



#### FEATURES

- Hot pluggable X2 MSA form factor
  - Total power consumption: 4.0W maximum
  - RoHS-6 compliant (lead-free)
  - Temperature range 0°C to 70°C
  - Transmission distance of 80 km
  - Cooled 1550nm EML
  - SC connector, single mode fiber
  - Full duplex transmission mode
  - Digital Optics Monitoring (DOM)
- Power supply: +5.0 V, +3.3 V, Adaptable Power Supply (APS: +1.2 V) Management and control via MDIO 2-wire bus
  - 70-pin connector
  - Separated signal/chassis ground
  - Mid pak module variance for front panel mounting
  - De-latch mechanism with low extraction force

#### APPLICATIONS

- 10 Gb/s Ethernet transmission systems for 80km Extended Range (ZR)

#### DESCRIPTION

POFLink's 10GbE X2 transceiver module PX2-10G-ZR is a hot pluggable in the Z-direction module that is usable in typical router line card applications, Storage, IP network and LAN and compliant to X2 MSA. The PX2-10G-ZR is a fully integrated 10.3Gbit/s optical transceiver module that consists of a 10.3Gbit/s optical transmitter and receiver, XAUI interface, Mux and Demux with clock and data recovery(CDR). This version of POFLink Inc. transceiver line uses an uncooled direct modulation (DM) 1550nm Cooled 1550nm EML to achieve 80km over standard single mode fiber as 10GBASE-ER of the IEEE 802.3ae.

## PRODUCT SELECTION

### I. Pin Descriptions Electrical Pad Layout

Signal Name	Level	I/O	Pin No.	Description
<b>Management and Monitoring Ports</b>				
MDIO	Open Drain	I/O	17	Management Data I/O. Requires external 10 – 22 kΩ pull-up to the APS on host.
MDC	1.2 V CMOS	I	18	Management Data Clock Input
PRTAD4	1.2 V CMOS	1	19	Port Address Input bit 4
PRTAD3	1.2 V CMOS	I	20	Port Address Input bit 3
PRTAD2	1.2 V CMOS	I	21	Port Address Input bit 2
PRTAD1	1.2 V CMOS	I	22	Port Address Input bit 1
PRTAD0	1.2 V CMOS	I	23	Port Address Input bit 0
LASI	Open Drain	O	9	Link Alarm Status Interrupt Output. Open Drain Compatible Output with 10 – 20 kΩ pull-up on host. Logic high = Normal Operation Logic low = Status Flag Triggered
RESET	Open Drain	I	10	Reset Input. Open Drain Compatible Input with 22 kΩ pull-up to APS internal to transponder. Logic high = Normal Operation Logic low = RESET
Vendor Specific			11,15,16,24	Vendor Specific Pins. Leave unconnected when not used.
TX ON/OFF	Open Drain	I	12	TX ON/OFF Input. Open Drain Compatible Input with 22 kΩ pull-up to APS internal to transponder. Logic high = Transmitter On Logic low = Transmitter Off
MOD DETECT		O	14	Pulled low inside transponder through a 1 kΩ resistor to Ground

# 10G X2 ZR Transceiver ( PX2-10G-ZR)

## 10Gb/s 1550nm Single Mode X2-ZR Transponder



Transmit Functions				
Reserved Reserved		11	68 67	Reserved For Future Use Reserved For Future Use
TX LANE 3- TX LANE 3+	AC-coupled, Internally biased differential XAUI	11	65 64	Module XAUI Input Lane 3- Module XAUI Input Lane 3+
TX LANE 2- TX LANE 2+		11	62 61	Module XAUI Input Lane 2- Module XAUI Input Lane 2+
TX LANE 1- TX LANE 1+		11	59 58	Module XAUI Input Lane 1- Module XAUI Input Lane 1+
TX LANE 0- TX LANE 0+		11	56 55	Module XAUI Input Lane 0- Module XAUI Input Lane 0+

Receive Functions				
Reserved Reserved		00	38 39	Reserved For Future Use Reserved For Future Use
RX LANE 0+ RX LANE 0-	AC-coupled, Internally biased differential XAUI	00	41 42	Module XAUI Output Lane 0+ Module XAUI Output Lane 0-
RX LANE 1+ RX LANE 1-		00	44 45	Module XAUI Output Lane 1+ Module XAUI Output Lane 1-
RX LANE 2+ RX LANE 2-		00	47 48	Module XAUI Output Lane 2+ Module XAUI Output Lane 2-
RX LANE 3+ RX LANE 3-		00	50 51	Module XAUI Output Lane 3+ Module XAUI Output Lane 3-

DC Power				
GND	0 V DC		1, 2, 3, 33, 34, 35, 36, 37, 40, 43, 46, 49, 52, 53, 54, 57, 60, 63, 66, 69, 70	Ground connection for signal ground on the module
APS	+1.2 V		7, 8, 28, 29	Input from Adaptive Power Supply
APS SENSE	+1.2 V		27	APS Sense Output. Connected to the APS input inside transponder.
APS SET			25	Feedback input from APS. Connected to GND through a 1180Ωresistor inside the transponder.
3.3 V	+3.3 V DC		5, 6, 30, 31	DC Power Input, +3.3 V DC, Nominal

# 10G X2 ZR Transceiver ( PX2-10G-ZR) 10Gb/s 1550nm Single Mode X2-ZR Transponder



5.0 V	+5.0 V DC		4, 32	DC Power Input, +5.0 V DC, Nominal
Reserved			26	Reserved for APD.
Reserved			13	Reserved.

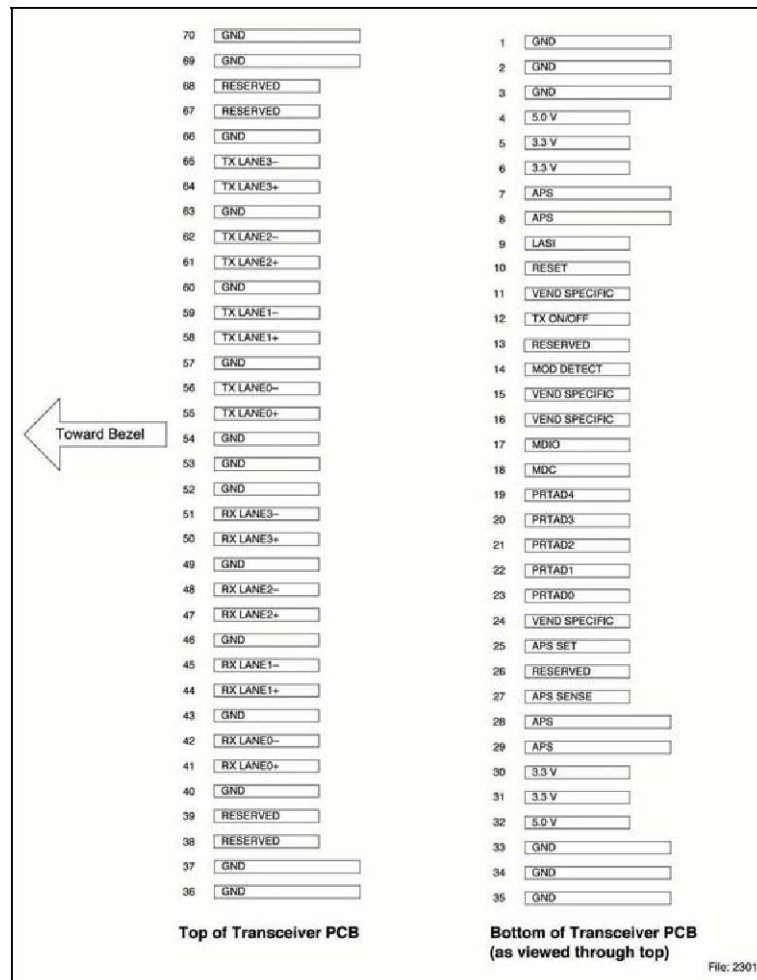


Fig 1-X2 Transponder Electrical Pad Layout

## II. Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Storage Ambient Temperature <sup>1)</sup>	TS	-20	85	°C
Operating Case Temperature <sup>1)</sup>	TC	0	70	°C
Supply Voltage +5.0 V	V5	0	6	V
Supply Voltage +3.3 V	V3	0	4	V
Supply Voltage APS	Vaps	0	1.5	V
Static Discharge Voltage, All Pins <sup>2)</sup>	STd		500	V
Peak Receive Optical Power	RxP		-1	dBm

# 10G X2 ZR Transceiver ( PX2-10G-ZR)

## 10Gb/s 1550nm Single Mode X2-ZR Transponder



	peak			
Average Receive Optical Power	RxP max		-1	dBm

Notes: 1) Non-condensing.  
2) HBM.

Exceeding any one of these values may permanently destroy the device.

### III. Electrical Characteristics Recommended Operating Conditions

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Operating Case Temperature <sup>1)</sup>	T <sub>C</sub>	0		70	°C
Transponder Total Power Consumption	P			4	W
Supply Voltage +5.0 V	V <sub>CC5</sub>	4.75	5.0	5.25	V
Supply Current +5.0 V	I <sub>CC5</sub>			500	mA
Supply Voltage +3.3 V	V <sub>CC3</sub>	3.14	3.3	3.47	V
Supply Current +3.3 V	I <sub>CC3</sub>			1000	mA
Supply Voltage APS	V <sub>CC_aps</sub>	1.152	1.2	1.248	V
Supply Current APS	I <sub>CC_aps</sub>			1200	mA

1. Worst case thermal location, see **Figure**

2. See also **Environmental Performance**.

### Electrical DC Characteristics

(V<sub>CC5</sub> = 4.75 V to 5.25 V, V<sub>CC3</sub> = 3.14 V to 3.47 V, V<sub>CC\_aps</sub> = 1.152 V to 1.248 V, T<sub>C</sub> = 0°C to 70°C)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>1.2 V CMOS (1.8 V CMOS Compatible<sup>1)</sup>) I/O DC Characteristics (PRTAD; LASI; RESET; TX_ONOFF)</b>					
External Pull-up Resistor for Open Drain	R <sub>pullup</sub>	10		22	kΩ
Output High Voltage <sup>2)</sup>	V <sub>oh</sub>	1			V
Output Low Voltage <sup>2)</sup>	V <sub>ol</sub>			0.15	V
Input High Voltage	V <sub>ih</sub>	0.84		1.5	V
Input Low Voltage	V <sub>il</sub>			0.36	V
Input Pull-down Current <sup>3)</sup>	I <sub>pd</sub>	20		120	μA
<b>XAUI I/O DC Characteristics (TXLANE[0..3]; RXLANE[0..3])</b>					
Differential Input Amplitude (pk-pk) <sup>4)</sup>	V <sub>in_xaui</sub>	200		2500	mV
Differential Output Amplitude (pk-pk) <sup>4)</sup>	V <sub>out_xaui</sub>	800		1600	mV
<b>MDIO I/O DC Characteristics (MDIO; MDC)</b>					
Output Low Voltage <sup>5)</sup>	V <sub>OL</sub>	-0.3		0.2	V
Output Low Current	I <sub>OL</sub>			4	mA
Input High Voltage	V <sub>IH</sub>	0.84		1.5	V
Input Low Voltage	V <sub>IL</sub>	-0.3		0.36	V
Pull-up Supply Voltage	V <sub>PU</sub>	1.152	1.2	1.248	V
Input Capacitance	C <sub>IN</sub>			10	pF
Load Capacitance	C <sub>LOAD</sub>			470	pF
External Pull-up Resistance	R <sub>LOAD</sub>	200			Ω

### Shenzhen POFLink Communication Equipment Co., Ltd.

4F, Landfeng Building Kefa Rd Hi-tech Industrial Park, Nanshan, Shenzhen, China  
 Tel: +86 755 26014656 Fax: +86 755 26532516  
 E-mail: info@poflink.com Http://www.poflink.com

# 10G X2 ZR Transceiver ( PX2-10G-ZR)

## 10Gb/s 1550nm Single Mode X2-ZR Transponder



1. For 1.8 V CMOS  $V_{oh} = 1.65$  V min.,  $V_{ol} = 0.15$  V max.,  $V_{ih} = 1.17$  V min.,  $V_{il} = 0.63$  V max.
2.  $R_{pull-up} = 10$  k $\Omega$  to 1.8 V.
3.  $V_{in} = 1.8$  V.
4. AC coupled.
5.  $I_{OL} = 100$   $\mu$ A.

### Electrical AC Characteristics

( $V_{CC5} = 4.75$  V to 5.25 V,  $V_{CC3} = 3.14$  V to 3.47 V,  $V_{CCaps} = 1.152$  V to 1.248 V,  $T_c = 0^\circ\text{C}$  to  $70^\circ\text{C}$ )

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>XAUI Input AC Characteristics (TXLANE[0..3])</b>					
Baud Rate Ethernet	$R_{XAUIIN}$		3.125		Gbit/s
Baud Rate Tolerance	$R_{TOLXAUI}$	-100		100	ppm
Differential Input Impedance	$Z_{INXAUI}$	80	100	120	$\Omega$
Differential Return Loss <sub>1)</sub>	$ S_{11} $	10			dB
Input Differential Skew <sub>2)</sub>	$t_{SKEWIN}$			75	ps
Jitter Amplitude Tolerance <sub>3)</sub>	$J_{XAUITOL}$			0.65	UI <sub>p-p</sub>
<b>XAUI Output AC Characteristics (RXLANE[0..3])</b>					
Baud Rate Ethernet	$R_{XAUIOUT}$		3.125		Gbit/s
Baud Rate Variation	$R_{XAUIVAR}$	-100		100	ppm
XAUI Eye Mask (far-end)	According to IEEE 802.3ae				
Output Differential Skew	$t_{SKEWOUT}$			15	ps
Output Differential Impedance	$Z_{OUTXAUI}$	80	100	120	$\Omega$
Differential Output Return Loss <sub>1)</sub>	$ S_{22} $	10			dB
Total Jitter <sub>4)</sub>	$TJ_{XAUI}$			0.35	UI
Deterministic Jitter <sub>4)</sub>	$DJ_{XAUI}$			0.37	UI
<b>Power-On Reset AC Characteristics</b>					
Power-On Reset and TX_ONOFF Characteristics	According to XENPAK MSA Issue 3.0, 2002-9-18				
<b>MDIO I/O AC Characteristics (MDIO; MDC)</b>					
MDIO Data Hold Time	$t_{HOLD}$	10			ns
MDIO Data Setup Time	$t_{SU}$	10			ns

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# 10G X2 ZR Transceiver ( PX2-10G-ZR)

## 10Gb/s 1550nm Single Mode X2-ZR Transponder



Delay from MDC Rising Edge to MDIO Data Change	$t_{DELAY}$			300	ns
MDC Clock Rate	$f_{MAX}$			2.5	MHz

1. 100 MHz to 2.5 GHz.
2. At crossing point.
3. Per IEEE Std 802.3ae.
4. At near-end, No pre-equalization, 1 UI = 320 ps.

### IV. Optical Characteristics

( $V_{CC5} = 4.75\text{ V to }5.25\text{ V}$ ,  $V_{CC3} = 3.14\text{ V to }3.47\text{ V}$ ,  $V_{CC\text{aps}} = 1.152\text{ V to }1.248\text{ V}$ ,  $T_C = 0^\circ\text{C to }70^\circ\text{C}$ )

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Transmitter</b>					
Average Launch Power	$P_{O-Avg}$	0		+4	dBm
Center Wavelength Range	$\lambda_{C-Tx}$	1530		1565	nm
Side Mode Suppression Ratio	SMSR	30			dB
Extinction Ratio	ER	9			dB
Relative Intensity Noise <sub>12OMA</sub>	RIN			-128	dB/Hz
Eye Mask Definition	Per IEEE 802.3ae				
<b>Receiver</b>					
Average Receiver Power <sub>1)</sub>	$P_{IN}$	-24		-7	dBm
Receiver Overload	$P_{IN-max}$	-7			dBm
Path Penalty at 1600 ps/nm @ 10.3Gb/s	DP			3	dB
Receiver Damage Power Threshold	$P_{IN-dmg}$	-1			dBm
Receiver Reflectance	REF <sub>RX</sub>			-27	dB
Center Wavelength Range	$\lambda_{C-RX}$	1260		1565	nm

Average Receiver Power (min) is defined at BER 1E-12 with PRBS31 or 10GbE source.

### V. General Specifications

#### Optical Interface Standard Specifications

Standard	Differential Group Delay Maximum (ps)	Operating Range (meters)
B1.1 SMF	10	2 to 80,000
B1.3 SMF	10	2 to 80,000

# 10G X2 ZR Transceiver ( PX2-10G-ZR) 10Gb/s 1550nm Single Mode X2-ZR Transponder



## Environmental Performance

Operating case temperature: 0°C to +70°C

Operating humidity: 0% –95% RH non-condensing

## Fibers and Connectors

The transponder has SC receptacles for both Tx and Rx. The transponder is designed for single mode SC cables, 0° polished endface (PC).

## 70-pin Connector

The module interface connector is a 70-pin, printed circuit board edge connection with a 0.5 mm pitch. The appropriate mating connector for the customer PCB is a 70-pin SMT, dual row, right angled, edge connector, 0.5 mm pitch (Tyco Electronics part number 1367337-1, Molex part number 74441-0003 or equivalent).

## Rail and Mechanical Mounting Requirements

The X2 rail system required to mount the X2 module is fully defined by the MSA. (Tyco Electronics part number 1367608-1: designed for belly to belly applications; and 1367610-1, designed for single sided board mount to fit into the standard host PCB footprint; or equivalent). For further details please refer to vendor-supplied information.

## Aqueous Wash

POFLink X2 transponders are neither solderable nor aqueous washable and are not intended for these processes.

## VI. Regulatory Compliance Eye Safety

Feature	Standard	Comments
ESD: Electrostatic Discharge to the Electrical Pins (HBM)	EIA/JESD22-A114 -B (MIL-STD 883D Method 3015.7)	Class 1a (> 500 V)
Immunity: Against Electrostatic Discharge (ESD) to the Module Receptacle	EN 61000-4-2 IEC 61000-4-2	Discharges ranging from $\pm 2$ kV to $\pm 25$ kV to the front end / faceplate / receptacle cause no damage to module (under recommended conditions).
Immunity: Against Radio Frequency Electromagnetic Field	EN 61000-4-3 IEC 61000-4-3	With a field strength of 10 V/m, noise frequency ranges from 10 MHz to 2 GHz. No effect on module performance between the specification limits.



# 10G X2 ZR Transceiver ( PX2-10G-ZR)

## 10Gb/s 1550nm Single Mode X2-ZR Transponder



Emission: Electromagnetic Interference (EMI)	FCC 47 CFR Part 15, Class B EN 55022 Class B CISPR 22	Noise frequency range: 30 MHz to 40 GHz Radiated emission does not exceed specified limits when measured with module inside a shielding enclosure with a MSA conforming cutout.
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POFLink PX2-10G-ZR transponders are Class 1 Laser Products. They are certified per the following standards:

Feature	Agency	Standard	Certificate Number
Laser Eye Safety	FDA/CDRH	CDRH 21 CFR 1040 and Laser Notice 50	9210176-77
Laser Eye Safety	TÜV	EN 60825-1: 1994+A11:1996+A2:2001 IEC 60825-1: 1993+A1:1997+A2:2001 IEC 60825-2: 2000, Edition 2	R 72052602
Electrical Safety	TÜV	EN 60950	R 72052602
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	1439230

Copies of the referenced certificates will be available at POFLink INC upon request.

### VII. DOM Parameters

Parameter	Values			Unit
	min.	typ.	max.	
Transponder Temperature Monitor Accuracy <sup>1)</sup>	-5		+5	°C
Laser Bias Current Monitor Accuracy <sup>2)</sup>	-10		+10	%
Transmit Power Monitor Accuracy <sup>3)</sup>	-3		+3	dB
Receive Power Monitor Accuracy <sup>3)</sup>	-3		+3	dB

1.0 to 70°C case temperature.

2.need EML range

3.0 dBm to +4 dBm.

### VIII. Mechanical Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Module Retention Force (latch strength)	F <sub>RET</sub>		200		N
Module Insertion Force	F <sub>IN</sub>		40		N
Module Extraction Force (with kick-out)	F <sub>EXT-K</sub>		16		N
Module Extraction Force (without kick-out)	F <sub>EXT</sub>		25		N

Pull Sleeve front face color is white.

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Tel: +86 755 26014656

Fax: +86 755 26532516

E-mail: info@poflink.com

Http://www.poflink.com

Package Outline

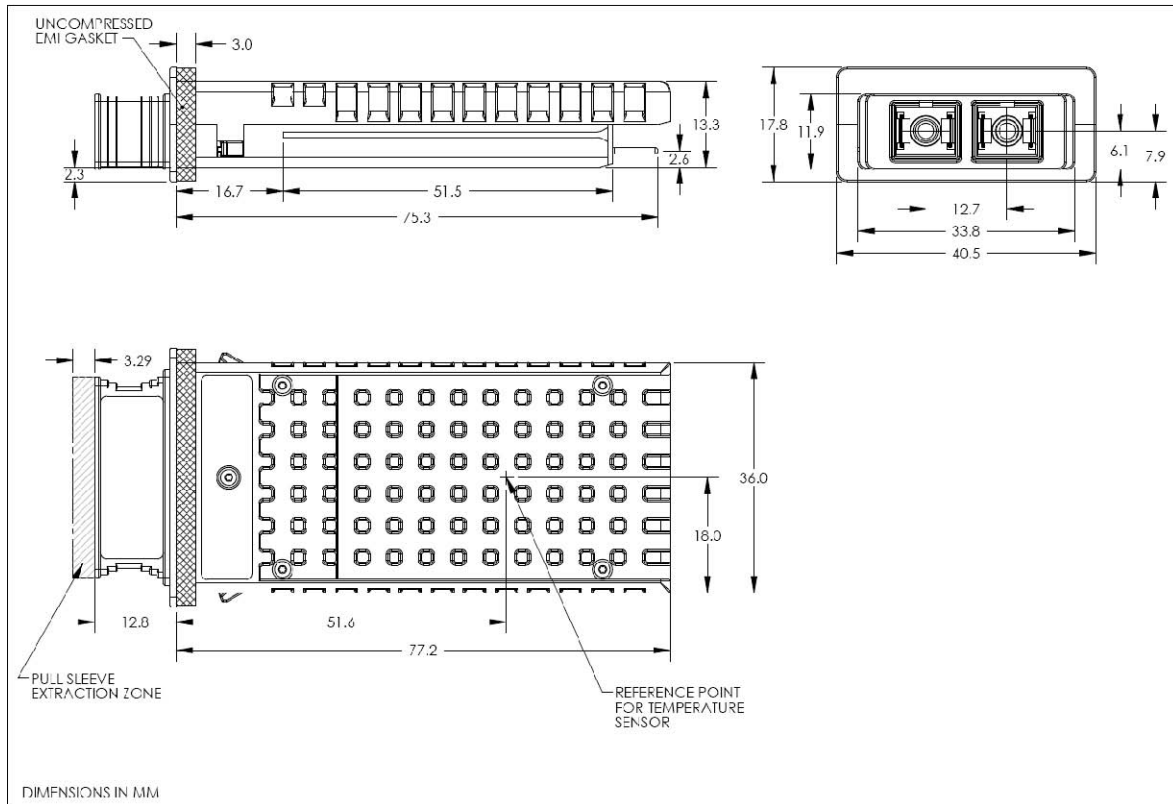


Figure 2-X2 Mechanical Dimensions