

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

Description

These LR 10Gb X2 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	TS	- 40		85	°C	
Supply Voltage (5V)	V5	0		6	V	
Supply Voltage (3.3V)	V3	0		4	V	
Supply Voltage (APS)	VAPS	0		1.5	V	
Optical Receiver Input	PIMAX			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)	VCC5	4.75	5	5.25	V	Operating Environment
Supply Voltage (+3.3V)	VCC3	3.14	3.3	3.47	V	Operating Environment
Supply Voltage (APS)	VCCAPS	1.152	1.2	1.248	V	Operating Environment
Supply Current (5V)	ICC5				100	mA
Supply Current (+3.3V)	ICC3			300	mA	
Supply Current (APS)	ICCAPS			1000	mA	
Case Operating Temperature	TC	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 $1.248V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Wavelength	λ	1290		1330	nm	
Launch Power	POUT	- 8.2		0.5	dBm	Average
Launch Power in OMA minus TDP	POUT_OMA	- 5.2			dBm	
Launch Power of OFF Transmitter	POUT_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	ORLT		12	dB		
Relative Intensity Noise	RIN		- 128	dB/Hz		
Transmitter Dispersion Penalty	TDP			3.2	dB	
Transmitter Reflectance	TRTX			- 12	dB	
Eye Mask Definition	According to IEEE 802.3ae					

Optical Characteristics - Receiver

VCC5=4.7 5V to 5.25V, VCC3=3.14V to 3.47V, VCCAPS=1.152V to 1.248V, TC=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Center Wavelength Range	λ_C	1260		1600	nm	
Optical Input Power	PIN	- 14.4		0.5	dBm	Average, Informative
Receiver Sensitivity in OMA	PIN_OMA			- 12.6	dBm	Informative
Stressed Receiver Sensitivity	PIN_S			- 10.3	dBm	
Receive Reflectance	TRRX			- 12	dB	
Loss of Signal Assert Level	PLOS_A	- 25			dBm	
Loss of Signal DeAssert Level	PLOS_D			- 16	dBm	
Loss of Signal Hysteresis	PLOS_H	1			dBm	
Receiver electrical 3dB upper cutoff frequency	FR			12.3	GHz	

Electrical Characteristics - DC

VCC5=4.75V to 5.25V, VCC3=3.14V to 3.47V, VCCAPS=1.152V to 1.248V, TC=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	RPU	10		22	k Ω	
Output High Voltage	VOH	1			V	
Output Low Voltage	VOL		0.15	V		
Input High Voltage	VIH	0.84		1.2	V	
Input Low Voltage	VIL			0.36	V	
Input Pull-Down Current	IPD	20		120	μ A	VIN=1.2V
B.						
XAUI I/O DC Charateristics (TXLANE[0..3]; RXLANE[0..3])						
Differential Input Amplitude (pk – pk)	VIN_XAUI	200		2500	mV	AC Coupled
Differential Output Amplitude (pk – pk)	VOUT_XAUI	800		1600	mV	AC Coupled
C.						
MDIO I/O DC Charateristics (MDIO; MDC)						
Output Low Voltage	VOL			0.2	V	IoL=100 μ A
Output Low Current	IoL			4	mA	
Input High Voltage	VIH	0.84		1.2	V	
Input Low Voltage	VIL			0.36	V	
Pull-Up Supply Voltage	VPU	1.152	1.2	1.248	V	
Input Capacitance	CIN			10	pF	
Load Capacitance	CLOAD			470	pF	
External Pull-Up Resistance	RPU	200			Ω	

Electrical Characteristics - AC

VCC5=4.75V to 5.25V, VCC3=3.14V to 3.47V, VCCAPS=1.152V to 1.248V, TC=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	BRXAUI_IN		3.125		GBd	
Baud Rate Tolerance	BRTOL_XAUI	- 100		100	ppm	
Differential Input Impedance	ZIN_XAUI	80	100	120	Ω	
Differential Return Loss	RLIN	10			dB	100 MHz to 2.5 GHz
Input Differential Skew	TIN_SKEW			75	ps	Crossing Point
Jitter Amplitude Tolerance	JXAUI_TOL			0.65	UIPP	IEEE 802.3ae

B.

XAUI Output AC Characteristics (RXLANE[0..3])

Baud Rate	BRXAUI_OUT		3.125		GBd	
Baud Rate Variation	BRXAUI_VAR	- 100		100	ppm	
XAUI Eye Mask (far-end)	According to IEEE 802.3ae					
Output Differential Skew	TOUT_SKEW			15	ps	
Output Differential Impedance	ZOUT_XAUI	80	100	120	Ω	
Differential Output Return Loss	ROUT	10			dB	100 MHz to 2.5 GHz
Total Jitter	TJXAUI			0.35	UI	Near-end No pre-equalization
Deterministic Jitter	DJXAUI			0.17	UI	1 UI=320 ps

C.

Power-On Reset Characteristics

Power-On Reset and TX_ONOFF Characteristics	According to X2 MSA Issue					
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D.

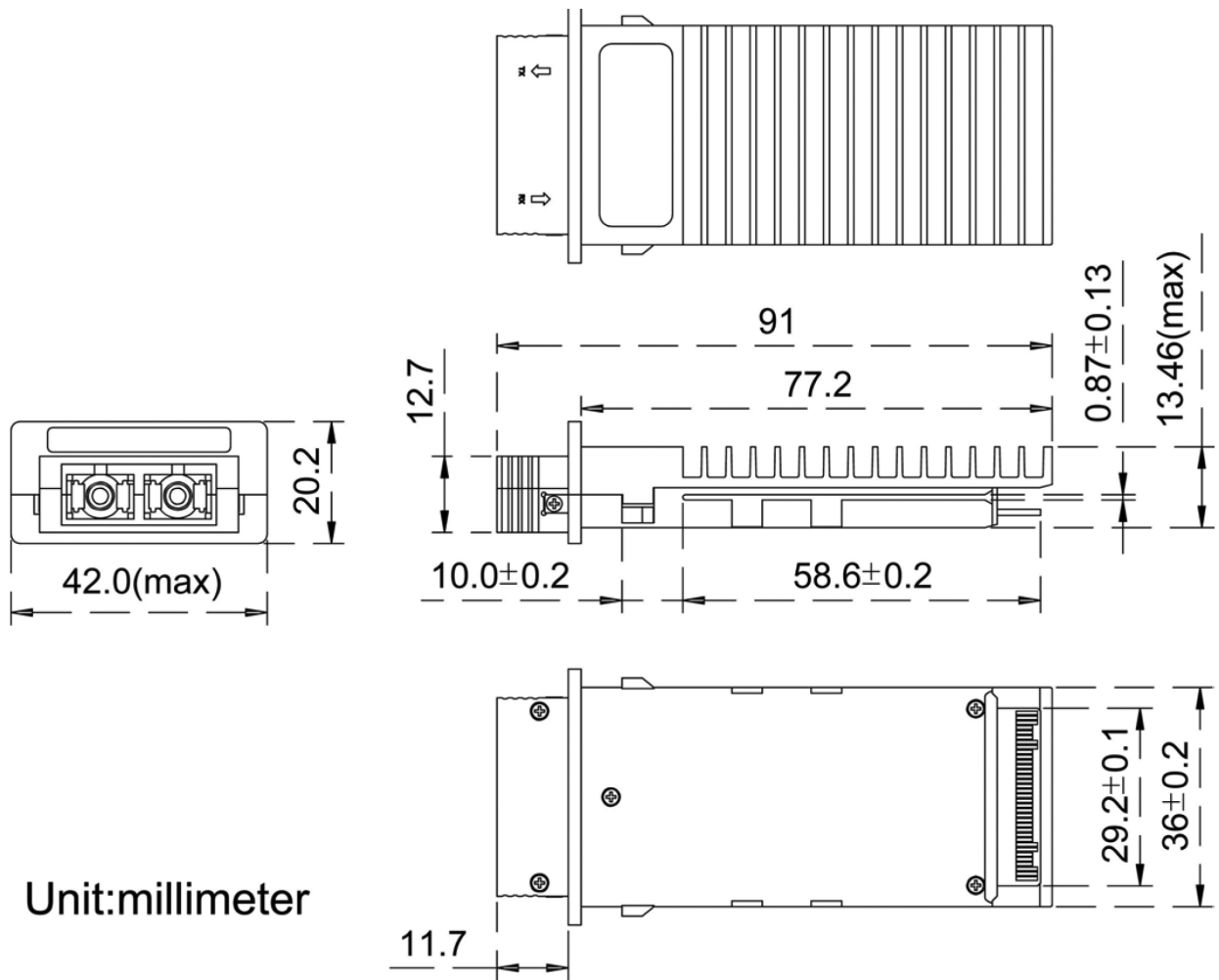
MDIO I/O AC Characteristics (MDIO; MDC)

MDIO Data Hold Time	THOLD	10			ns	
MDIO Data Setup Time	TSU	10			ns	
Delay from MDC Rising Edge to MDIO Data Change	TDELAY			300	ns	
MDC Clock Rate	fMAX			2.5	MHz	

Digital Diagnostic

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Temperature Monitor	TMON	-5		+5	°C	
Laser Bias Monitor	IMON	-10		10	%	
TX Power Monitor	PTX	-3		+3	dBm	
RX Power Monitor	PRX	-3		+3	dBm	

Dimensions:



Unit: millimeter

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

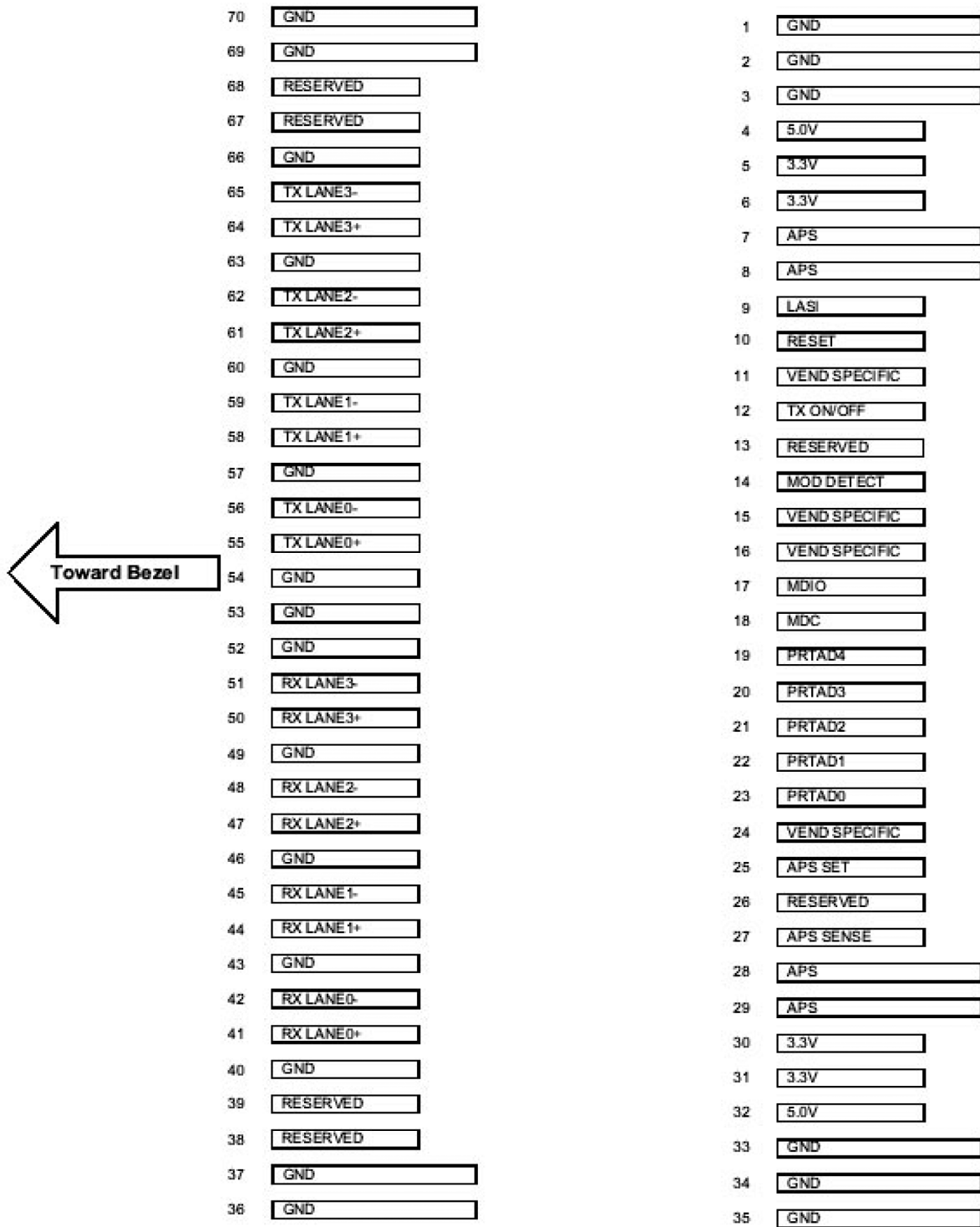
Pin Assignment – Pin 1 to Pin 35

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