

Product Specification

High Link Budget, Multi-Rate, DWDM XFP Optical Transceiver

FTLX3912M3xx

PRODUCT FEATURES

- Supports 8.5Gb/s* to 11.3Gb/s bit rates
- 100GHz channel spacing on the ITU C-band
- Hot-pluggable XFP footprint
- RoHS-6 Compliant (lead-free)
- Temperature-stabilized 1550nm EML transmitter
- Supports -300ps/nm to +800ps/nm
- 3.3V and 5V power supplies required
- Point-to-Point & OSNR optimized versions
- Power dissipation < 3.5W
- Commercial temperature range: 0°C to 70°C
- Reference clock not required



APPLICATIONS

- SONET OC-192 IR-2 Transmitter w/APD
- SDH STM S-64.2b Transmitter w/APD
- SDH STM S-64.3b Transmitter w/APD
- ITU-T G.709 Transmitter w/APD
- 10GBASE-ER/EW Transmitter w/APD
- 10GBASE-ER/EW + FEC Tx w/APD
- 40km 10G Fibre Channel Transmitter w/APD

Finisar's 40km DWDM FTLX3912M3xx Small Form Factor 10Gb/s XFP transceivers comply with the current XFP Multi-Source Agreement (MSA) Specification¹. The transmitter specification is based upon SONET OC-192 IR-2, OC-192 IR-3, SDH STM S-64.2b, STM S-64.3b and 10-Gigabit Ethernet 10GBASE-ER/EW per IEEE 802.3ae but uses an APD ROSA for additional link budget. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA. The optical transceiver is compliant per the RoHS Directive 2011/65/EU³. See Finisar Application Note AN-2038 for more details⁴.

PRODUCT SELECTION

FTLX3912M3xx

xx: 100GHz ITU Grid wavelength (see next page)

Part Numbers for Amplified (OSNR) Applications:

Channel #	Product Code	Frequency (THz)	Center Wavelength (nm)
17	FTLX3912M317	191.7	1563.86
18	FTLX3912M318	191.8	1563.05
19	FTLX3912M319	191.9	1562.23
20	FTLX3912M320	192.0	1561.42
21	FTLX3912M321	192.1	1560.61
22	FTLX3912M322	192.2	1559.79
23	FTLX3912M323	192.3	1558.98
24	FTLX3912M324	192.4	1558.17
25	FTLX3912M325	192.5	1557.36
26	FTLX3912M326	192.6	1556.55
27	FTLX3912M327	192.7	1555.75
28	FTLX3912M328	192.8	1554.94
29	FTLX3912M329	192.9	1554.13
30	FTLX3912M330	193.0	1553.33
31	FTLX3912M331	193.1	1552.52
32	FTLX3912M332	193.2	1551.72
33	FTLX3912M333	193.3	1550.92
34	FTLX3912M334	193.4	1550.12
35	FTLX3912M335	193.5	1549.32
36	FTLX3912M336	193.6	1548.51
37	FTLX3912M337	193.7	1547.72
38	FTLX3912M338	193.8	1546.92
39	FTLX3912M339	193.9	1546.12
40	FTLX3912M340	194.0	1545.32
41	FTLX3912M341	194.1	1544.53
42	FTLX3912M342	194.2	1543.73
43	FTLX3912M343	194.3	1542.94
44	FTLX3912M344	194.4	1542.14
45	FTLX3912M345	194.5	1541.35
46	FTLX3912M346	194.6	1540.56
47	FTLX3912M347	194.7	1539.77
48	FTLX3912M348	194.8	1538.98
49	FTLX3912M349	194.9	1538.19
50	FTLX3912M350	195.0	1537.40
51	FTLX3912M351	195.1	1536.61
52	FTLX3912M352	195.2	1535.82
53	FTLX3912M353	195.3	1535.04
54	FTLX3912M354	195.4	1534.25
55	FTLX3912M355	195.5	1533.47
56	FTLX3912M356	195.6	1532.68
57	FTLX3912M357	195.7	1531.90
58	FTLX3912M358	195.8	1531.12
59	FTLX3912M359	195.9	1530.33
60	FTLX3912M360	196.0	1529.55
61	FTLX3912M360	196.0	1528.77

Part Numbers for Point-to-Point (maximum Link Budget) Applications:

Channel #	Product Code	Frequency (THz)	Center Wavelength (nm)
17*	FTLX3912M317P	191.7	1563.86
18*	FTLX3912M318P	191.8	1563.05
19	FTLX3912M319P	191.9	1562.23
20	FTLX3912M320P	192.0	1561.42
21	FTLX3912M321P	192.1	1560.61
22	FTLX3912M322P	192.2	1559.79
23	FTLX3912M323P	192.3	1558.98
24	FTLX3912M324P	192.4	1558.17
25	FTLX3912M325P	192.5	1557.36
26	FTLX3912M326P	192.6	1556.55
27	FTLX3912M327P	192.7	1555.75
28	FTLX3912M328P	192.8	1554.94
29	FTLX3912M329P	192.9	1554.13
30	FTLX3912M330P	193.0	1553.33
31	FTLX3912M331P	193.1	1552.52
32	FTLX3912M332P	193.2	1551.72
33	FTLX3912M333P	193.3	1550.92
34	FTLX3912M334P	193.4	1550.12
35	FTLX3912M335P	193.5	1549.32
36	FTLX3912M336P	193.6	1548.51
37	FTLX3912M337P	193.7	1547.72
38	FTLX3912M338P	193.8	1546.92
39	FTLX3912M339P	193.9	1546.12
40	FTLX3912M340P	194.0	1545.32
41	FTLX3912M341P	194.1	1544.53
42	FTLX3912M342P	194.2	1543.73
43	FTLX3912M343P	194.3	1542.94
44	FTLX3912M344P	194.4	1542.14
45	FTLX3912M345P	194.5	1541.35
46	FTLX3912M346P	194.6	1540.56
47	FTLX3912M347P	194.7	1539.77
48	FTLX3912M348P	194.8	1538.98
49	FTLX3912M349P	194.9	1538.19
50	FTLX3912M350P	195.0	1537.40
51	FTLX3912M351P	195.1	1536.61
52	FTLX3912M352P	195.2	1535.82
53	FTLX3912M353P	195.3	1535.04
54	FTLX3912M354P	195.4	1534.25
55	FTLX3912M355P	195.5	1533.47
56	FTLX3912M356P	195.6	1532.68
57	FTLX3912M357P	195.7	1531.90
58	FTLX3912M358P	195.8	1531.12
59	FTLX3912M359P	195.9	1530.33
60	FTLX3912M360P	196.0	1529.55
61	FTLX3912M361P	196.0	1528.77

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	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.

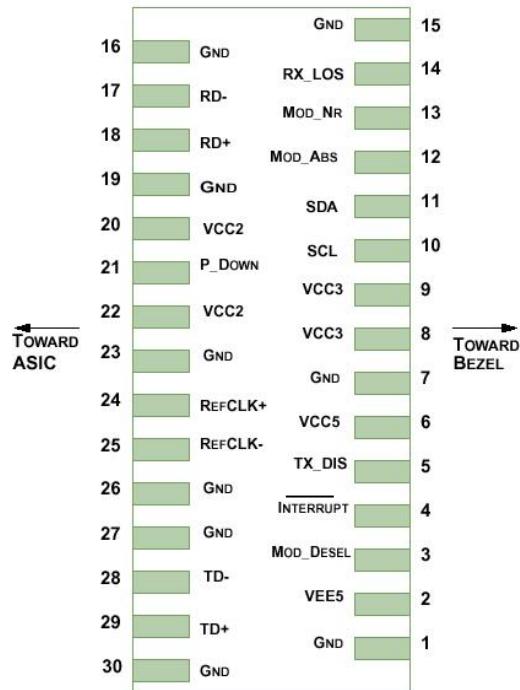


Diagram of Host Board Connector Block Pin Numbers and Names

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage 1	V _{cc3}	-0.5		4.0	V	
Maximum Supply Voltage 2	V _{cc5}	-0.5		6.0	V	
Storage Temperature	T _S	-40		85	°C	
Case Operating Temperature	T _{OP}	0		70	°C	
SBS Threshold	T _{X_{SBS}}	8			dBm	

III. Electrical Characteristics (T_{OP} = 0 to 70 °C, V_{CC5} = 4.75 to 5.25 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.	
Main Supply Voltage	V _{cc5}	4.75		5.25	V		
Supply Voltage #2	V _{cc3}	3.13		3.45	V		
Supply Current – V _{cc5} supply	I _{cc5}			450	mA		
Supply Current – V _{cc3} supply	I _{cc3}			750	mA		
Module total power	P			3.5	W	1	
Transmitter							
Input differential impedance	R _{in}		100		Ω	2	
Differential data input swing	V _{in,pp}	120		820	mV		
Transmit Disable Voltage	V _D	2.0		V _{cc}	V	3	
Transmit Enable Voltage	V _{EN}	GND		GND+ 0.8	V		
Transmit Disable Assert Time				10	us		
Receiver							
Differential data output swing	V _{out,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}	V _{cc} – 0.5		V _{ccHOST}	V	6	
LOS Normal	V _{LOS norm}	GND		GND+0.5	V	6	
Power Supply Rejection	PSR	See Note 6 below					7

Notes:

- Maximum total power value is specified across the full temperature and voltage range.
- After internal AC coupling.
- Or open circuit.
- Into 100 ohms differential termination.
- 20 – 80 %
- 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.
- Per Section 2.7.1. in the XFP MSA Specification¹.

IV. Optical Characteristics ($T_{OP} = 0$ to 70°C , $V_{CC5} = 4.75$ to 5.25 Volts)

Please note that the Transmitter of the FTLX3912M3xx becomes operational within 5 seconds of power-up. This is due to the time required for the EML to reach its optimum operating temperature.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Pwr: 9/125 SMF	P_{OUT}	-1		+3	dBm	
Optical Extinction Ratio	ER	8.2			dB	
Center Wavelength Spacing			100		GHz	
Transmitter Center Wavelength – End Of Life	λ_c	X-100	X	X+100	pm	
Transmitter Center Wavelength – Beginning Of Life	λ_c	X-25	X	X+25	pm	
Transmitter Dispersion Penalty (@ 800 ps/nm)	TDP			2	dB	1
Sidemode Suppression ratio	SSR_{min}	30			dB	
Tx Jitter (SONET) 20kHz-80MHz	T_{Xj1}			0.3	UI	
Tx Jitter (SONET) 4MHz – 80MHz	T_{Xj2}			0.1	UI	
Relative Intensity Noise	RIN			-130	dB/Hz	
Receiver						
Maximum Input Power	P_{MAX}	-7			dBm	
Rx Damage Threshold	P_{DAM}	+5			dBm	
Optical Center Wavelength	λ_C	1270		1600	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 (FTLX3912M3xx & FTLX3912M3xxP)						
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Sensitivity back-to-back at OSNR>30dB (dBm)	Sensitivity at -300 to +800ps/nm with OSNR>30dB (dB)	Threshold Adjustm.	
8.5	1e-12	-300 to +800	-24	-22	No	
9.95	1e-12	-300 to +800	-24	-22	No	
10.3	1e-12	-300 to +800	-24	-22	No	
10.7	1e-12	-300 to +800	-24	-21	No	
10.7	1e-4	-300 to +800	-27	-24	Yes	
11.1	1e-4	-300 to +800	-27	-23	Yes	
11.3	1e-4	-300 to +800	-27	-23	Yes	
OSNR Performance (FTLX3912M3xx ONLY)						
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Max OSNR, -300 ps/nm to +800 ps/nm at Power: -9 to -19dBm (dB)		Threshold Adjustm.	
9.95	1e-12	-300 to +800	26		No	
10.3	1e-12	-300 to +800	26		No	
10.7	1e-4	-300 to +800	19		Yes	
11.1	1e-4	-300 to +800	19		Yes	
11.3	1e-4	-300 to +800	19		Yes	

Notes:

- 2dB spec is defined for 9.95Gb/s operation

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate	BR	9.95		11.3	Gb/s	1
Bit Error Ratio	BER			10^{-12}		2
Max. Supported Link Length	L_{MAX}		40		km	3

Notes:

- SONET OC-192 IR-2, OC-192 IR-3, 10GBASE-ER/EW, 10G Fibre Channel, ITU-T G.709, 10GBASE-ER/EW + FEC, 10G Fibre Channel + FEC
- Tested with a $2^{31} - 1$ PRBS
- G.652 fibre

VI. Environmental Specifications

The FTLX3912M3xx transceiver has an operating case temperature range from 0°C to +70°C.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	0		70	°C	
Storage Temperature	T_{sto}	-40		85	°C	

VII. Regulatory Compliance

Finisar 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	9210176-77
Laser Eye Safety	TÜV	EN 60825-1: 2007, EN60825-2:2004+A1 IEC 60825-1: 2007 (2 nd Edition) IEC 60825-2: 2010 (3 rd Edition)	R72101686
Electrical Safety	TÜV	EN 60950:2006+A11	R72101686
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	2283290

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

VIII. Digital Diagnostics Functions

As defined by the XFP MSA¹, 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

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 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 documentation¹.

8.5Gb/s Fibre-Channel:

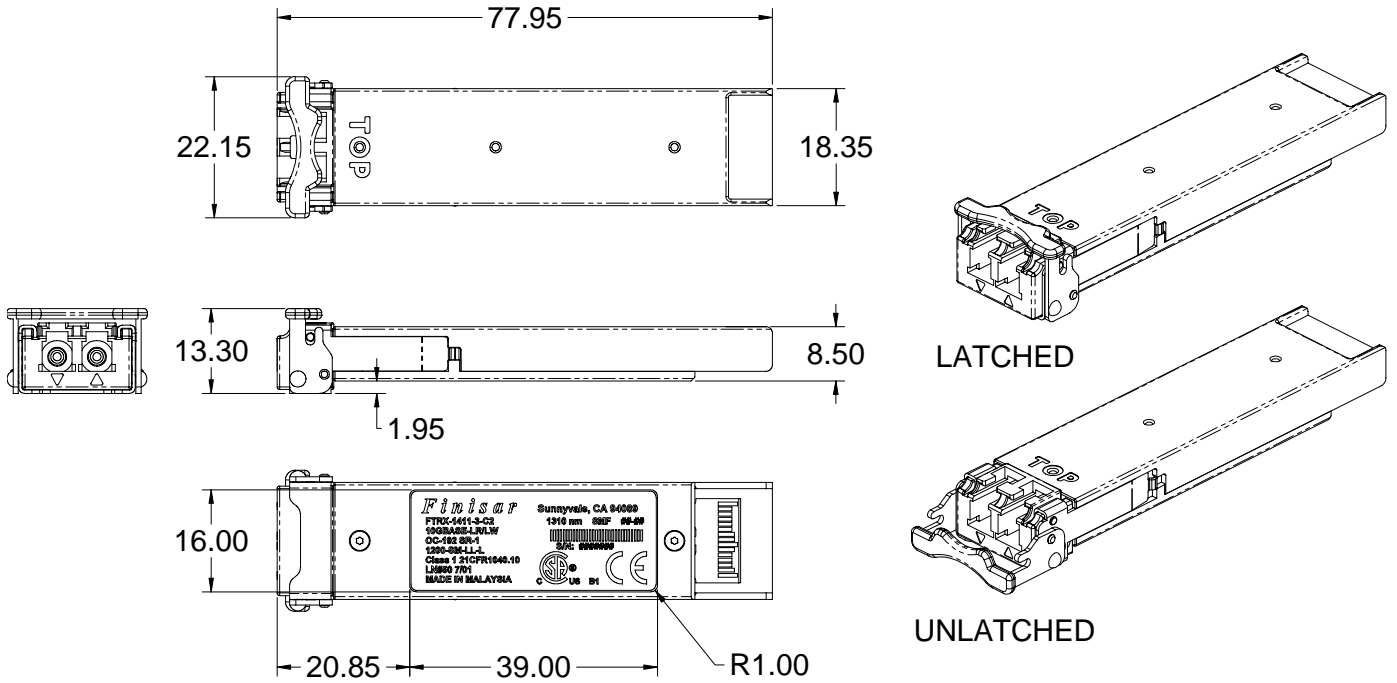
To operate the FTLX3912M3xx at 8.5Gb/s Fibre-Channel, the EEPROM-Table 0, Byte 117, Bit 0 must be set as follows; .

- EEPROM Byte 117, Bit 0, value “1” for 8GFC:
- EEPROM Byte 117, Bit 0 value “0” for 10Gb/s rates:
 - (It is also possible to bypass the CDRs with, Byte 111, Bit 0.)

By default, a power cycling the transceiver will return the transceiver to normal 10Gb/s operation with the CDRs active.

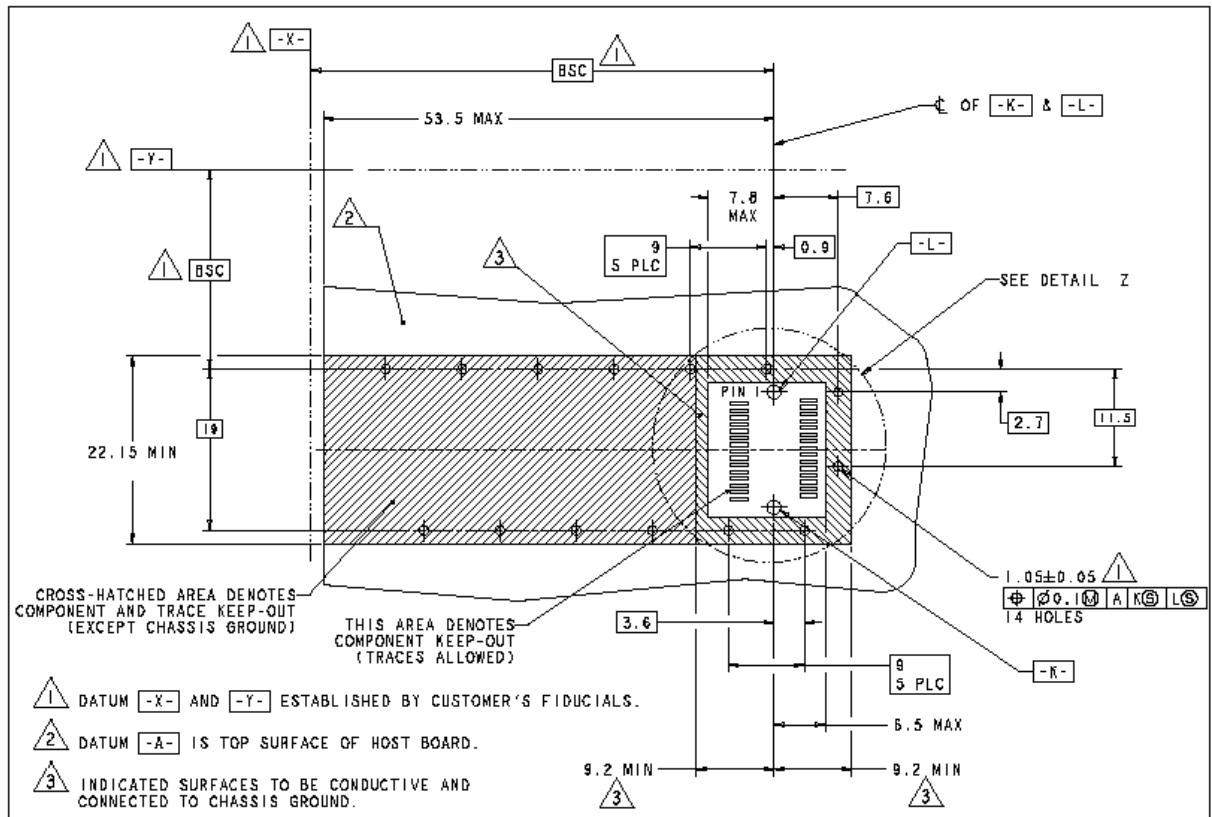
IX. Mechanical Specifications

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

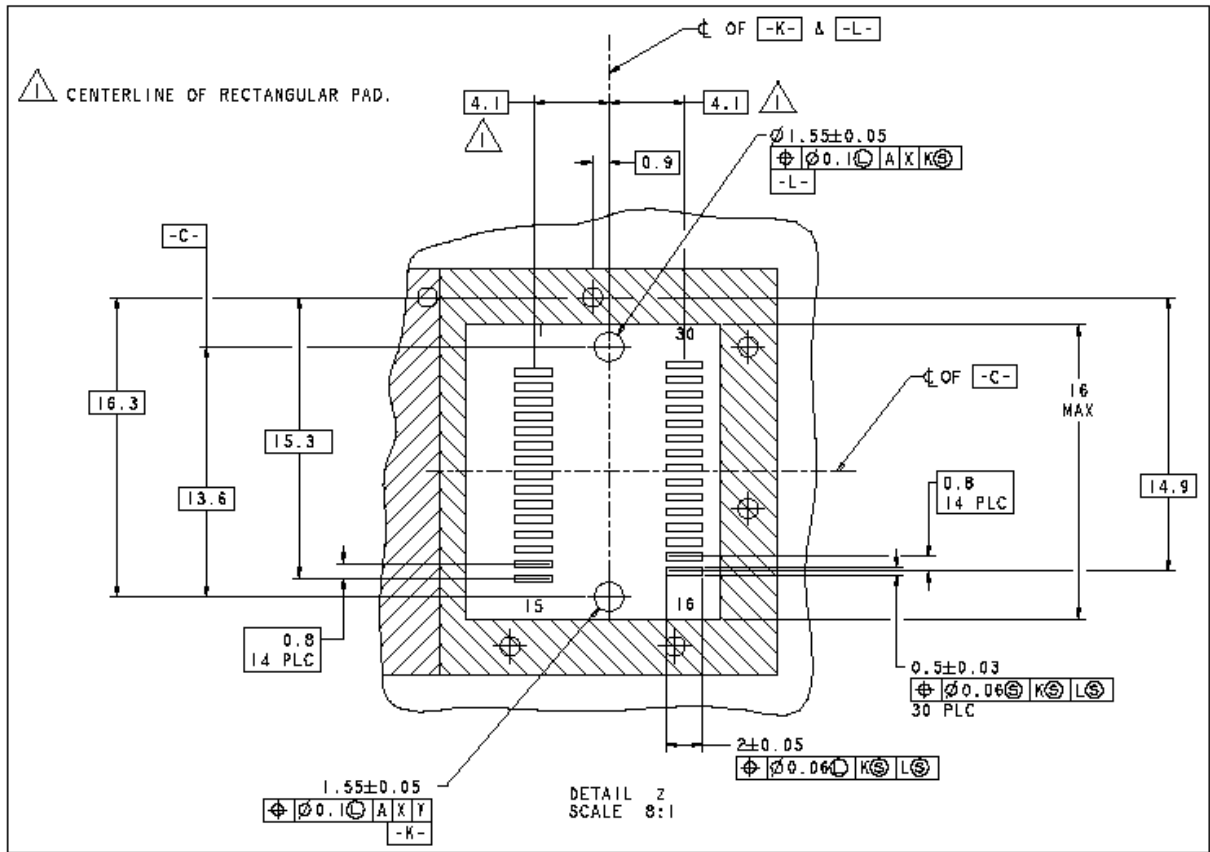


XFP Transceiver (dimensions are in mm)

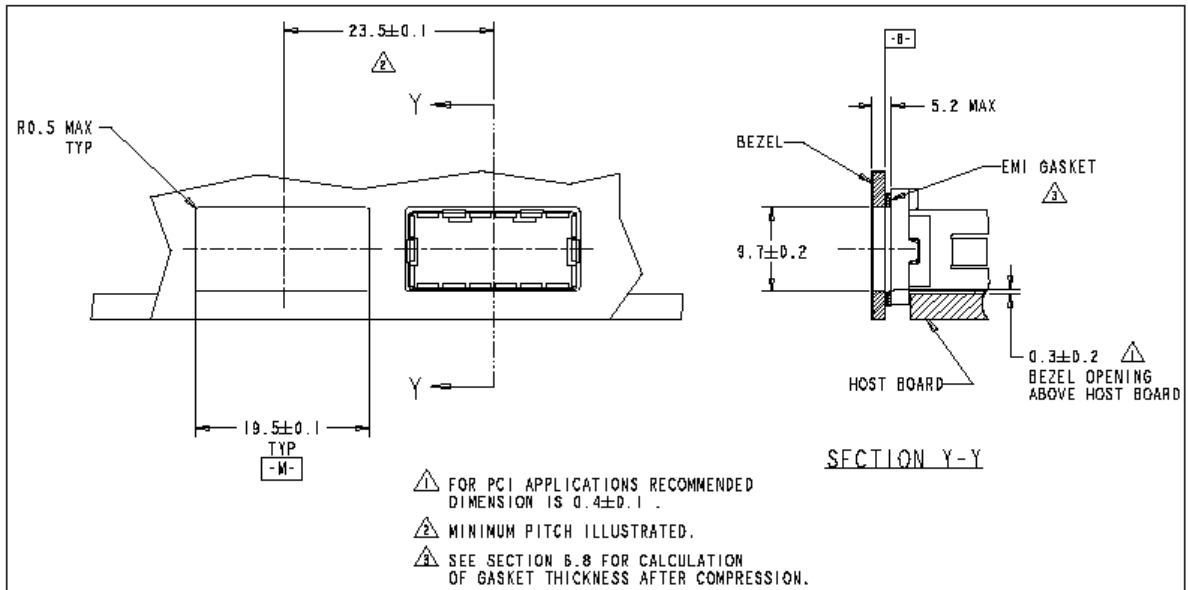
X. PCB Layout and Bezel Recommendations



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. 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 2011/65/EU of the European Council Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”
4. “Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers”

XII. Revision History

Revision	Date	Description
A1	8/31/2010	• Document created.
C1	4/15/2012	• Production Release Datasheet
C4	9/18/2013	• Minor corrections
D1	8/31/2015	• Updated logo and RoHS statement

XIII. For More Information

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