Finisar

Product Specification

RoHS-6 Compliant
10GBASE-LRM X2 Transponder

FTLX1341E2

PRODUCT FEATURES

- Hot pluggable X2 MSA form factor
- Total power consumption: 4.0 W maximum
- RoHS-6 compliant (lead-free)
- Temperature range 0°C to 70°C
- Transmission distance up to 220m*
- Uncooled 1310 nm directly modulated Fabry-Perot (FP) laser
- Built In Advanced Electronic Dispersion Compensation (EDC)
- SC connector, multimode fiber
- Full duplex transmission mode
- Digital Optics Monitoring (DOM)
- Power supply: +5.0 V, +3.3 V
- Adaptable Power Supply (APS: +1.2 V)
- XAUI electrical interface
  - 4 x 3.125 Gb/s Ethernet
- 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

- IEEE 802.3aq-2006
- 10 Gb/s Ethernet transmission on legacy multimode fiber.

The Finisar FTLX1341E2 transponder incorporates Electronic Dispersion Compensation (EDC) which provides correction for the severe modal dispersion that may occur during propagation through links up to 220m on legacy installed FDDI multimode fiber. The EDC device incorporates a Feed Forward Equalizer (FFE) and a Decision Feedback Equalizer (DFE). The EDC also contains sophisticated clock recovery architecture for extracting a robust clock from extremely distorted signals.

PRODUCT SELECTION

FTLX1341E2

* Maximum reach as defined by IEEE. Longer reach possible depending upon link implementation.

I. Pin Description

Signal Name	Level	I/O	Pin No.	Description
Management and Monitoring Ports				
MDIO	Open Drain (output) 1.2V CMOS (input)	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	1.2 V CMOS	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	1.2 V CMOS	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	Module Detect. Pulled low inside transponder through a 1 kΩ resistor to Ground
Transmit Functions				
Reserved Reserved		I I	68 67	Reserved For Future Use Reserved For Future Use
TX LANE 3– TX LANE 3+	AC-coupled, Internally biased differential XAUI	I I	65 64	Module XAUI Input Lane 3– Module XAUI Input Lane 3+
TX LANE 2– TX LANE 2+		I I	62 61	Module XAUI Input Lane 2– Module XAUI Input Lane 2+
TX LANE 1– TX LANE 1+		I I	59 58	Module XAUI Input Lane 1– Module XAUI Input Lane 1+
TX LANE 0– TX LANE 0+		I I	56 55	Module XAUI Input Lane 0– Module XAUI Input Lane 0+

Receive Functions				
Reserved Reserved		O O	38 39	Reserved For Future Use Reserved For Future Use
RX LANE 0+ RX LANE 0–	AC-coupled, Internally biased differential XAUI	O O	41 42	Module XAUI Output Lane 0+ Module XAUI Output Lane 0–
RX LANE 1+ RX LANE 1–		O O	44 45	Module XAUI Output Lane 1+ Module XAUI Output Lane 1–
RX LANE 2+ RX LANE 2–		O O	47 48	Module XAUI Output Lane 2+ Module XAUI Output Lane 2–
RX LANE 3+ RX LANE 3–		O O	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 1180Ω resistor inside the transponder.
3.3 V	+3.3 V DC		5, 6, 30, 31	DC Power Input, +3.3 V DC, Nominal
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.

Electrical Pad Layout

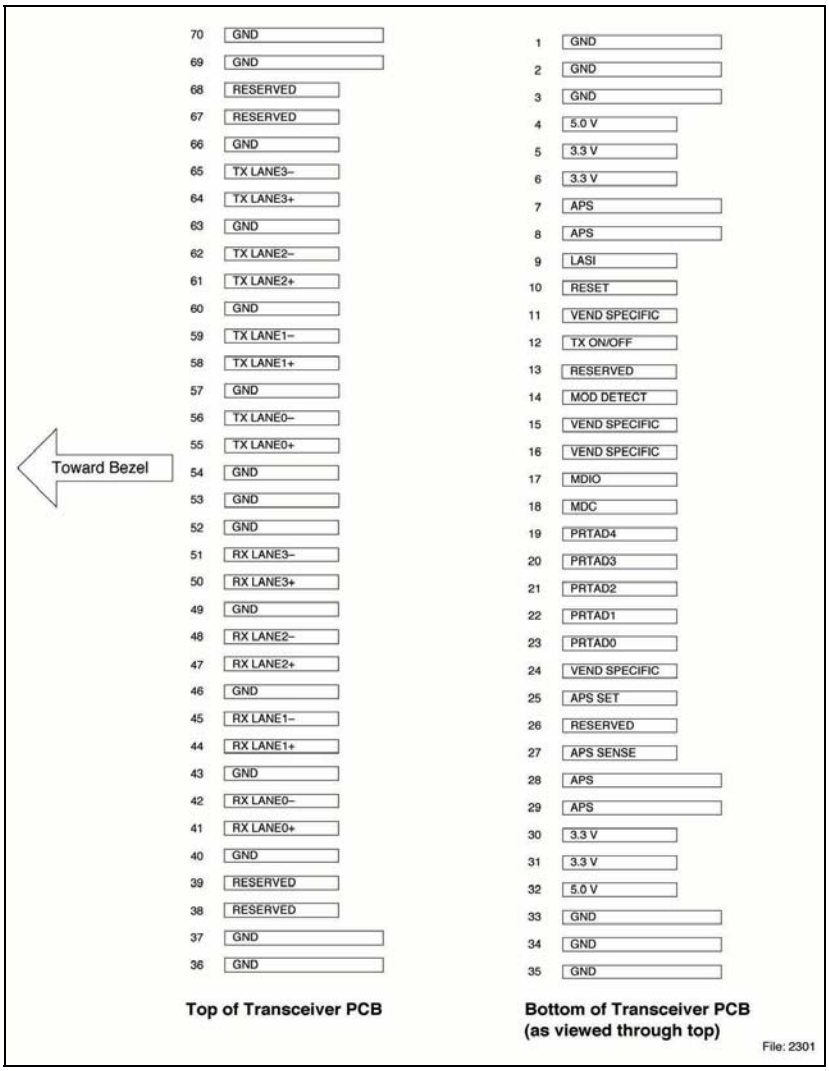


Figure 1- X2 Transponder Electrical Pad Layout

II. Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Storage Temperature[1)]	T_S	-40	85	°C
Supply Voltage +5.0 V	V_5	0	6	V
Supply Voltage +3.3 V	V_3	0	4	V
Supply Voltage APS	V_{aps}	0	1.5	V
Static Discharge Voltage, All Pins[2)]	ST_d		500	V
Average Receive Optical Power	$Rx_{P\ max}$		1.5	dBm

Notes:
1) Non-condensing
2) HBM

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device.

III. Electrical Characteristics

Recommended Operating Conditions

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Operating Case Temperature[1)]	T_C	0		70	°C
Transponder Total Power Consumption	P			4	W
Supply Voltage +5.0 V	V_{CC5}	4.75	5.0	5.25	V
Supply Current +5.0 V	I_{CC5}			10	mA
Supply Voltage +3.3 V	V_{CC3}	3.14	3.3	3.47	V
Supply Current +3.3 V	I_{CC3}			830	mA
Supply Voltage APS	$V_{CC\ aps}$	1.152	1.2	1.248	V
Supply Current APS	$I_{CC\ aps}$			850	mA

[1)] Measured at reference thermal location, see **Figure 3**.
See also **Environmental Performance.**

Electrical DC Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
1.2 V CMOS (1.8 V CMOS Compatible[1)]) I/O DC Characteristics (PRTAD; LASI; RESET; TX_ONOFF)					
External Pull-up Resistor for Open Drain	R_{pullup}	10		22	kΩ
Output High Voltage[2)]	V_{oh}	1			V
Output Low Voltage[2)]	V_{ol}			0.15	V
Input High Voltage	V_{ih}	0.84		1.5	V
Input Low Voltage	V_{il}			0.36	V
Input Pull-down Current[3)]	I_{pd}	20		120	µA
MDIO I/O 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
Output Low Voltage[5)]	V_{OL}	–0.3		0.2	V
Output Low Current	I_{OL}			20	mA
Input High Voltage	V_{IH}	0.84	1.2	1.5	V
Input Low Voltage	V_{IL}	–0.3		0.36	V
Pull-up Supply Voltage	V_{PU}	0.84	1.2	1.5	V
Input Capacitance	C_{IN}			10	pF
Load Capacitance	C_{LOAD}			470	pF
External Pull-up Resistance	R_{LOAD}	200			Ω
Power-On Reset AC Characteristics					
Power-On Reset and TX_ONOFF Characteristics	According to XENPAK MSA Issue 3.0 Draft 4.0, 2002-9-9				

[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)] $R_{pull\text{-}up}$ = 10 kΩ to 1.8 V.
[3)] V_{in} = 1.8 V.
[4)] AC coupled.
[5)] I_{OL} = 100 µA.

Electrical AC Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
XAUI Input AC Characteristics (TXLANE[0..3])					
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	Ω
Differential Return Loss[1)]	$\|S_{11}\|$	10			dB
Input Differential Skew[2)]	t_{SKEWIN}			75	ps
Jitter Amplitude Tolerance[3)]	$J_{XAUITOL}$			0.65	UI_{p-p}
XAUI Output AC Characteristics (RXLANE[0..3])					
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 Impedance	$Z_{OUTXAUI}$	80	100	120	Ω
Differential Output Return Loss[1)]	$\|S_{22}\|$	10			dB

1) 100 MHz to 2.5 GHz.
2) At crossing point.
3) Per IEEE Std 802.3ae.

IV. Optical Characteristics

RMS Spectral Width Mask

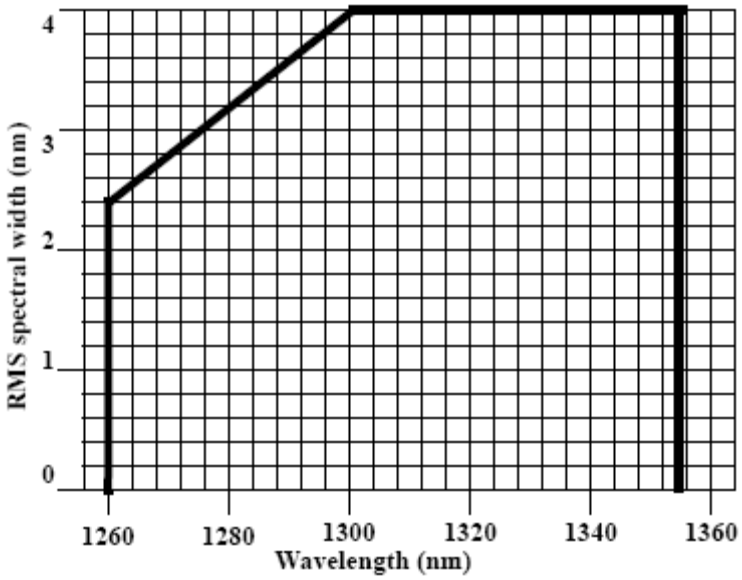


Figure 2-Transmitter Maximum RMS Spectral Width

Optical Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Optical Modulation Amplitude (OMA)	P_{OMA}	-4.5		+1.5	dBm	
Average Launch Power	P_{AVE}	-6.5		+0.5	dBm	
Peak Launch Power	P_{MAX}			+3	dBm	
Optical Wavelength	λ	1260		1355	nm	
Spectral Width	λ_{rms} @1260nm			2.4	nm	1
	λ_{rms} @ 1260nm-1300nm			See Figure 2		
	λ_{rms} @ 1300nm-1355nm			4		
Optical Extinction Ratio	*ER*	3.5			dB	
Optical Eye Mask Margin		0			%	2
Transmitter Waveform Dispersion Penalty	*TWDP*			4.7	dB	3
Average Launch Power of OFF Transmitter	P_{OFF}			-30	dBm	
Uncorrelated Jitter [rms]	Tx_j			0.033	UI	
Relative Intensity Noise	$RIN_{20}OMA$			-128	dB/Hz	
Encircled Flux	<5μm	30			%	
	<11μm	81				
Tramsmitter Reflectance				-12	dB	
Receiver						
Overload in OMA		+1.5			dBm	4
Comprehensive Stressed Receiver Sensitivity (OMA) @ 10.3125Gb/s	Precursor			-6.5	dBm	
	Symmetrical			-6.0		
	Postcursor			-6.5		
Optical Center Wavelength	λ_C	1260		1355	nm	
Receiver Reflectance	R_{rx}			-12	dB	
Signal Detect Deassert Level	P_{SDD}			-14.4	dBm	
Signal Detect Assert Level	P_{SDA}	-25.0			dBm	
Signal Detect Hysteresis	P_{SDH}	0.5	1.5		dB	

Notes:
1) Maximum RMS spectral width as specified by Figure 68-3 in IEEE802.3aq -2006
2) Optical eye mask per IEEE802.3aq -2006.
3) TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3aq -2006
4) Receiver overload specified in OMA and under the worst comprehensive stressed condition.

V. General Specifications

Optical Interface Standard Specifications

Fiber Type	850nm OFL Bandwidth	Symbol	Distance [1]	Units
62.5μm	"FDDI" 160MHz/km	Lmax	220	m
	OM1 200MHz/km		220	
50μm	400MHz/km	Lmax	100	m
	OM2 500MHz/km		220	
	OM3 2000MHz/km		220	

Notes:
1) Operating range as defined by IEEE standards. Longer reach possible depending upon link implementation.

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 multimode 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 Requirement

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

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

VI. Regulatory Compliance

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 ±2 kV to ±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 field strength of 10 V/m, noise frequency ranges from 10 MHz to 2 GHz. No effect on module performance between the specification limits.
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.

Eye Safety

Finisar FTLX1341E2 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 72082131
Electrical Safety	TÜV	EN 60950	R 72082131
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	1439230

Copies of the referenced certificates are available from Finisar Corporation upon request.

VII. DOM Parameters

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

[1)] 0 to 70°C case temperature.
[2)] 0 to 12.5 mA.
[3)] -8.2 dBm to +0.5 dBm.

VIII. Mechanical Specifications

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Module Retention Force (latch strength)	F_{RET}		200		N
Module Insertion Force	F_{IN}		40		N
Module Extraction Force (with kick-out)	F_{EXT-K}		16		N
Module Extraction Force (without kick-out)	F_{EXT}		25		N

Pull Sleeve front face color is orange.

Package Outline

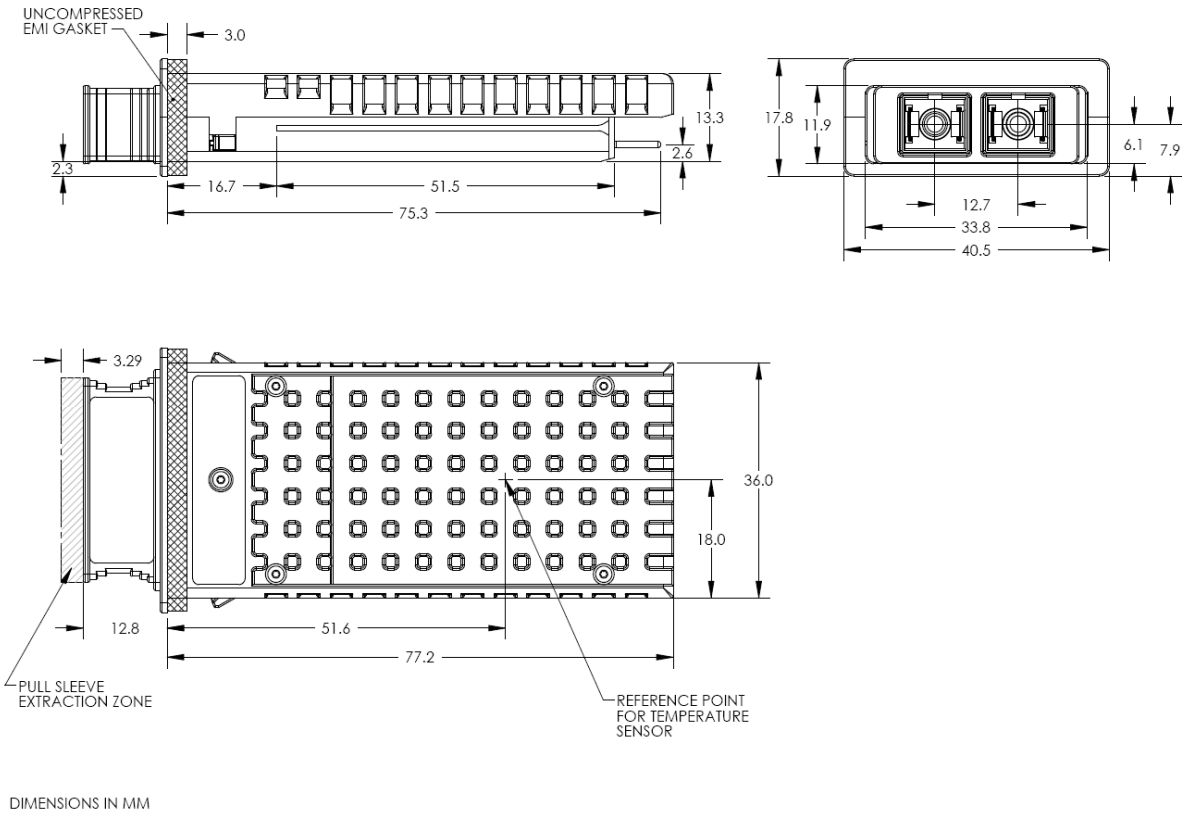


Figure 3-X2 Mechanical Dimensions

IX. References

The following references are provided for informational purposes only. The parameters and operational behavior outlined in this specification describe the complete functionality of the 10G Transponder. Contact Finisar for any items concerning the operational characteristics of this device.

1. IEEE 802.3ae-2002, August 30, 2002.
2. IEEE Std 802.3aq™-2006
3. X2 MSA Rev 2.0b, January 30, 2003

X. For More Information

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