

X2-10GB-LR-OC Transceiver, 1310nm, SC Connectors, 10km over Single-Mode Fiber.

Description

These X2-10GB-LR-OC optical transceivers are designed for Storage, IP network and LAN. They are hot pluggable modules in the Z-direction that are mainly usable in typical router/switch line card applications. They are fully integrated 10.3 Gb/s optical transceiver modules that consist of a 1310nm wavelength optical transmitter and receiver, XAUI interface, Mux and Demux with clock and data recovery (CDR). In addition, they comply with the X2 Multi Sourcing Agreement (MSA).



Features

- Up to 10 GBd bi-directional data links.
- Compliant with IEEE 802.3ae, 10GBASE-LR application.
- Compliant with X2 MSA.
- 1310nm DFB laser.
- PIN Photo-detector.
- XAUI electrical interface: 4 lanes @ 3.125 GBd.
- MDIO, DOM (Digital Optics Monitoring) support.
- Hot Z-Pluggable.
- SC Connectors
- Up to 10km on SMF
- Power Supply: 5V/3.3V/Adaptable Power Supply (APS: 1.2V)
- RoHS Compliance
- Operating temperature range: 0°C to 70°C.

Applications

- 10 GBd Ethernet.
-

Technical Standard:

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Storage Ambient Temperature	T_S	- 40		85	°C	
Supply Voltage (5V)	V_5	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}			1.5	dBm	Average

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR		10.3125		GBd	
Bit Error Rate	BER			10-12		
Total Power Consumption	P			3	W	
Supply Voltage (5V)	V_{CC5}	4.75	5	5.25	V	Operating Environment
Supply Voltage (+3.3V)	V_{CC3}	3.14	3.3	3.47	V	Operating Environment
Supply Voltage (APS)	V_{CCAPS}	1.152	1.2	1.248	V	Operating Environment
Supply Current (5V)	I_{CC5}			100	mA	
Supply Current (+3.3V)	I_{CC3}			300	mA	
Supply Current (APS)	I_{CCAPS}			1000	mA	
Case Operating Temperature	T_C	0		70	°C	

Link Distances

Parameter	Fiber Type	Distance Range (Km)
10.3125 GBd	9/125um SMF	10

Optical Characteristics - Transmitter

V_{CC5} = 4.75V to 5.25V, V_{CC3} = 3.14V to 3.47V, V_{CCAPS} = 1.152V to 1.248V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Wavelength	λ	1290		1330	nm	
Launch Power	P_{OUT}	- 8.2		0.5	dBm	Average
Launch Power in OMA minus TDP	P_{OUT_OMA}	- 5.2			dBm	
Launch Power of OFF Transmitter	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	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					

Optical Characteristics - Receiver

V_{CC5} = 4.7 5V to 5.25V, V_{CC3} = 3.14V to 3.47V, V_{CCAPS} = 1.152V to 1.248V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Center Wavelength Range	λ_C	1260		1600	nm	
Optical Input Power	P_{IN}	- 14.4		0.5	dBm	Average, Informative
Receiver Sensitivity in OMA	P_{IN_OMA}			- 12.6	dBm	Informative
Stressed Receiver Sensitivity	P_{IN_S}			- 10.3	dBm	
Receive Reflectance	TR_{RX}			- 12	dB	
Loss of Signal Assert Level	P_{LOS_A}	- 25			dBm	
Loss of Signal DeAssert 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

V_{CC5} = 4.75V to 5.25V, V_{CC3} = 3.14V to 3.47V, V_{CCAPS} = 1.152V to 1.248V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	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 Charateristics (TXLANE[0..3]; RXLANE[0..3])						
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
C.						
MDIO I/O DC Charateristics (MDIO; MDC)						
Output Low Voltage	V_{OL}			0.2	V	I_{OL} = 100 μ 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

V_{CC5} =4.75V to 5.25V, V_{CC3} =3.14V to 3.47V, V_{CCAPS} =1.152V to 1.248V, T_C =0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
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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	100 MHz to 2.5 GHz
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	100 MHz to 2.5 GHz
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					
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D.

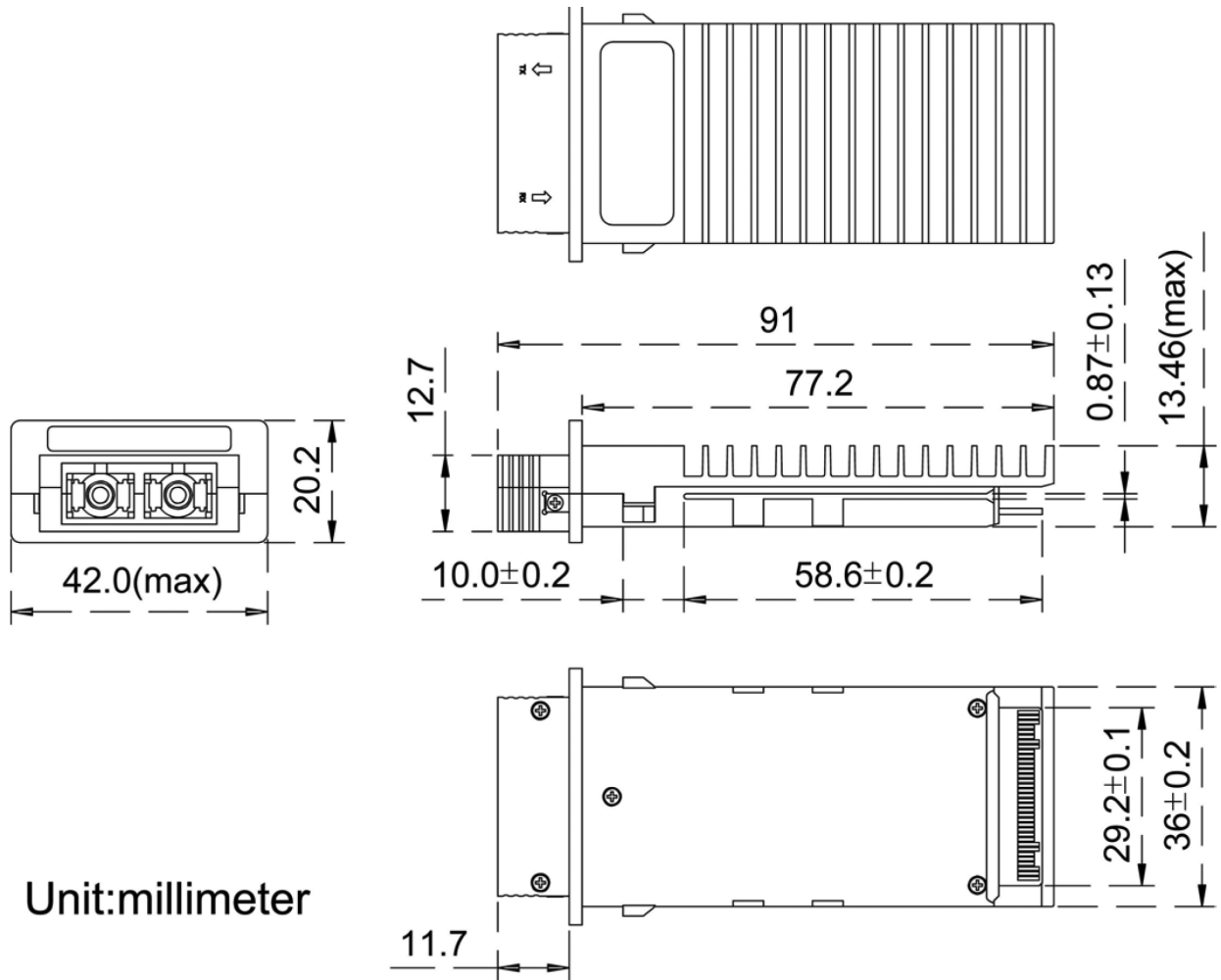
MDIO I/O AC Characteristics (MDIO; MDC)

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	

Digital Diagnostic

Parameter	Symbol	Min	Typ	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	

Dimensions:



Unit: millimeter

ALL DIMENSIONS ARE $\pm 0.2\text{mm}$ UNLESS OTHERWISE SPECIFIED

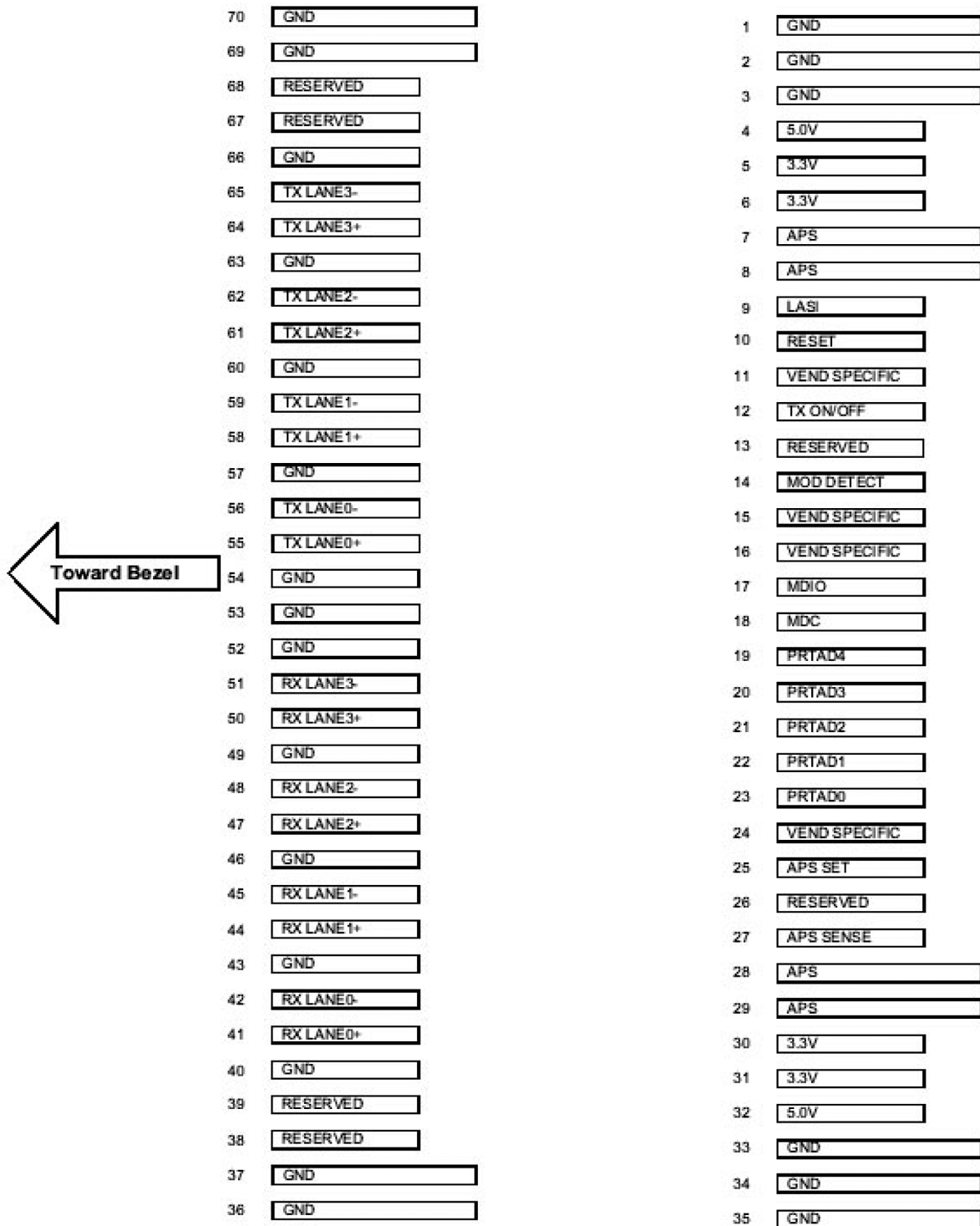
Pin Assignment – Pin 1 to Pin 35

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	RESET	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			Vendor 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

Pin Assignment – Pin 36 to Pin 70

PIN #	Symbol	I/O	Logic	Description	Remarks
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	

Electrical Pad Layout



Top of Transceiver PCB

Bottom of Transceiver PCB
As viewed through top

.....C7 H97 < '8 JfYWh
% %\$' `GmWUa cfY'; `Yb'8 fZhfUVi Vt'7 UbncbZ7 5` - &* +
D< CB9 _ - (- !& , !((++ j'7 9 @@ _ - (- !) \$\$!+\$&*
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