. 2  32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	29		VccTx	+3.3V Transmitter Power Supply.			
32 GND Module Ground. 1  33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	30		Vcc1	+3.3V Power Supply.			
33 CML-I Tx3+ Transmitter Non-Inverted Data Input.	31	LVTTL-I	LPMode	Low-Power Mode.			
· ·	32		GND	Module Ground.			
34 CML-I Tx3- Transmitter Inverted Data Input.	33	CML-I	Tx3+	Transmitter Non-Inverted Data Input.			
	34	CML-I	Tx3-	Transmitter Inverted Data Input.			

35		GND	Module Ground.	1
36	CML-I	Tx1+	Transmitter Non-Inverted Data Input.	
37	CML-I	Tx1-	Transmitter Inverted Data Input.	
38		GND	Module Ground.	1

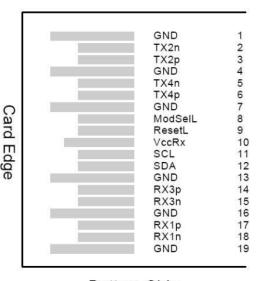
### Notes:

- 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  $4.7k\Omega$ - $10k\Omega$  pull-up resistor to the Host\_Vcc.

## **Electrical Pin-Out Details**

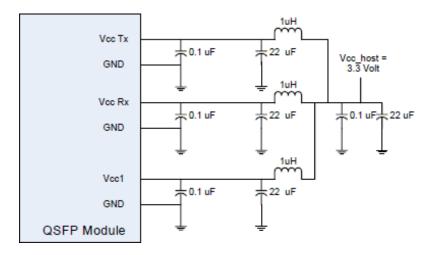


Top Side Viewed from Top

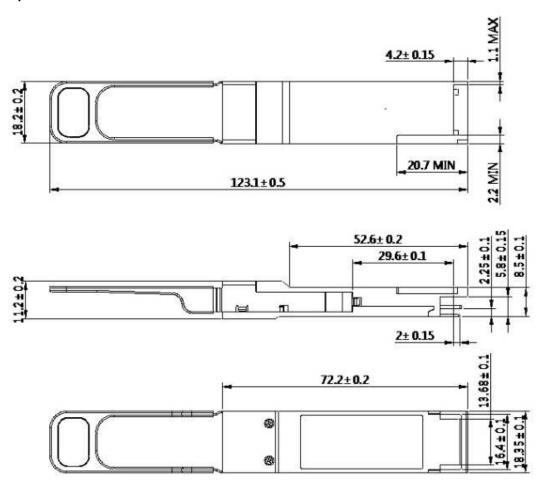


Bottom Side Viewed from Bottom

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



# **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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