

## X2-LR-PRO

MSA and TAA Compliant 10GBase-LR X2 Transceiver (SMF, 1310nm, 10km, DOM, 0 to 70C, SC)

### Features

- X2 MSA 2.0 Compliance
- Duplex SC Connector
- Commercial Temperature 0 to 70 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



### Applications:

- 10GBase-LR Ethernet
- 8x/10x Fibre Channel
- Access, Datacenter and Enterprise
- Mobile Fronthaul CPRI/OBSAI

### Product Description

This MSA Compliant X2 transceiver provides 10GBase-LR throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1310nm via a SC 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.

Proline'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.



### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Storage Ambient Temperature	T <sub>S</sub>	-40		85	°C
Supply Voltage (5V)	V <sub>S</sub>	0		6	V
Supply Voltage (3.3V)	V <sub>3</sub>	0		4	V
Supply Voltage (APS)	V <sub>APS</sub>	0		1.5	V
Optical Receiver Input	P <sub>IMAX</sub>			1.5	dBm

### General Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit
Data Rate	DR		10.3125		GBd
Bit Error Rate	BER			10 <sup>-12</sup>	
Total Power Consumption	P			3	W
Supply Voltage (5V)	V <sub>CC5</sub>	4.75	5	5.25	V
Supply Voltage (+3.3V)	V <sub>CC3</sub>	3.14	3.3	3.47	V
Supply Voltage (APS)	V <sub>CCAPS</sub>	1.152	1.2	1.248	V
Supply Current (5V)	I <sub>CC5</sub>			100	mA
Supply Current (+3.3V)	I <sub>CC3</sub>			300	mA
Supply Current (APS)	I <sub>CCAPS</sub>			1000	mA
Case Operating Temperature	T <sub>C</sub>	0		70	°C

### Link Distance

Parameter	Fiber Type	Distance Range (km)
10.3 GBd	9/125μm SMF	10

## Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Optical Wavelength	$\lambda$	1290		1330	nm	
Launch Power	$P_{OUT}$	-8.2		0.5	dBm	
Launch Power in OMA minus TDP	$P_{OUT\_OMA}$	-5.2			dBm	
Launch Power of OFF Transmitter	$P_{OUT\_OFF}$			-30	dBm	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20dB)	$\Delta \lambda$			0.6	nm	
Optical Extinction Ratio	ER	3.5			dB	
Optical Modulation amplitude	OMA	-5.2			dBm	
Optical Return Loss Tolerance	$ORL_T$			12	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Dispersion Penalty	TDP			3.2	dB	
Transmitter Reflectance	$TR_{TX}$			-12	dB	
Eye Mask Definition		According to IEEE 802.3ae				
<b>Receiver</b>						
Center Wavelength Range	$\lambda_c$	1260		1600	nm	
Optical Input Power	$P_{IN}$	-14.4		0.5	dBm	
Receiver Sensitivity in OMA	$P_{IN\_OMA}$			-12.6	dBm	
Stressed Receiver Sensitivity	$P_{IN\_S}$			-10.3	dBm	
Receiver Reflectance	$TR_{RX}$			-12	dB	
Loss of Signal Assert Level	$P_{LOS\_A}$	-25			dBm	
Loss of Signal De-assert Level	$P_{LOS\_D}$			-16	dBm	
Loss of Signal Hysteresis	$P_{LOS\_H}$	1			dBm	
Receiver electrical 3dB upper cutoff frequency	FR			12.3	GHz	

## Electrical Characteristics - DC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>A. 1.2V COMS I/O DC Characteristics (PRTAD; LASI; RESET; TX_ON/OFF)</b>						
External Pull-Up Resistor for Open Drain	$R_{PU}$	10		22	$K\Omega$	
Output High Voltage	$V_{OH}$	1			V	
Output Low Voltage	$V_{OL}$			0.15	V	
Input High Voltage	$V_{IH}$	0.84		1.2	V	
Input Low Voltage	$V_{IL}$			0.36	V	
Input Pull-Down Current	IPD	20	120	120	$\mu A$	$V_{IN}=1.2V$
<b>B. XAUI I/O DC Characteristics (TXLAN[0..3]; RXLANE[0..3])</b>						
Differential Input Amplitude (pk-pk)	$V_{IN\_XAUI}$	200		2500	mV	AC Coupled
Differential output Amplitude (pk-pk)	$V_{OUT\_XAUI}$	800		1600	mV	AC Coupled
<b>C. MDIO I/O DC Characteristics (MDIO; MDC)</b>						
Output Low Voltage	$V_{OL}$			0.2	V	$I_{OL} = 100\mu A$
Output Low Current	$I_{OL}$			4	mA	
Input High Voltage	$V_{IH}$	0.84		1.2	V	
Input Low Voltage	$V_{IL}$			0.36	V	
Pull-Up Supply Voltage	$V_{PU}$	1.152	1.2	1.248	V	
Input Capacitance	$C_{IN}$			10	pF	
Load Capacitance	$C_{LOAD}$			470	pF	
External Pull-Up Resistance	RPU	200			$\Omega$	

## Electrical Characteristics - AC

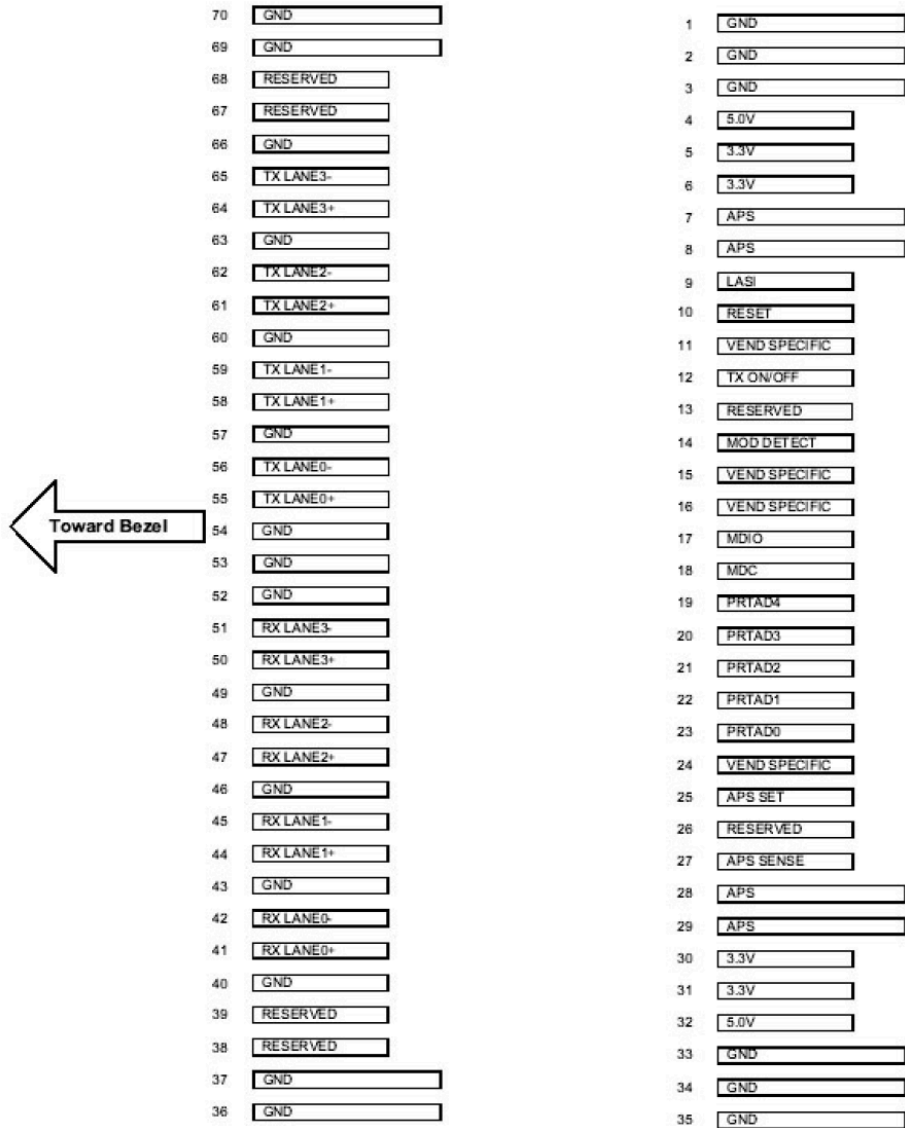
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes	
<b>A. XAUI Input AC Characteristics (TXLANE[0..3])</b>							
Baud Rate	BR <sub>XAUI_IN</sub>		3.125		GBd		
Baud Rate Tolerance	BR <sub>TOL_XAUI</sub>	-100		100	ppm		
Differential Input Impedance	Z <sub>IN_XAUI</sub>	80	100	120	Ω		
Differential Return Loss	RL <sub>IN</sub>	10			dB	100MHz to 2.5 GHz	
Input Differential Skew	T <sub>IN_SKEW</sub>			75	ps	Crossing Point	
Jitter Amplitude Tolerance	J <sub>XAUI_TOL</sub>			0.65	UI <sub>pp</sub>	IEEE 802.3ae	
<b>B. XAUI Output AC Characteristics (RXLANE[0..3])</b>							
Baud Rate	BR <sub>XAUI_OUT</sub>		3.125		GBd		
Baud Rate Variation	BR <sub>XAUI_VAR</sub>	-100		100	ppm		
XAUI Eye Mask (far-end)		According to IEEE 802.3ae					
Output Differential Skew	T <sub>OUT_SKEW</sub>			15	ps		
Output Differential Impedance	Z <sub>OUT_XAUI</sub>	80	100	120	Ω		
Differential Output Return Loss	RL <sub>OUT</sub>	10			dB	100 MHz to 2.5 GHz	
Total Jitter	TJ <sub>XAUI</sub>			0.35	UI	Near-end No pre-equalization 1 UI=320 ps	
Deterministic Jitter	DJ <sub>XAUI</sub>			0.17	UI		
<b>C. Power-On Reset Characteristics</b>							
Power-On Reset and TX_ONOFF Characteristics		According to X2 MSA Issue					
<b>D. MDIO I/O AC Characteristics (MDIO; MDC)</b>							
MDIO Data Hold Time	T <sub>HOLD</sub>	10			ns		
MDIO Data Setup Time	T <sub>SU</sub>	10			ns		
Delay from MDC Rising Edge to MDIO Data Change	T <sub>DELAY</sub>			300	ns		
MDC Clock Rate	f <sub>MAX</sub>			2.5	MHz		

## Pin Descriptions

Pin#	Symbol	I/O	Logic	Description	Pin#
1	GND	I	Supply	Electrical ground	1
2	GND	I	Supply	Electrical ground	2
3	GND	I	Supply	Electrical ground	3
4	5.0V	I	Supply	Power	4
5	3.3V	I	Supply	Power	5
6	3.3V	I	Supply	Power	6
7	APS	I	Supply	Adaptive Power Supply	7
8	APS	I	Supply	Adaptive Power Supply	8
9	LASI	O	Open Drain	Link Alarm Status Interrupt. 10-22k ohm pull up on host	9
10	REST	I	1.2V CMOS	TX OFF when MDIO RESET	10
11	VEND SPECIFIC			Vendor Specific Pin. Leave unconnected	11
12	TX ON/OFF	I	1.2V CMOS	Transmitter ON/OFF	12
13	Reserved			Reserved	13
14	MOD DETECT	O		Pulled low inside module through 1k ohm	14
15	VEND SPECIFIC			Vendor Specific Pin. Leave unconnected	15
16	VEND SPECIFIC			Vender Specific Pin. Leave unconnected	16
17	MDIO	I/O	Open Drain	Management Data IO	17
18	MDC	I	1.2V CMOS	Management data clock	18
19	PRTAD4	I	1.2V CMOS	Port Address bit 4 (Low=0)	19
20	PRTAD3	I	1.2V CMOS	Port Address bit 3 (Low=0)	20
21	PRTAD2	I	1.2V CMOS	Port Address bit 2 (Low=0)	21
22	PRTAD1	I	1.2V CMOS	Port Address bit 1 (Low=0)	22
23	PRTAD0	I	1.2V CMOS	Port Address bit 0 (Low=0)	23
24	VEND SPECIFIC			Vendor Specific Pin. Leave unconnected	24
25	APS SET	O		Feedback output for APS	25
26	RESERVED			Reserved for Avalanche Photodiode use	26
27	APS SENSE	O	Analog	APS Sense Connection	27
28	APS	I	Supply	Adaptive Power Supply	28
29	APS	I	Supply	Adaptive Power Supply	29
30	3.3V	I	Supply	Power	30
31	3.3V	I	Supply	Power	31
32	5.0V		Supply	Power	32
33	GND	I	Supply	Electrical Ground	33
34	GND	I	Supply	Electrical Ground	34

35	GND	I	Supply	Electrical Ground	35
36	GND	I	Supply	Electrical Ground	36
37	GND	I	Supply	Electrical Ground	37
38	RESERVED			Reserved	38
39	RESERVED			Reserved	39
40	GND	I	Supply	Electrical ground	40
41	RX LANE 0+	O	AC	Module XAUI Output Lane 0+	41
42	RX LANE 0-	O	AC	Module XAUI Output Lane 0-	42
43	GND	I	Supply	Electrical ground	43
44	RX LANE 1+	O	AC	Module XAUI Output Lane 1+	44
45	RX LANE 1-	O	AC	Module XAUI Output Lane 1-	45
46	GND	I	Supply	Electrical ground	46
47	RX LANE 2+	O	AC	Module XAUI Output Lane 2+	47
48	RX LANE 2-	O	AC	Module XAUI Output Lane 2-	48
49	GND	I	Supply	Electrical ground	49
50	RX LANE 3+	O	AC	Module XAUI Output Lane 3+	50
51	RX LANE 3-	O	AC	Module XAUI Output Lane 3-	51
52	GND	I	Supply	Electrical ground	52
53	GND	I	Supply	Electrical ground	53
54	GND	I	Supply	Electrical ground	54
55	TX LANE 0+	O	AC	Module XAUI Input Lane 0+	55
56	TX LANE 0-	O	AC	Module XAUI Input Lane 0-	56
57	GND	I	Supply	Electrical ground	57
58	TX LANE 1+	O	AC	Module XAUI Input Lane 1+	58
59	TX LANE 1-	O	AC	Module XAUI Input Lane 1-	59
60	GND	I	Supply	Electrical ground	60
61	TX LANE 2+	O	AC	Module XAUI Input Lane 2+	61
62	TX LANE 2-	O	AC	Module XAUI Input Lane 2-	62
63	GND	I	Supply	Electrical ground	63
64	TX LANE 3+	O	AC	Module XAUI Input Lane 3+	64
65	TX LANE 3-	O	AC	Module XAUI Input Lane 3-	65
66	GND	I	Supply	Electrical ground	66
67	RESERVED			Reserved	67
68	RESERVED			Reserved	68
69	GND	I	Supply	Electrical Ground	69
70	GND	I	Supply	Electrical Ground	70

# Electrical Pad Layout



Top of Transceiver PCB

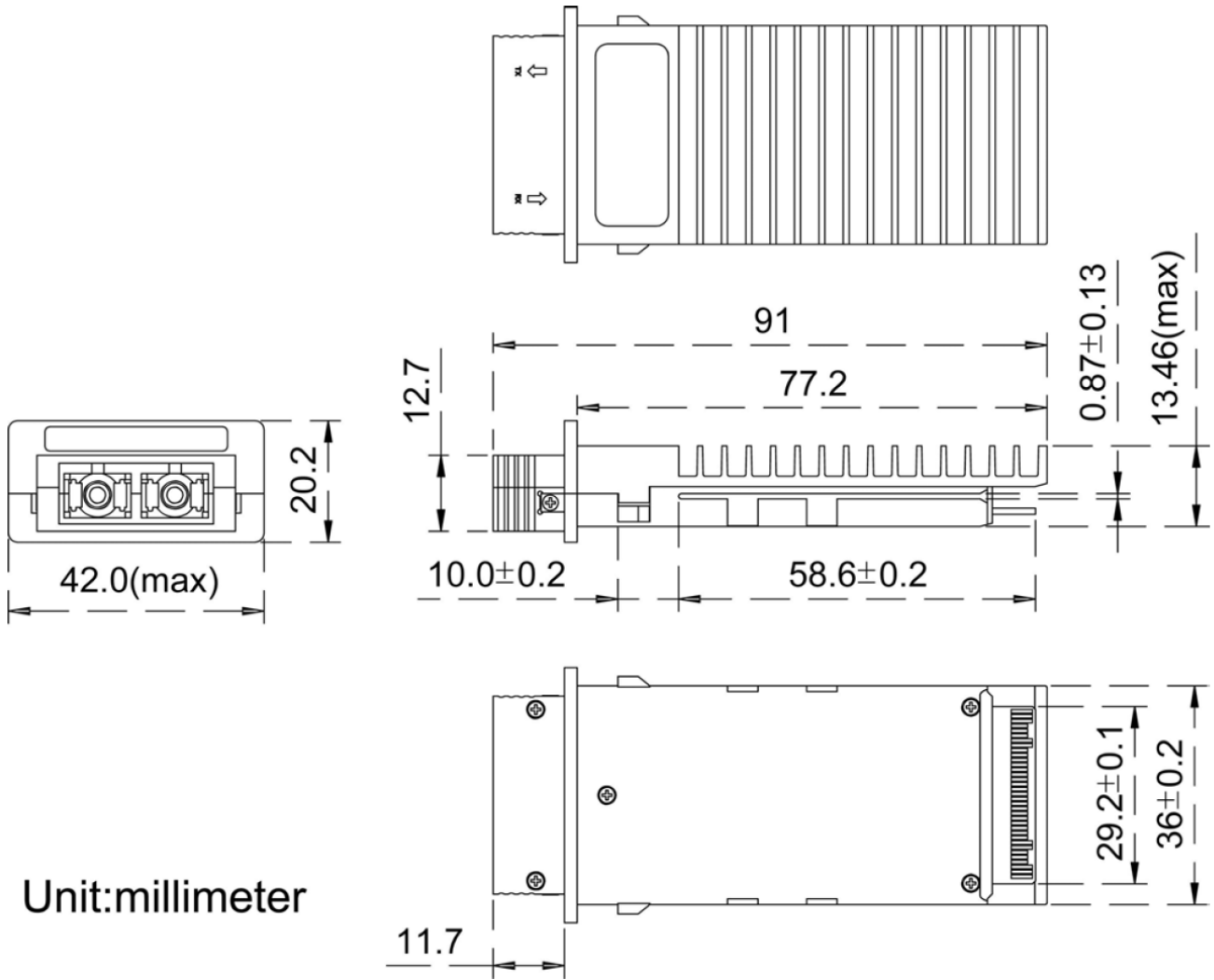
Bottom of Transceiver PCB  
As viewed through top

## Digital Diagnostic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Temperature Monitor	T <sub>MON</sub>	-5		5	°C	
Laser Bias Monitor	I <sub>MON</sub>	-10		10	%	
TX Power Monitor	P <sub>TX</sub>	-3		3	dBm	
RX Power Monitor	P <sub>RX</sub>	-3		3	dBm	



# Mechanical Specifications



Unit: millimeter

**About Us:**

Proline Options is one of North America's leading providers of transceivers and high speed cabling. With a reputation for quality, tested products that cover the connectivity spectrum, Proline Options has a solution for you regardless of the specification.

At Proline Options, every product is tested in its intended application - never batch or spec tested only. We run bandwidth, distance and IOS network tests. We have documented an impressive 0.03% failure rate over the last 10 years. To continue this rate of success we invest millions annually in our own on-site testing lab.



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