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F i n i s a r

Product Specification
+2400 ps/nm (~120km) TDM XFP Optical Transceiver
FTLX4213M3BCL

PRODUCT FEATURES

- Supports 9.95Gb/s to 10.3Gb/s

- 0 to +2400 ps/nm Dispersion Tolerance (~120km reach without dispersion compensation)

- Supports <60 seconds Tx_Disable Negate time

- Temperature-stabilized CML^{TM} transmitter

- Temperature range: -5°C to 70°C

- RoHS-6 Compliant (lead-free)

- Power dissipation <3.5W

- Built-in digital diagnostic functions

- Adjustable receiver threshold

APPLICATIONS

- 10Gb/s SONET/SDH

- 10Gb/s Ethernet

Finisar's FTLX4213M3BCL Small Form Factor 10Gb/s (XFP) transceiver complies with the XFP Multi-Source Agreement (MSA) Specification[1]. It supports 10Gb/s SONET/SDH,10 Gigabit Ethernet, and 10 Gigabit Fibre Channel applications over ~120km of fiber without dispersion compensation. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA. The transceiver is RoHS compliant and lead free per Directive 2002/95/EC[3], and Finisar Application Note AN-2038[4].

PRODUCT SELECTION

<div style="border:1px solid">

FTLX4213M3BCL

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I.   Pin Descriptions

Pin	Logic	Symbol	Name/Description	Ref.
1		GND	Module Ground	1
2		VEE5	Optional –5.2 Power Supply – **Not required**	
3	LVTTL-I	Mod-Desel	Module De-select; When held low allows the module to respond to 2-wire serial interface commands	
4	LVTTL-O	$\overline{\text{Interrupt}}$	Interrupt (bar); Indicates presence of an important condition which can be read over the serial 2-wire interface	2
5	LVTTL-I	TX_DIS	Transmitter Disable; Transmitter laser source turned off	
6		VCC5	+5 Power Supply	
7		GND	Module Ground	1
8		VCC3	+3.3V Power Supply	
9		VCC3	+3.3V Power Supply	
10	LVTTL-I	SCL	Serial 2-wire interface clock	2
11	LVTTL-I/O	SDA	Serial 2-wire interface data line	2
12	LVTTL-O	Mod_Abs	Module Absent; Indicates module is not present. Grounded in the module.	2
13	LVTTL-O	Mod_NR	Module Not Ready; Finisar defines it as a logical OR between RX_LOS and Loss of Lock in TX/RX.	2
14	LVTTL-O	RX_LOS	Receiver Loss of Signal indicator	2
15		GND	Module Ground	1
16		GND	Module Ground	1
17	CML-O	RD-	Receiver inverted data output	
18	CML-O	RD+	Receiver non-inverted data output	
19		GND	Module Ground	1
20		VCC2	+1.8V Power Supply – **Not required**	
21	LVTTL-I	P_Down/RST	Power Down; When high, places the module in the low power stand-by mode and on the falling edge of P_Down initiates a module reset	
			Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle.	
22		VCC2	+1.8V Power Supply – **Not required**	
23		GND	Module Ground	1
24	PECL-I	RefCLK+	Reference Clock non-inverted input, AC coupled on the host board – **Not required**	
25	PECL-I	RefCLK-	Reference Clock inverted input, AC coupled on the host board – **Not required**	
26		GND	Module Ground	1
27		GND	Module Ground	1
28	CML-I	TD-	Transmitter inverted data input	
29	CML-I	TD+	Transmitter non-inverted data input	
30		GND	Module Ground	1

Notes:
1. Module circuit ground is isolated from module chassis ground within the module.
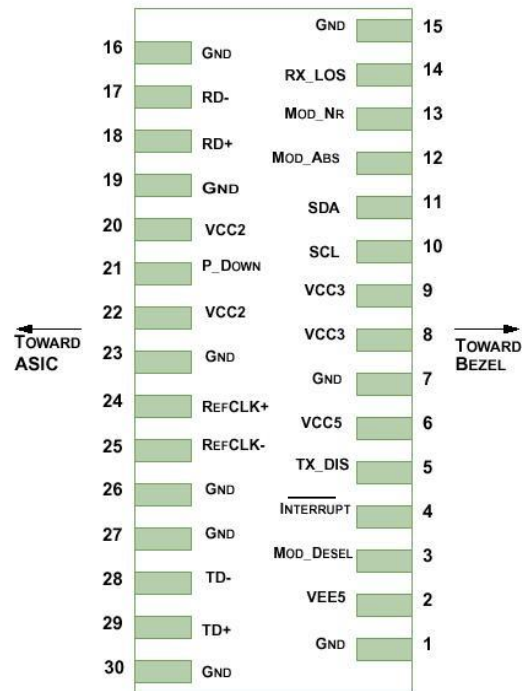2. Open collector; should be pulled up with 4.7k – 10kohms on host board to a voltage between 3.15V and 3.6V.

Diagram of Host Board Connector Block Pin Numbers and Names

II.   Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage #1	Vcc3	-0.5		4.0	V	
Maximum Supply Voltage #2	Vcc5	-0.5		6.0	V	
Storage Temperature	T_S	-40		85	°C	
Case Operating Temperature	T_{OP}	-5		70	°C	
Receiver Damage Threshold	P_{Rdmg}	+1			dBm	

III. Electrical Characteristics (T$_{OP}$ = -5 to 70 °C, V$_{CC5}$ = 4.75 to 5.25 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage #1	Vcc5	4.75		5.25	V	
Supply Voltage #2	Vcc3	3.13		3.46	V	
Supply Current – Vcc5 supply	Icc5			500	mA	
Supply Current – Vcc3 supply	Icc3			650	mA	
Module total power	P			3.5	W	1
Transmitter						
Input differential impedance	R$_{in}$		100		Ω	2
Differential data input swing	Vin,pp	120		820	mV	
Transmit Disable Voltage	V$_D$	2.0		Vcc	V	3
Transmit Enable Voltage	V$_{EN}$	GND		GND+ 0.8	V	
Transmit Disable Assert Time				100	us	
Transmit Disable De-Assert Time				60	seconds	
Receiver						
Differential data output swing	Vout,pp	340	650	850	mV	4
Data output rise time	t$_r$			38	ps	5
Data output fall time	t$_f$			38	ps	5
LOS Fault	V$_{LOS\ fault}$	Vcc – 0.5		Vcc$_{HOST}$	V	6
LOS Normal	V$_{LOS\ norm}$	GND		GND+0.5	V	6
Power Supply Rejection	PSR		See Note 7 below			7

Notes:
1. Maximum total power value is specified across the full temperature and voltage range.
2. After internal AC coupling.
3. Or open circuit.
4. Into 100 ohms differential termination.
5. 20 – 80 %
6. Loss Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
7. Per Section 2.7.1. in the XFP MSA Specification[1].

IV. Optical Characteristics (EOL, T_{OP} = -5 to 70°C, V_{CC5} = 4.75 to 5.25 Volts)

Transmitter						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Ref.**
Output Opt. Pwr: 9/125 SMF	P_{OUT}	0		+4.0	dBm	
Optical Extinction Ratio	ER	8.2			dB	1
Operating Wavelength Range		1530		1560	nm	
SBS Threshold		13			dBm	
Tx_Disable Negate Time				60	seconds	3
Sidemode Suppression ratio	SSR_{min}	35			dB	
Tx Jitter 20kHz-80MHz	Tx_{j1}			0.3	UI	4,5
Tx Jitter 4MHz – 80MHz	Tx_{j2}			0.1	UI	4,5
Relative Intensity Noise	RIN			-135	dB/Hz	
Receiver						
Maximum Input Power	P_{MAX}	-9			dBm	
Optical Center Wavelength	λ_C	1270		1615	nm	
Receiver Reflectance	R_{rx}			-27	dB	
LOS De-Assert	LOS_D			-30	dBm	
LOS Assert	LOS_A	-37			dBm	
LOS Hysteresis		0.5			dB	

Receiver Sensitivity					6
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Sensitivity back-to-back at OSNR>30dB (dBm)	Sensitivity at 0 to +2400ps/nm with OSNR>30dB (dB)	Threshold Adjustm.
9.95	1e-12	0 to +2400	-22	-21	No
10.3	1e-12	0 to +2400	-22	-21	No

Notes:
1. Measured with unfiltered eye pattern. (without 4th order Bessel-Thompson Filter)
2. SBS Threshold is achieved without dithering
3. X = Specified ITU Grid frequency. Wavelength stability is achieved within 70 seconds of power up. Tx_Disable Negate time spec of <60 seconds
4. Measured with a host jitter of 50 mUI peak-to-peak.
5. GR-253-CORE Issue 4
6. Measured at 1528-1600nm with worst ER; BER<10^{-12}; PRBS31.

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate	BR	9.95		10.3	Gb/s	1
Maximum Supported Link Length	L_{MAX}		120		km	2

Notes:
1. SONET OC-192, 10G Ethernet
2. Distance indicates dispersion budget. Optical amplification is required to achieve maximum distance.

VI. Environmental Specifications

Finisar FTLX4213M3BCL XFP transceivers have an operating temperature range from -5°C to +70°C case temperature.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	-5		70	°C	
Storage Temperature	T_{sto}	-40		85	°C	

VII. Regulatory Compliance

Finisar FTLX4213M3BCL XFP transceivers 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	TBD
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	TBD
Electrical Safety	TÜV	EN 60950	TBD
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	TBD

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

VIII.   Digital Diagnostics Functions

As defined by the XFP MSA[1], Finisar XFP transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage
- TEC Temperature

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.
- The FTLX4213M3BCL has a Tx_Disable time of <100$u$sec, and Tx_NR is not implemented.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the XFP transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the XFP transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 000h to the maximum address of the memory.

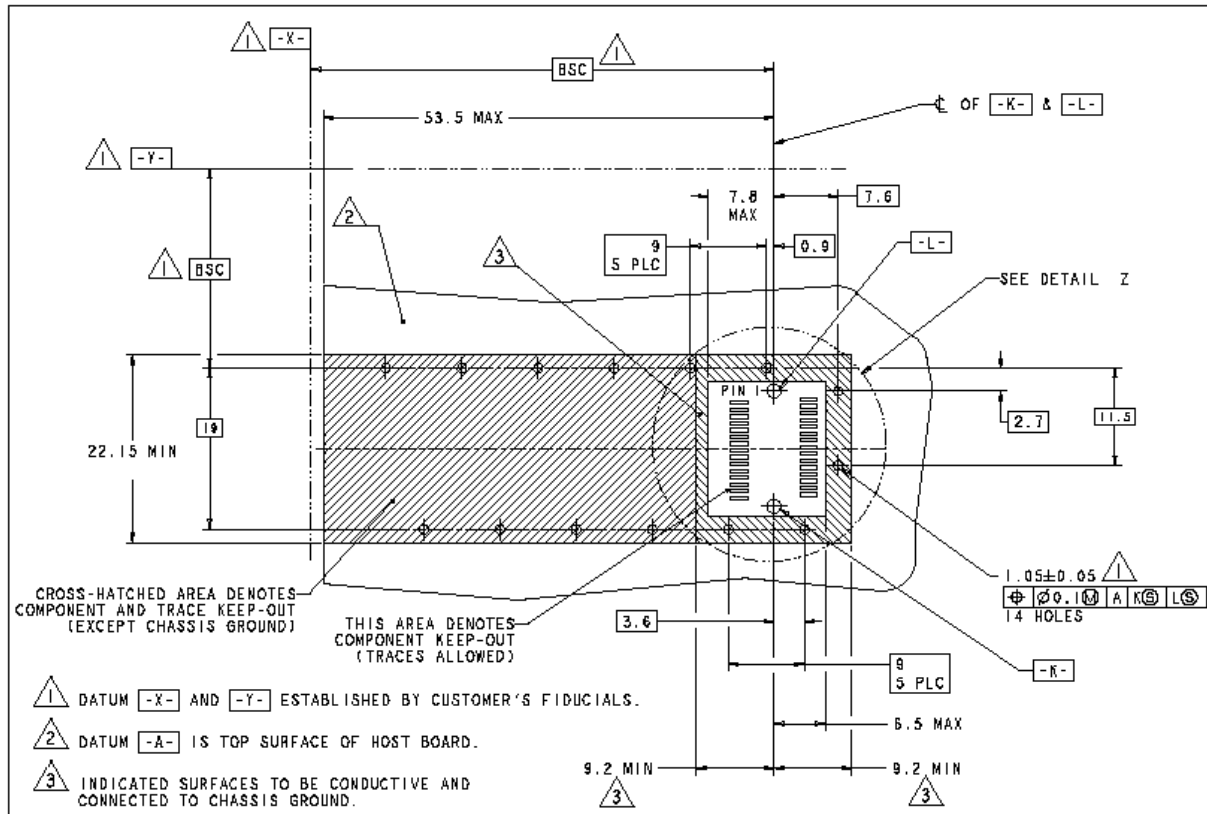For more detailed information, including memory map definitions, please see the XFP MSA documentation[1].

IX.   Mechanical Specifications

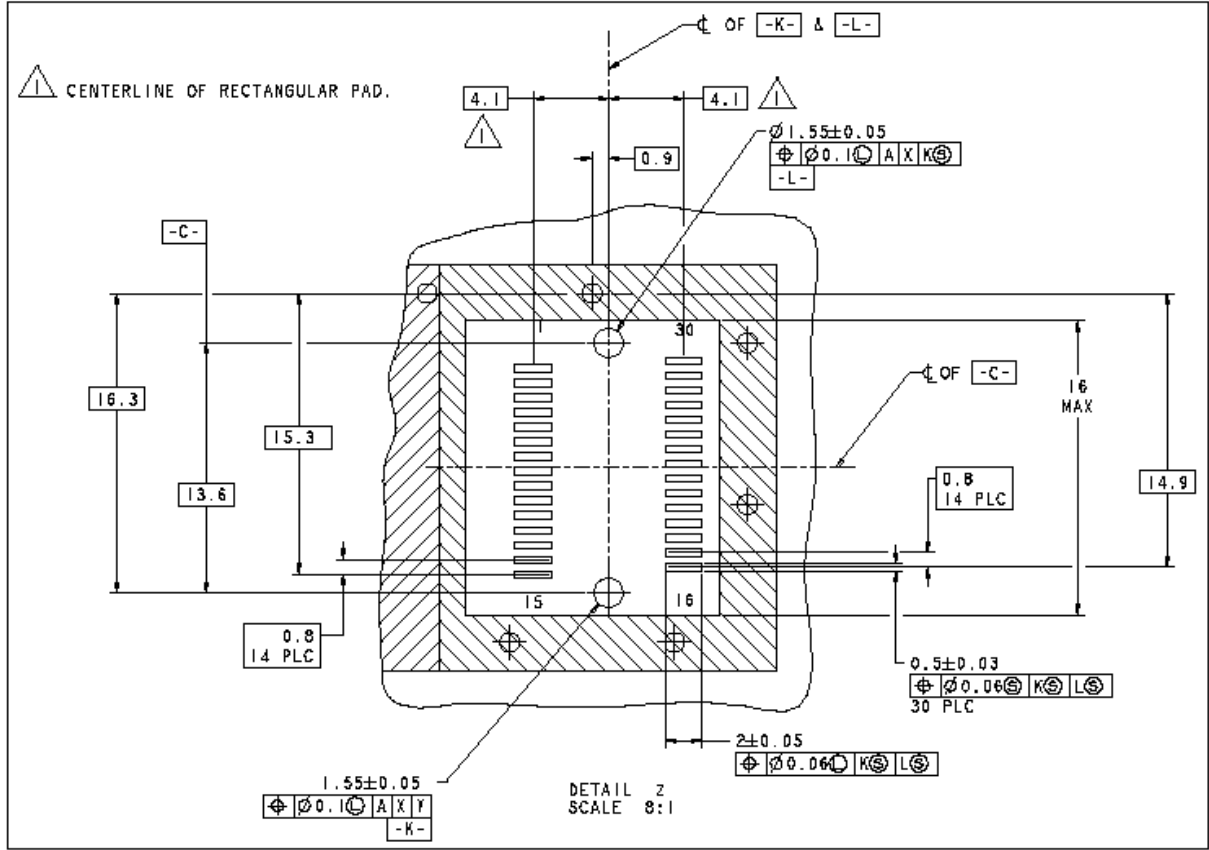Finisar's XFP transceivers are compliant with the dimensions defined by the XFP Multi-Sourcing Agreement (MSA).
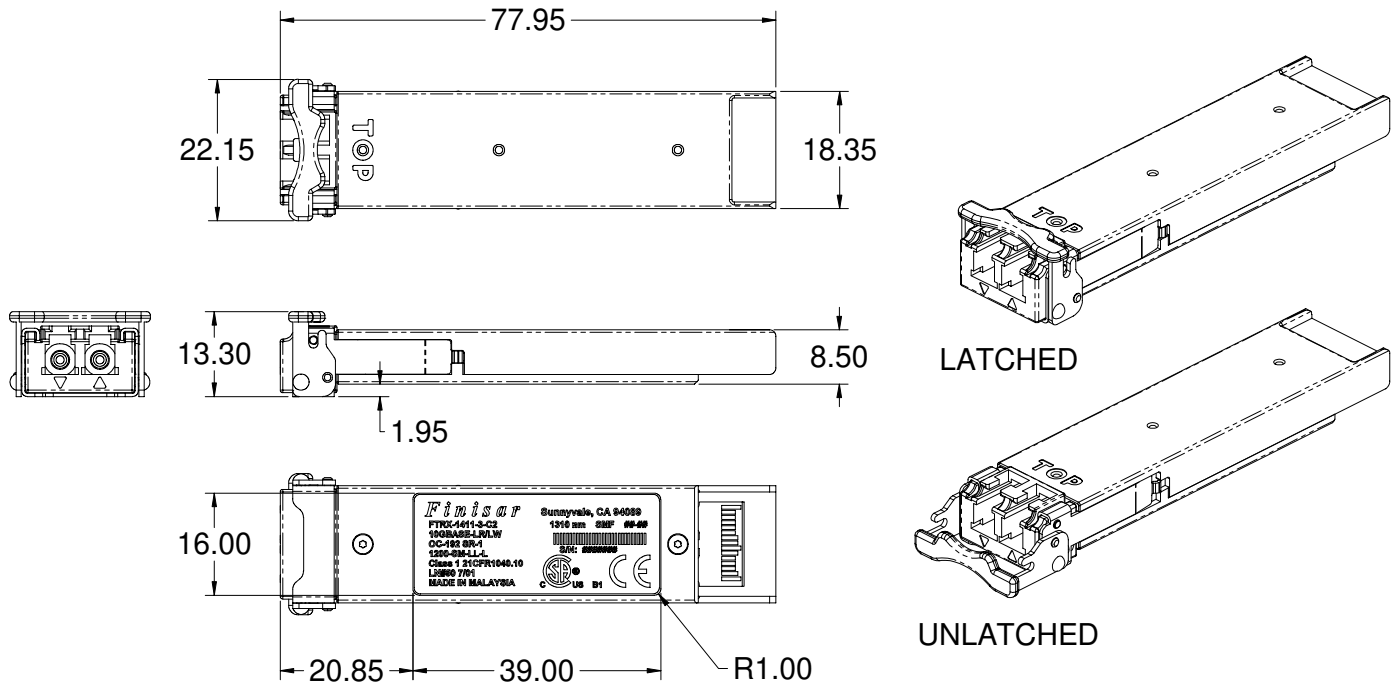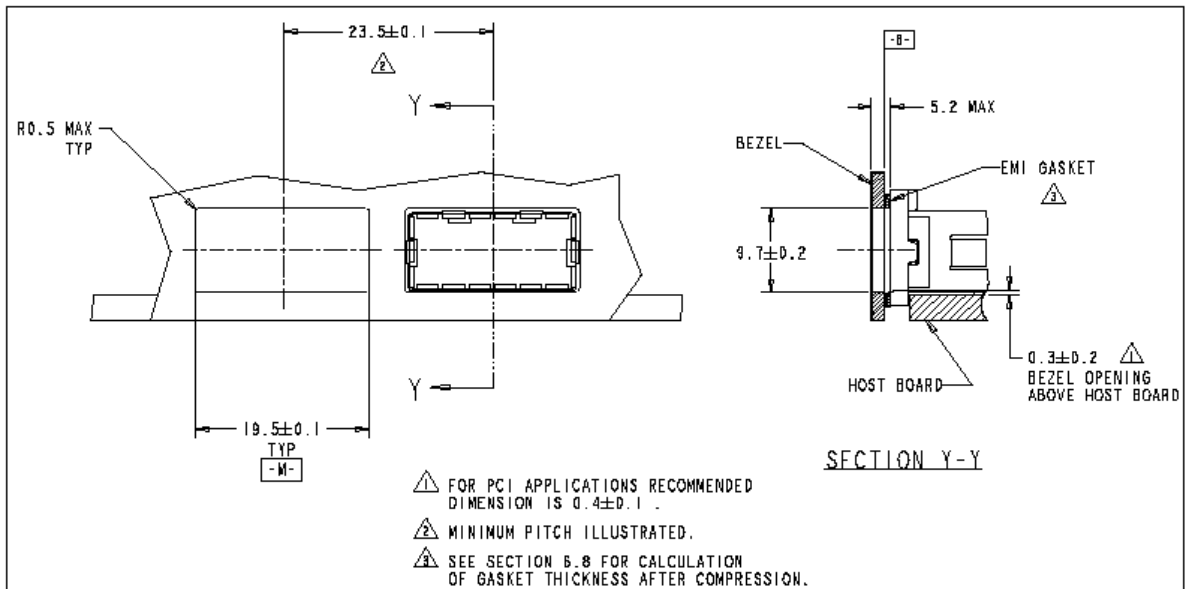

XFP Transceiver (dimensions are in mm)

X.   PCB Layout and Bezel Recommendations

XFP Host Board Mechanical Layout (dimensions are in mm)

XFP Detail Host Board Mechanical Layout (dimensions are in mm)

XFP Recommended Bezel Design (dimensions are in mm)

XI. Notes & Exceptions

The FTLX4213M3xxxx product family has the following exceptions to the XFP MSA;

- o Tx_Disable time of <100*u*sec,
- o Tx_Disable negate time of <60seconds
- o Tx_NR is not implemented.
- o Reset Completion Bit is not implemented in EEPROM (Table 0: Byte 84: Bit 0)

XII. References

1. 10 Gigabit Small Form Factor Pluggable Module (XFP) Multi-Source Agreement (MSA), Rev 4.5 – August 2005. Documentation is currently available at http://www.xfpmsa.org/

2. Application Note AN-2035: "Digital Diagnostic Monitoring Interface for XFP Optical Transceivers" – Finisar Corporation, December 2003

3. Directive 2002/95/EC of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment". January 27, 2003.

4. "Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers", Finisar Corporation, January 21, 2005.

XIII. Datasheet Revision History

Revision	Date	Description
A2	7/15/2010	• Beta Sample Datasheet
B1	8/27/2010	• Added "Notes & Exceptions" Summary
B2	9/27/2010	• Corrected back-to-back Rx Sensitivity Spec
B3	7/18/2011	• Corrected SBS & Tx_Disable timing specifications

XIV. For More Information

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