FINISAR

Product Specification

40km Multi-Rate DWDM XFP Optical Transceiver

FTLX3613M3xx

PRODUCT FEATURES

- Supports 9.95Gb/s to 11.32Gb/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
- Duplex LC connector
- Power dissipation < 3.5W
- Built-in digital diagnostic functions
- Commercial temperature range: 0°C to 70°C
- Reference clock not required

APPLICATIONS

- SONET OC-192 IR-2 Transmitter
  ITU G.959.1, P1S1-2Dxb Transmitter
  SDH STM S-64.2b Transmitter
  SDH STM S-64.3b Transmitter
  ITU-T G.709 Transmitter
- 10GBASE-ER/EW Transmitter
  10GBASE-ER/EW (OTU1e/2e) Tx
- 40km 10G Fibre Channel Transmitter

Finisar's 40km DWDM FTLX3613M3xx Small Form Factor 10Gb/s XFP transceivers comply with the current XFP Multi-Source Agreement (MSA) Specification[1]. 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 Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA. The optical transceivers are compliant per the RoHS Directive 2011/65/EU. See Finisar Application Note AN-2038[4] for more details.

PRODUCT SELECTION

FTLX3613M3xx

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

Channel #	Product Code	Frequency (THz)	Center Wavelength (nm)
16	FTLX3613M316	191.6	1564.68
17	FTLX3613M317	191.7	1563.86
18	FTLX3613M318	191.8	1563.05
19	FTLX3613M319	191.9	1562.23
20	FTLX3613M320	192.0	1561.42
21	FTLX3613M321	192.1	1560.61
22	FTLX3613M322	192.2	1559.79
23	FTLX3613M323	192.3	1558.98
24	FTLX3613M324	192.4	1558.17
25	FTLX3613M325	192.5	1557.36
26	FTLX3613M326	192.6	1556.55
27	FTLX3613M327	192.7	1555.75
28	FTLX3613M328	192.8	1554.94
29	FTLX3613M329	192.9	1554.13
30	FTLX3613M330	193.0	1553.33
31	FTLX3613M331	193.1	1552.52
32	FTLX3613M332	193.2	1551.72
33	FTLX3613M333	193.3	1550.92
34	FTLX3613M334	193.4	1550.12
35	FTLX3613M335	193.5	1549.32
36	FTLX3613M336	193.6	1548.51
37	FTLX3613M337	193.7	1547.72
38	FTLX3613M338	193.8	1546.92
39	FTLX3613M339	193.9	1546.12
40	FTLX3613M340	194.0	1545.32
41	FTLX3613M341	194.1	1544.53
42	FTLX3613M342	194.2	1543.73
43	FTLX3613M343	194.3	1542.94
44	FTLX3613M344	194.4	1542.14
45	FTLX3613M345	194.5	1541.35
46	FTLX3613M346	194.6	1540.56
47	FTLX3613M347	194.7	1539.77
48	FTLX3613M348	194.8	1538.98
49	FTLX3613M349	194.9	1538.19
50	FTLX3613M350	195.0	1537.40
51	FTLX3613M351	195.1	1536.61
52	FTLX3613M352	195.2	1535.82
53	FTLX3613M353	195.3	1535.04
54	FTLX3613M354	195.4	1534.25
55	FTLX3613M355	195.5	1533.47
56	FTLX3613M356	195.6	1532.68
57	FTLX3613M357	195.7	1531.90
58	FTLX3613M358	195.8	1531.12
59	FTLX3613M359	195.9	1530.33
60	FTLX3613M360	196.0	1529.55
61	FTLX3613M361	196.1	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	$\overline{\text{Interrupt}}$	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.

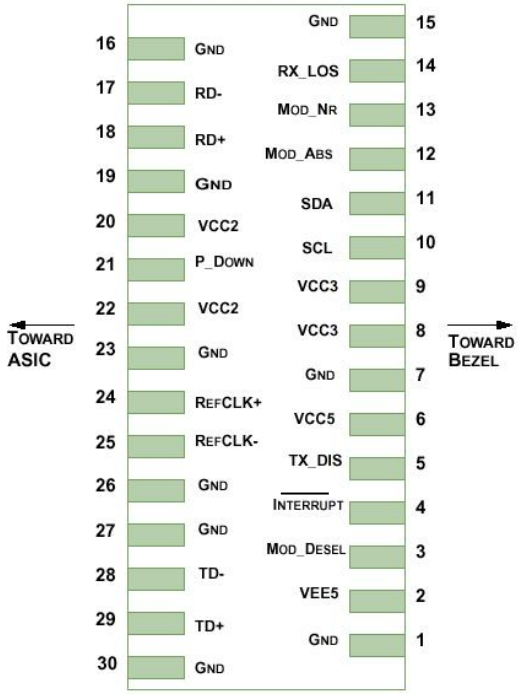


Diagram of Host Board Connector Block Pin Numbers and Names

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}	0		70	°C	
SBS Threshold	Tx_{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	Vcc5	4.75		5.25	V	
Supply Voltage #2	Vcc3	3.13		3.45	V	
Supply Current – Vcc5 supply	Icc5			450	mA	
Supply Current – Vcc3 supply	Icc3			750	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				10	us	
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 6 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 (T_{OP} = 0 to 70°C, V_{CC5} = 4.75 to 5.25 Volts)

Please note that the Transmitter of the FTLX3613M3xx becomes operational within 5 seconds of power-up. This is due to the time required for the EML to reach its optimum operating temperature.

Transmitter						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Ref.**
Output Opt. Pwr: 9/125 SMF	P_{OUT}	-1		+2	dBm	
Optical Modulation Amplitude	OMA	-2.1			dBm	1
Optical Extinction Ratio	ER	8.2			dB	
Center Wavelength Spacing			100		GHz	2
Transmitter Center Wavelength – End Of Life	λ_C	X-100	X	X+100	pm	3
Transmitter Center Wavelength – Beginning Of Life	λ_C	X-25	X	X+25	pm	3
Path Penalty +800ps/nm, ≤10.7Gb/s				2	dB	7
Path Penalty +800ps/nm, ≥11.05Gb/s				2.5	dB	7
Sidemode Suppression ratio	SSR_{min}	30			dB	
Tx Jitter (SONET) 20kHz-80MHz	Tx_{j1}			0.3	UI	4
Tx Jitter (SONET) 4MHz – 80MHz	Tx_{j2}			0.1	UI	5
Relative Intensity Noise	RIN			-130	dB/Hz	
Receiver						
Rx Sensitivity ≤ 10.7Gb/s (BER 1e-12)	R_{SENS1}			-16	dBm	6
Rx Sensitivity ≥ 11.05Gb/s (BER 1e-12)	R_{SENS2}			-15	dBm	6
Stressed Rx Sensitivity(OMA) @ 11.1Gb/s	R_{SENS3}			-11.3	dBm	
Overload Power	P_{OL}	-1			dBm	
Optical Center Wavelength	λ_C	1260		1600	nm	
Receiver Reflectance	R_{rx}			-27	dB	
LOS De-Assert	LOS_D			-22	dBm	
LOS Assert	LOS_A	-27.5			dBm	
LOS Hysteresis		0.5			dB	

OSNR Performance				8
Data rate (Gb/s)	BER	Dispersion (ps/nm)	Max OSNR w/ dispersion at Power: -1 to -11dBm (dB)	Threshold Adjustm. Required
8.5	1e-12	-300 to 800	27	No
9.95	1e-12	-300 to 800	27	No
10.3	1e-12	-300 to 800	27	No
10.7	1e-4	-300 to 800	21	No
11.1	1e-4	-300 to 800	21	No
11.3	1e-4	-300 to 800	22	No

1. Guaranteed minimum OMA for all data rates up to 11.32Gb/s
2. Corresponds to approximately 0.8 nm.
3. X = Specified ITU Grid wavelength. Wavelength stability is achieved within 10 seconds of power up.
4. Measured with a host jitter of 50 mUI peak-to-peak.
5. Measured with a host jitter of 7 mUI RMS.
6. Measured at 1528-1600nm with worst ER; BER<10^{-12}; PRBS31.
7. Dispersion penalty is measured in loopback using 18ps/(nm*km) fiber (SMF-28)
8. All OSNR measurements are performed with 0.1nm resolution over specific Rx_power range

9. V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate	BR	8.5		11.32	Gb/s	1
Bit Error Ratio	BER			10^{-12}		2
Max. Supported Link Length	L_{MAX}		40		km	3

Notes:
1. SONET OC-192 IR-2 (ITU G.959.1, P1S1-2Dxb), OC-192 IR-3, 10GBASE-ER/EW, 10G Fibre Channel, ITU-T G.709, 10GBASE-ER/EW OTU1e/OTU2e, 8G Fibre Channel
2. Tested with a $2^{31} – 1$ PRBS
3. G.652 fibre

VI. Environmental Specifications

The FTLX3613M3xx 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 (2nd Edition) IEC 60825-2: 2010 (3rd 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 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

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 documentation[1].

8.5Gb/s Fibre-Channel rate select:

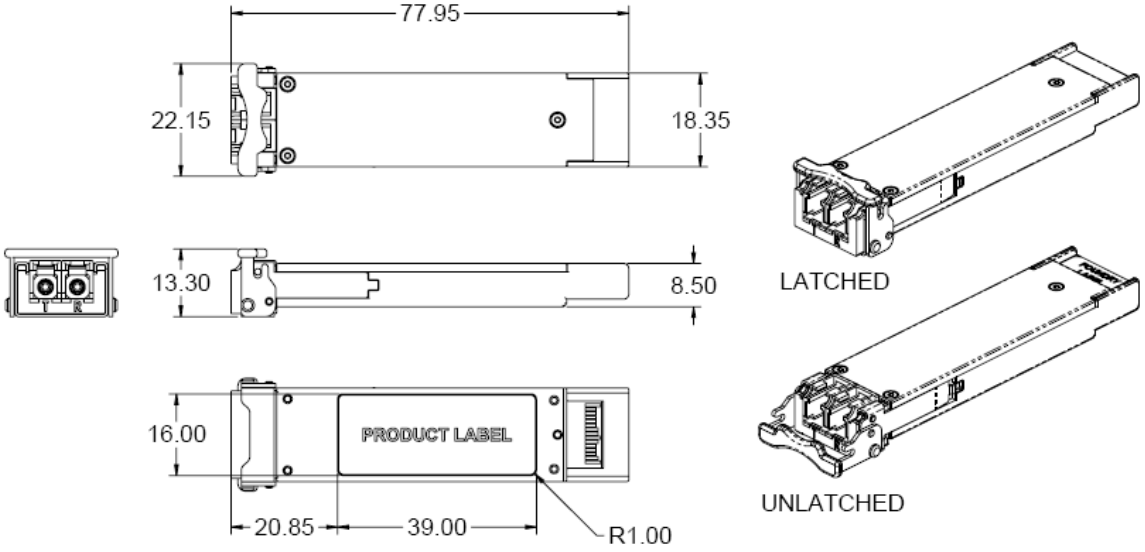
To operate the FTLX3813M3xx at 8.5Gb/s Fibre-Channel, the EEPROM-Table 0, Byte 117, Bit 0 must be set as follows;

- 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.

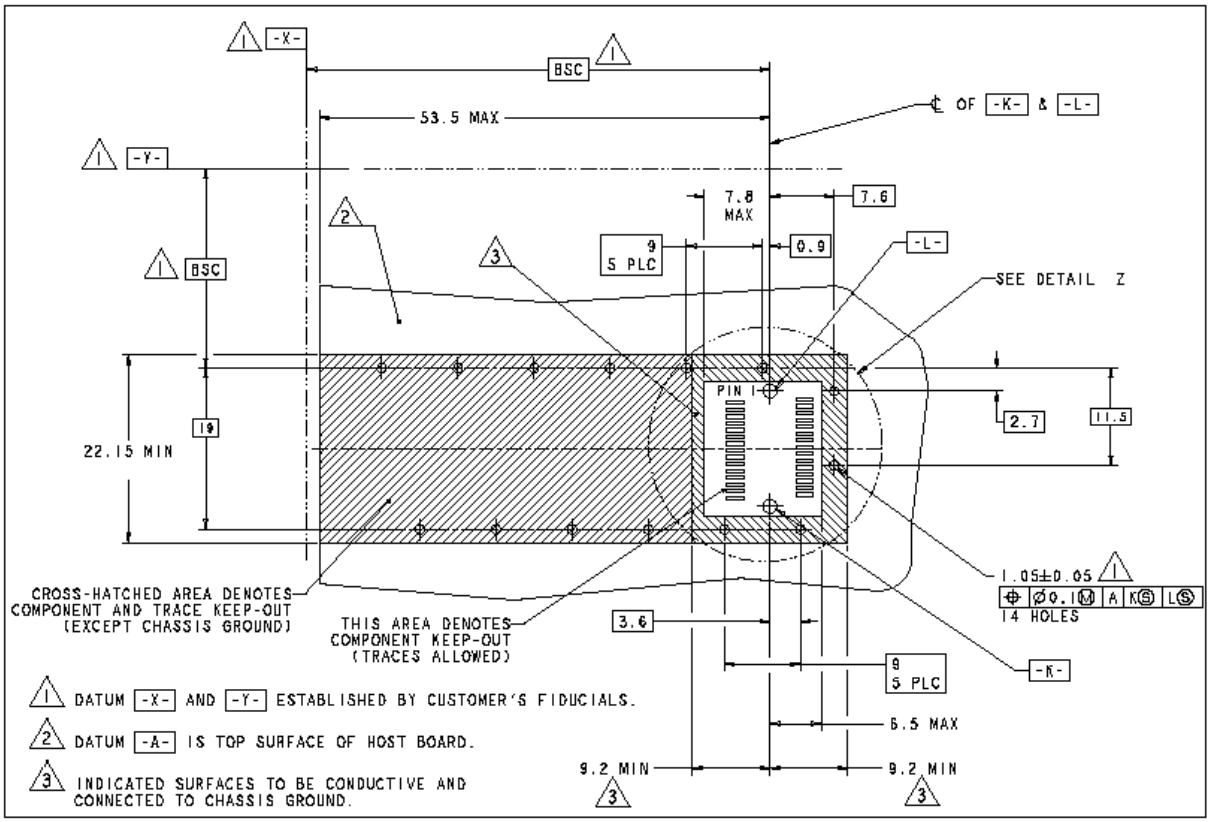
IX. Mechanical Specifications

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

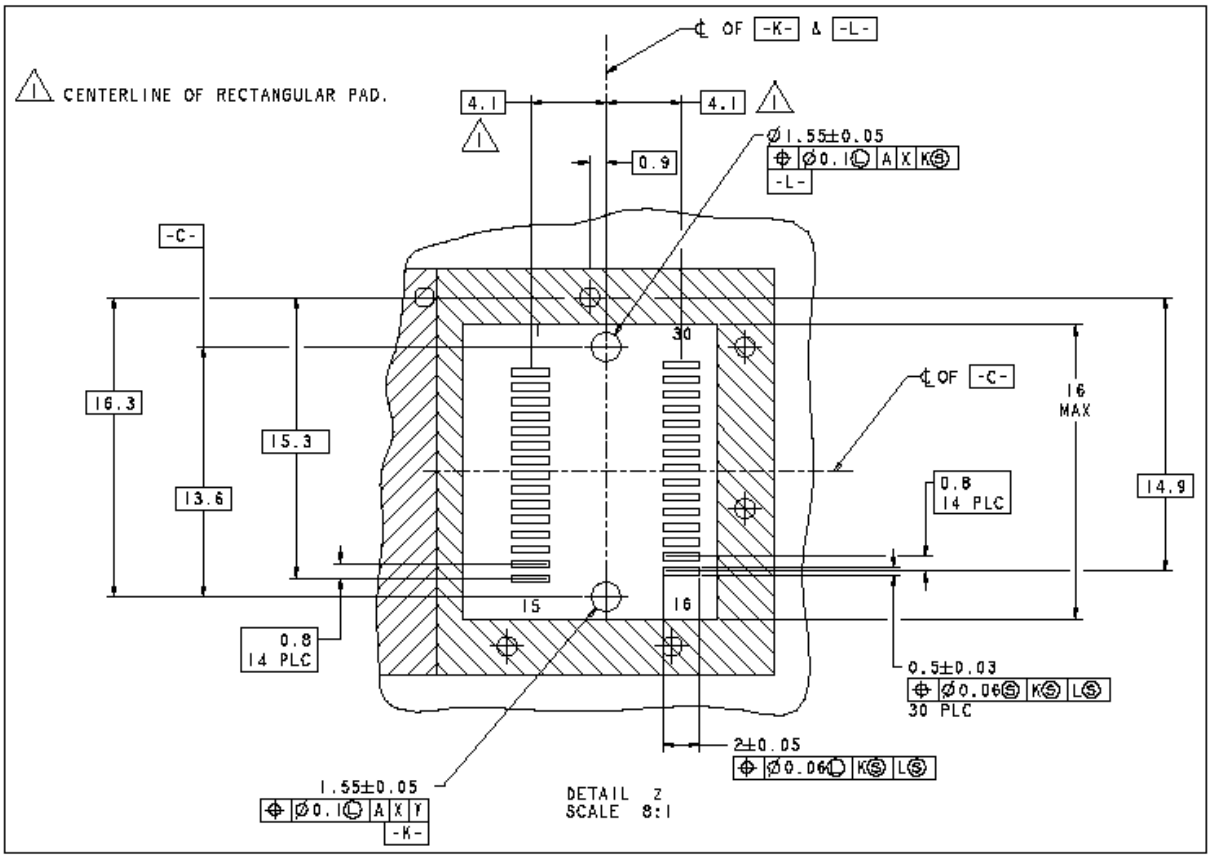


XFP Transceiver (dimensions are in mm)

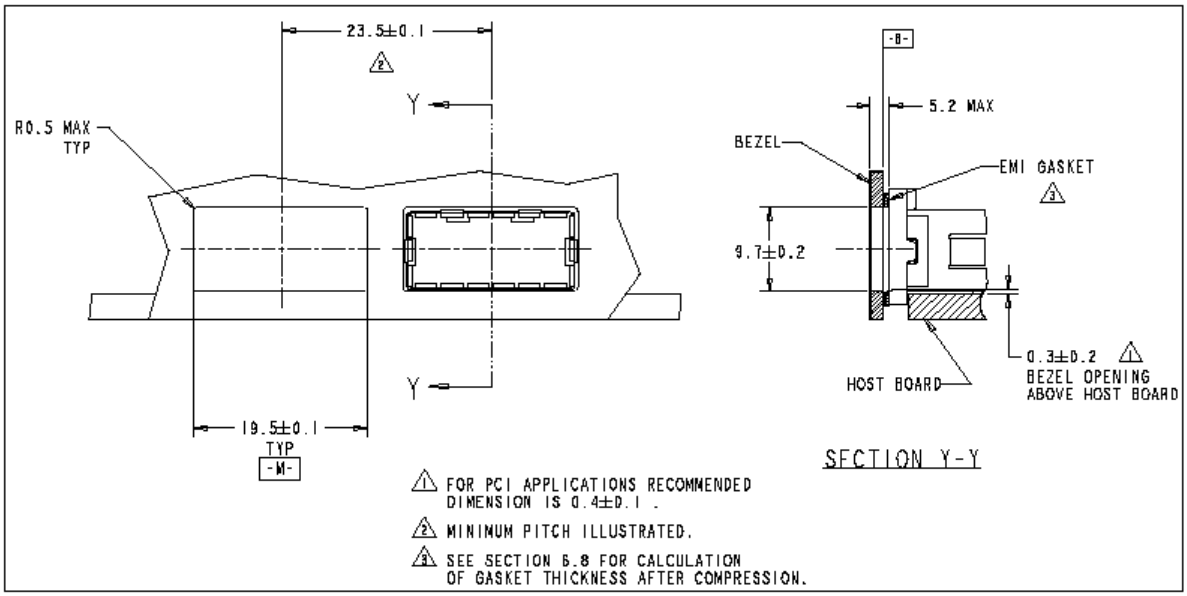
X. PCB Layout and Bezel Recommendations



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". Certain products may use one or more exemptions as allowed by the Directive.

4. "Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers"

XII. Revision History

Revision	Date	Description
A1	1/23/2013	• Document created.
A2	3/26/2013	• Corrected Overload limit
B1	8/27/2015	• Updated logo and RoHS statement.

XIII. For More Information

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