



X2-10GB-ER



The X2-10GB-ER is programmed to be fully compatible and functional with all intended Cisco Series switching devices. This X2 optical transceiver is designed for IEEE 802.3ae 10GBASE-ER interconnects and is compliant with the X2 Multi-Source Agreement (MSA) Specification. This module is designed for single mode fiber and operates at a nominal wavelength of 1550nm up to 40KM.

Compliance:

- IEEE 802.3ae
- 10GBASE-ER
- X2 MSA
- RoHS

Applications:

- 10Gb Ethernet

Features:

- Up to 10 GBd bi-directional bit rates
- 1550nm EML laser
- PIN photo-detector
- XAUI electrical interface: 4 lanes @ 3.125 GBd
- MDIO, DOM (Digital Optics Monitoring) support
- Hot-pluggable X2 footprint
- Duplex SC Connector
- Up to 40Km over singlemode fiber
- Adaptable 5V / 3.3V / 1.2V power supply
- Operating Case Temperature: C-Temp: 0° to 70°

Absolute Maximum Ratings

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Storage Ambient Temperature	T_s	-40		85	°C	
Supply Voltage (5V)	V_s	0		6	V	
Supply Voltage (3.3V)	V_3	0		4	V	
Supply Voltage (APS)	V_{APS}	0		1.5	V	
Optical Receiver Input	P_{IMAX}			-5	dBm	Average



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General Specifications

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Data Rate	DR		10.3125		GBd	
Bit Error Rate	BER			10 ⁻¹²		
Total Power Consumption	P			4	W	
Supply Voltage (5V)	V _{CC5}	4.75	5	5.25	V	Operating Env
Supply Voltage (+3.3V)	V _{CC3}	3.14	3.3	3.47	V	Operating Env
Supply Voltage (APS)	V _{CCAPS}	1.152	1.2	1.248	V	Operating Env
Supply Current (5V)	I _{CC5}			350	mA	
Supply Current (+3.3V)	I _{CC3}			300	mA	
Supply Current (APS)	I _{CCAPS}			1000	mA	

Link Distances

Parameter	Fiber Type	Distance Range (m)
10.3GBd	9/125um SMF	2-40,000

Optical Characteristics - Transmitter

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Optical Wavelength	λ	1530		1570	nm	
Launch Power	P _{OUT}	-1		2	dBm	Average
Launch Power in OMA	P _{OMA}	-5.2			dBm	
Launch Power of OFF	P _{OUT_OFF}			-30	dBm	Average
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20 dB)	$\Delta\lambda$			0.6	nm	
Optical Extinction Ratio	ER	8.2			dB	
Optical Return Loss Tolerance	ORL _T			12	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Dispersion Penalty	TDP			2	dB	

Optical Characteristics Receiver

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Center Wavelength Range	λ_c	1260		1600	nm	
Optical Input Power	P _{IN}	-16		0.5	dBm	Average, Informative
Receiver Sensitivity in OMA	P _{IN_OMA}			-14.1	dBm	Informative
Stressed Receiver Sensitivity	P _{IN_S}			-11.3	dBm	
Receive Reflectance	T _{RRX}			-27	dB	
Loss of Signal Assert Level	P _{LOS_A}	-25			dBm	
Loss of Signal DeAssert Level	P _{LOS_D}			-17	dBm	
Loss of Signal Hysteresis	P _{LOS_H}	1			dBm	
RX electrical 3dB upper cutoff-frequency	FR			12.3	GHz	



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Electrical Characteristics - DC

Parameter	Symbol	Min	Type	Max	Unit	Remarks
A) 1.2V COMS I/O DC Characteristics (PRTAD; LASI; RESET; TX_ON/OFF)						
External Pull-Up Resistor For Open Drain	R_{PU}	10		22	k Ω	
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	I_{PD}	20		120	μ A	$V_{IN}=1.2V$
B) XAUI I/O DC Characteristics (TXLANE[0..3]; RXLANE[0..3])						
Differential Input Amplitude	V_{IN_XAUI}	200		2500	mV	AC Coupled
Differential Output Amplitude	V_{OUT_XAUI}	800		1600	mV	AC Coupled
C) MDIO I/O DC Characteristics (MDIO; MDC)						
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	R_{PU}	200			Ω	

Electrical Characteristics - AC

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

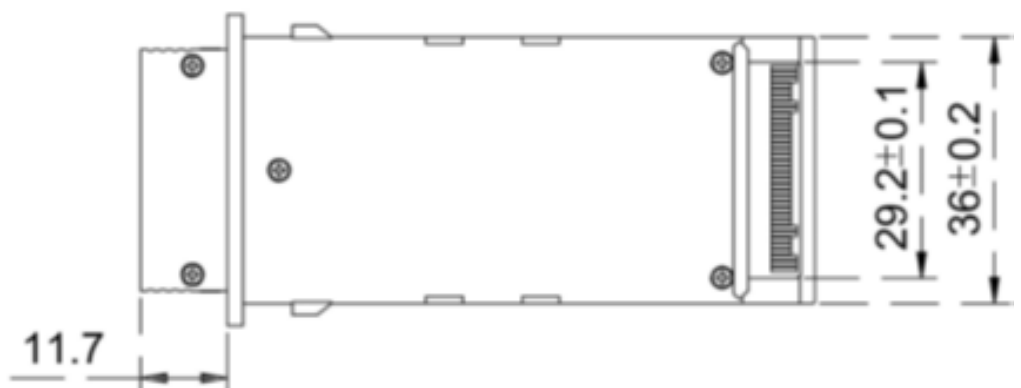
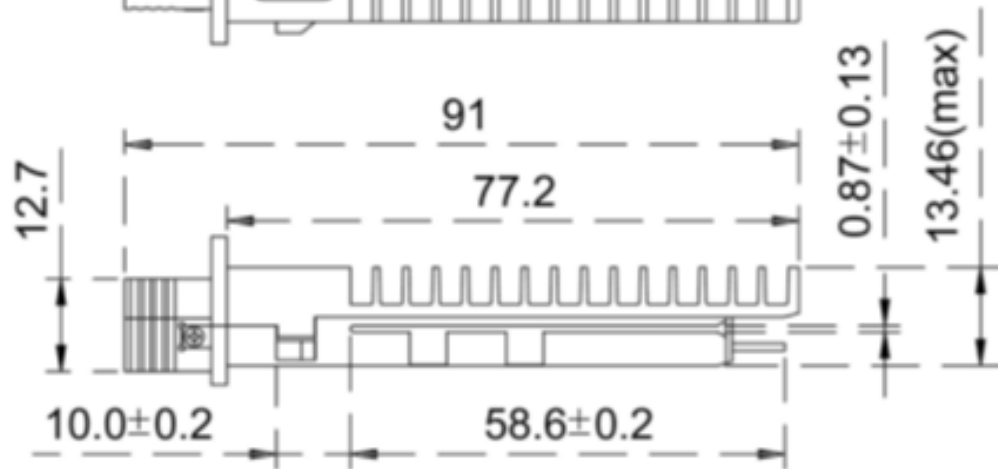
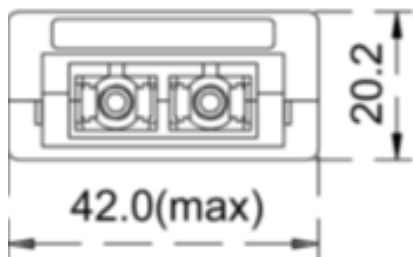
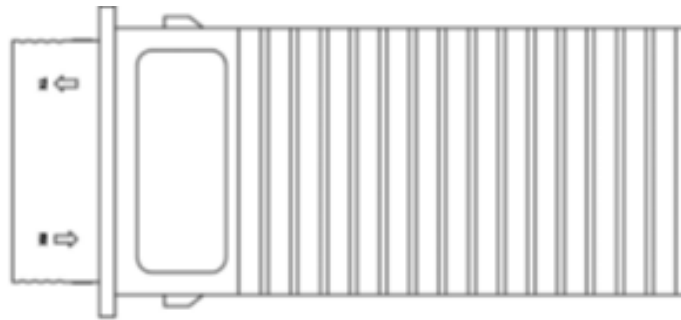


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Digital Diagnostic

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Temperature Monitor	T _{MON}	-5		+5	°C	
Laser Bias Monitor	I _{MON}	-10		10	%	
TX Power Monitor	P _{TX}	-3		+3	dBm	
RX Power Monitor	P _{RX}	-3		+3	dBm	



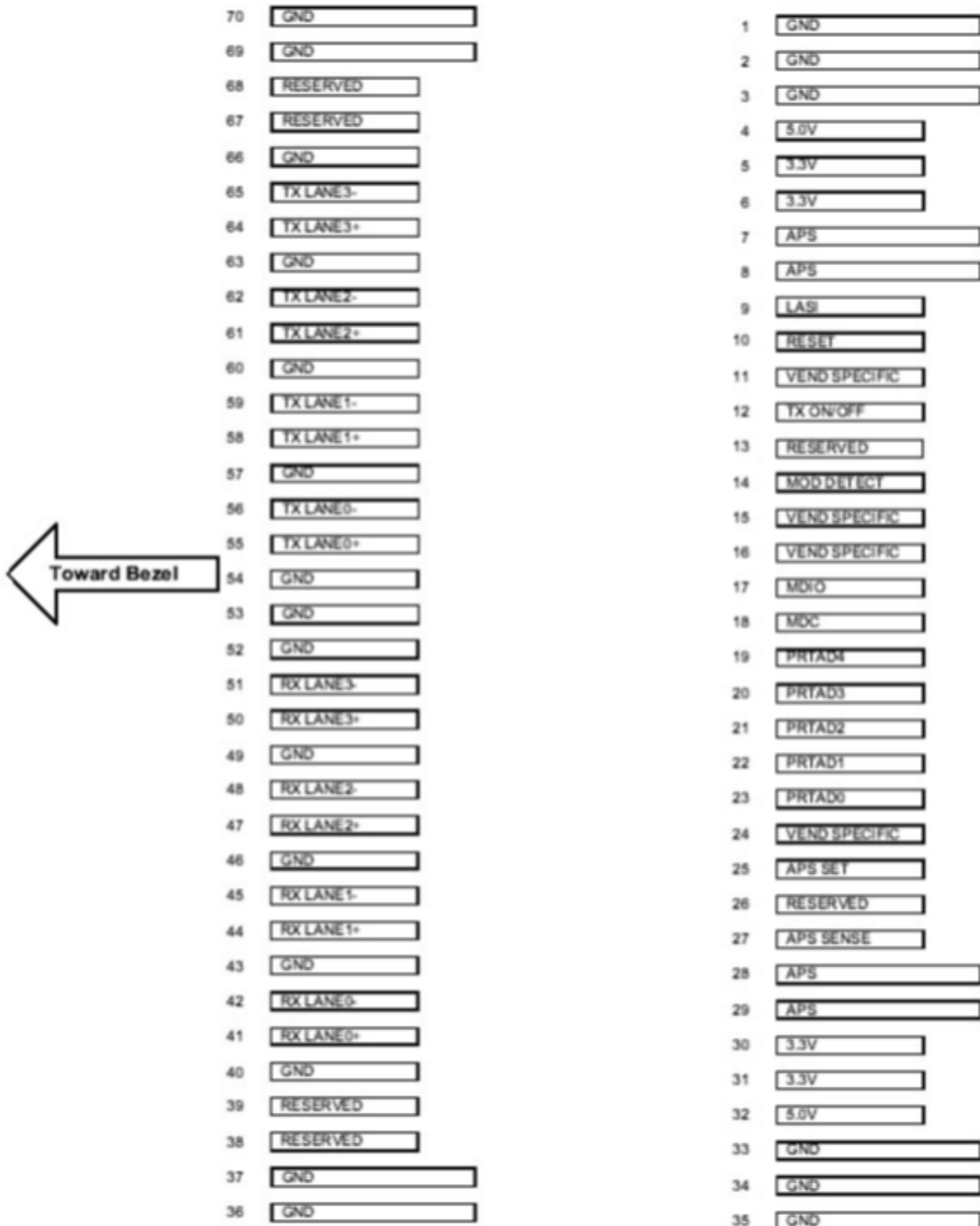
Unit: millimeter



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Electrical Pad Layout





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Pin Assignment - Pin 1 to Pin 35:

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



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Pin Assignment - Pin 36 to Pin 70:

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

Remarks

1. IEEE standard 802.3. IEEE Standard Department, 2005., 10GBASE-SR
2. XENPAK Multi-Source Agreement (MSA).