Finisar

Product Specification

Multi-rate CWDM Pluggable SFP Transceiver

FWLF1521P2Nxx

PRODUCT FEATURES

- Up to 2.67 Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- Built-in digital diagnostic functions
- Uncooled DFB laser transmitter in 8 possible CWDM wavelengths
- Duplex LC connector
- Very low jitter
- Metal enclosure, for lower EMI
- Single 3.3V power supply
- Low power dissipation
- Operating temperature range: -10°C to 85°C

APPLICATIONS

- Metro Access Rings and Point-to-Point networking for SONET, Gigabit Ethernet and Fibre Channel
- High temperature environments

Finisar's FWLF1521P2Nxx CWDM Small Form Factor Pluggable (SFP) transceivers are designed for operation in Metro Access Rings and Point-to-Point networks using SONET[1],Gigabit Ethernet[2] and Fibre Channel[3] networking equipment. They are available in eight different CWDM wavelengths and comply with ITU CWDM standard[4]. Digital diagnostics functions can be accessed via an I^2C serial bus. In addition, the transceivers comply with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA)[5] are RoHS and lead free compliant per Directive 2002/95/EC[6] and Finisar Application Note AN-2038[7].

PRODUCT SELECTION

Wavelength	xx	Clasp Color Code	Wavelength	xx	Clasp Color Code
1471 nm	47	Gray	1551 nm	55	Yellow
1491 nm	49	Violet	1571 nm	57	Orange
1511 nm	51	Blue	1591 nm	59	Red
1531 nm	53	Green	1611 nm	61	Brown

I. Pin Descriptions

Pin	Symbol	Name/Description	Ref.
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault. Not supported.	
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	2
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	3
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	3
7	Rate Select	No connection required	4
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
10	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
11	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
15	V_{CCR}	Receiver Power Supply	
16	V_{CCT}	Transmitter Power Supply	
17	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. 100 ohm termination between TD+ and TD-, AC Coupled thereafter.	
19	TD-	Transmitter Inverted DATA in. See TD+	
20	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. **Circuit ground is internally isolated from chassis ground.**
2. Laser output disabled on T_{DIS} >2.0V or open, enabled on T_{DIS} <0.8V.
3. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 5.5V. MOD_DEF(0) pulls line low to indicate module is plugged in.
4. Finisar 2x receiver achieves simultaneous 1x and 2x operation without active control.
5. LOS is open collector output. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 5.5V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

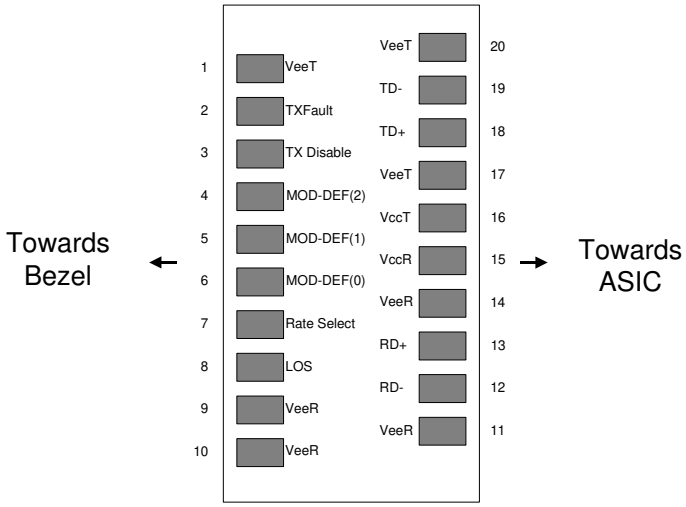


Diagram of Host Board Connector Block Pin Numbers and Names

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	T_S	-40		85	°C	
Case Operating Temperature	T_{OP}	-10		85	°C	

III. Electrical Characteristics (T_{OP} = -10 to 85 °C, V_{CC} = 3.11 to 3.5 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.1		3.5	V	
Supply Current	Icc		200	350	mA	
Transmitter						
Input differential impedance	R_{in}		100		Ω	1
Differential data input swing	Vin,pp	500		1600	mV	
Transmit Disable Voltage	V_D	Vcc – 1.3		Vcc	V	
Transmit Enable Voltage	V_{EN}	Vee		Vee+ 0.8	V	2
Transmit Disable Assert Time				10	us	
Receiver						
Single ended data output swing	Vout,pp	250		470	mV	3
Data output rise time	t_r		100	175	ps	4
Data output fall time	t_f		100	175	ps	4
LOS Fault	$V_{LOS\ fault}$	Vcc – 0.5		Vcc_{HOST}	V	5
LOS Normal	$V_{LOS\ norm}$	Vee		Vee+0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:
1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. 20% to 80 %
5. Loss Of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 2.0 MHz up to specified value applied through the recommended power supply filtering network.

IV. Low Speed Signals

Parameter	Symbol	Min	Typ	Max	Units	Notes/Conditions
RX_LOS Assert Level		-30			dBm	
RX_LOS Deassert Level				-19	dBm	
RX_LOS Hysteresis		0.5	2		dB	
RX_LOS Assert Delay	t_loss_on			100	µsec	From detection of loss of signal to assertion of RX_LOS
RX_LOS Negate Delay	t_loss_off			100	µsec	From detection of presence of signal to negation of RX_LOS
TX_DISABLE Assert Time	t_off			10	µsec	Rising edge of TX_DISABLE to fall of output signal below 10% of nominal
TX_DISABLE Negate Time	t_on			1000	µsec	Falling edge of TX_DISABLE to rise of output signal above 90% of nominal. Time indicated is under steady-state temperature conditions.
TX_DISABLE Reset Time	t_reset	10			µsec	TX_DISABLE HIGH before TX_DISABLE set LOW
TX_FAULT Assert				100	µsec	From fault to assertion of TX_FAULT
Initialization Time				300	msec	From power on to negation of TX_FAULT using TX_DISABLE

V. Optical Characteristics (T_{OP} = -10 to 85 °C, V_{CC} = 3.1 to 3.5 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Pwr (EOL)	P_{OUT}	0		+5	dBm	2
Optical Wavelength	λ	(X-6.5)	X	(X+6.5)	nm	3
Wavelength Temperature Dependence			0.08	0.125	nm/°C	
Spectral Width	$\Delta\lambda_{20}$			1	nm	4
Optical Extinction Ratio	ER	8.2			dB	5
Sidemode Suppression Ratio	$SMSR_{min}$	30			dB	
Optical Rise/Fall Time	t_r/ t_f			180	ps	6
RIN	RIN			-120	dB/Hz	
Transmitter Jitter Generation				75	mUI	7
Dispersion Penalty at 50 km				2	dB	8
Optical Return Loss		24			dB	
Receiver						
Optical Input Power	P_{in}	-20		-3	dBm	9
Optical Input Wavelength	λ_C	1450		1620	nm	
Receiver Jitter Generation				75	mUI	7
Optical Return Loss		27			dB	

Notes:
1. Parameters are specified over temperature and voltage, at end of life unless otherwise noted.
2. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
3. Over case temperature of -10 to 85 °C. The Transmitter Center Wavelength "X" is as specified by the customer. The current available wavelengths are: 1471, 1491, 1511, 1531, 1551, 1571, 1591, and 1611 nm. Please see the "Product Selection" section on page 1.
4. Full width, -20dB from peak.
5. Measured filtered, at 2.488 Gb/s. Min represents worst-case ER over temperature and at end of life.
6. Unfiltered, 20% to 80%.
7. Measured per GR-253[2] section 5.6 for OC-48 B.
8. SMF-28 fiber used. 50kms represents 1000ps/nm at 1610nm. Measured at 2.488Gb/s with a PRBS 2^{23}-1 pattern at a BER<10^{-12}.
9. P_{in} represents the range of input powers where BER<10^{-12}. P_{in} is valid over all data rates specified in Section VI.

VI. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Data Rate	BR	0.155*		2.67	Gb/sec	*OC-3/12 compatible. Not compliant w/ all OC-3/12 specifications, such as min ER .(OC-48 compliance takes precedence)
Total Link Budget	--	20	22		dB	2.488 Gb/s, BER < 10^{-12} w/ PRBS 2^{23}-1. Does not include dispersion penalty

VII. Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	-10		85	°C	
Storage Temperature	T_{sto}	-40		85	°C	

VIII. Regulatory Compliance

Finisar CWDM SFP transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Agency	Standard
Laser Eye Safety	FDA/CDRH	CDRH and IEC-825 Class 1 Laser Product. See Note 1
Laser Eye Safety	TÜV	EN 60950 EN 60825-1 EN 60825-2
Electrical Safety	CSA	CLASS 3862.07 CLASS 3862.87

Note 1: Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

IX. Digital Diagnostic Functions

All Finisar SFPs support the 2-wire serial communication protocol outlined in the SFP MSA[5]. These SFPs use an Atmel AT24C01A 128 byte E^2PROM with an address of A0h (see table below for E^2PROM contents). For details on interfacing with the E^2PROM, see the Atmel data sheet titled "AT24C01A/02/04/08/16 2-Wire Serial CMOS E^2PROM."[8]

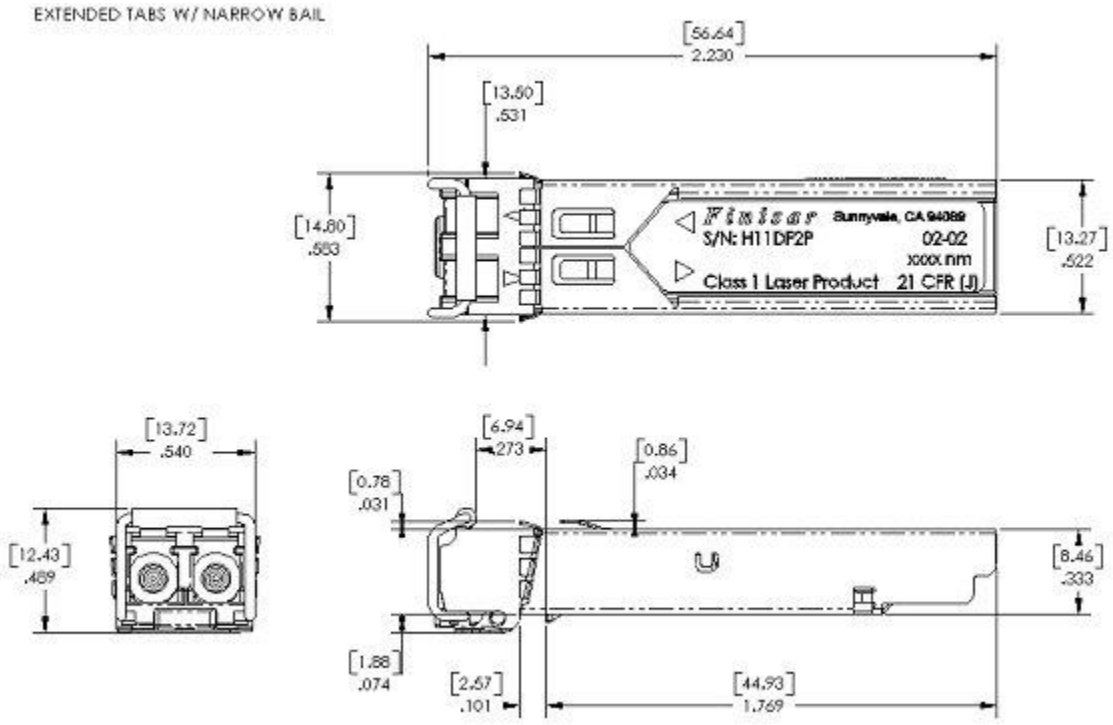
Finisar's CWDM SFPs also support extended diagnostic features as described in Finisar Applications Note AN-2030, "Digital Diagnostic Monitoring Interface for Optical Transceivers"[9], and additional information is available in SFF standard titled: "Digital Diagnostic Monitoring Interface for Optical Transceivers[10] (SFF-8472 rev9.3). A controller IC that monitors system parameters such as laser current, module temperature, transmitter power, and received power is accessible at address A2H.

I2C clock speed, digital diagnostic accuracy and digital diagnostic range can be found in the table below. Values in the table represent the worst-case values over temperature, voltage, and life.

Parameter	Symbol	Min	Typ	Max	Units	Notes/Conditions
I^2C Clock Speed		0		100,000	Hz	Bus can be driven blind
Accuracy						
Transceiver Temperature	$DD_{Temperature}$	-3		+3	°C	Measured at controller IC
Transceiver Supply Voltage	$DD_{Voltage}$	-3		+3	%	Measured at controller IC
Tx Bias Curent	DD_{Bias}	-10		+10	%	
Tx Output Power	$DD_{TxPower}$	-3		+3	dB	100% tested in production tested at room temp to ±2 dB
Received Average Power	$DD_{RxPower}$	-3		+3	dB	100% tested in production tested at room temp to ±2 dB
Range						
Transceiver Temperature	$DD_{Temperature}$	-40		85	°C	
Transceiver Supply Voltage	$DD_{Voltage}$	3.0		4.0	V	
Tx Bias Curent	DD_{Bias}	0		90	mA	
Tx Output Power	$DD_{TxPower}$	-10		5	dBm	
Received Average Power	$DD_{RxPower}$	-23		0	dBm	

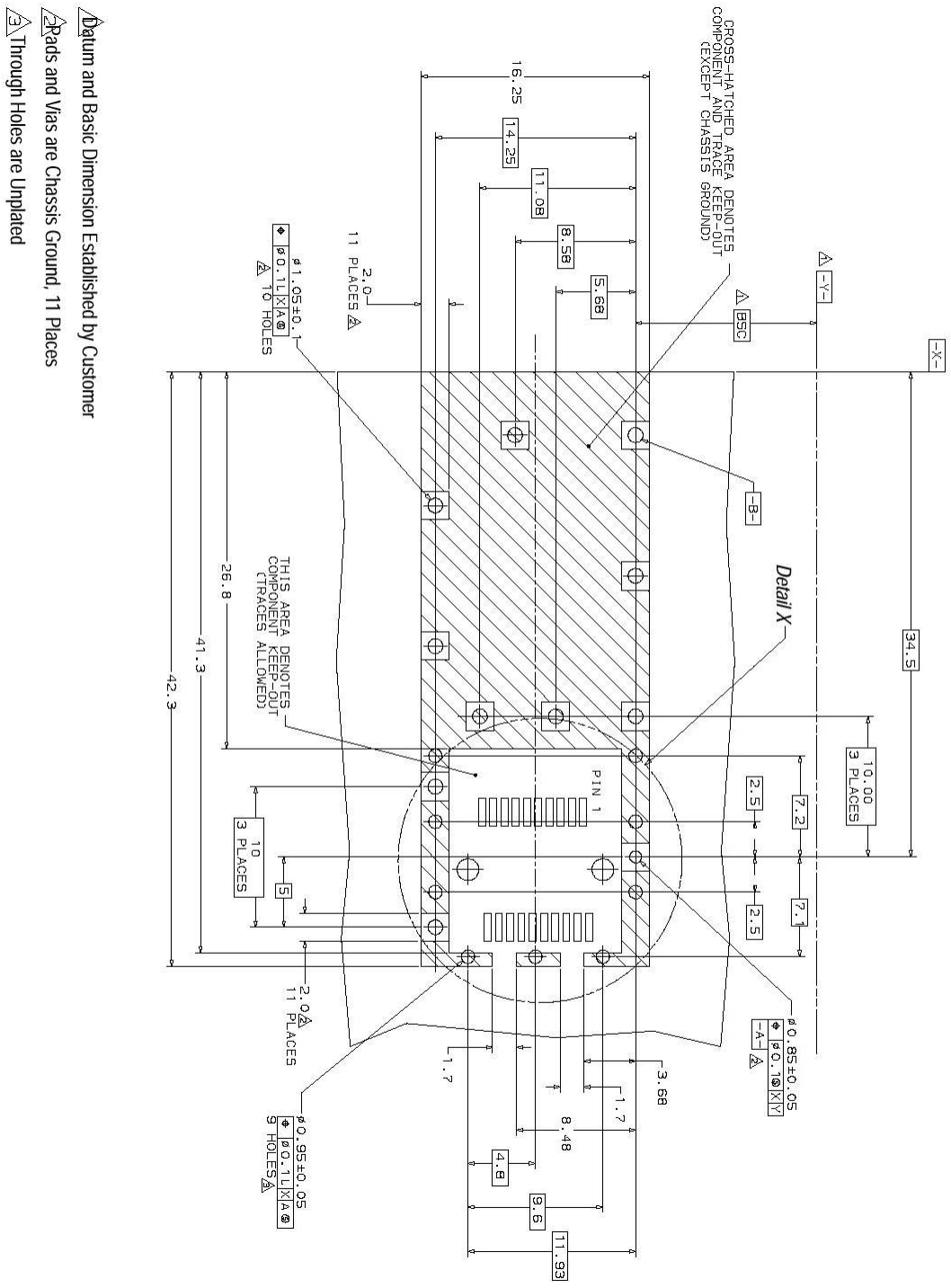
X. Mechanical Specifications

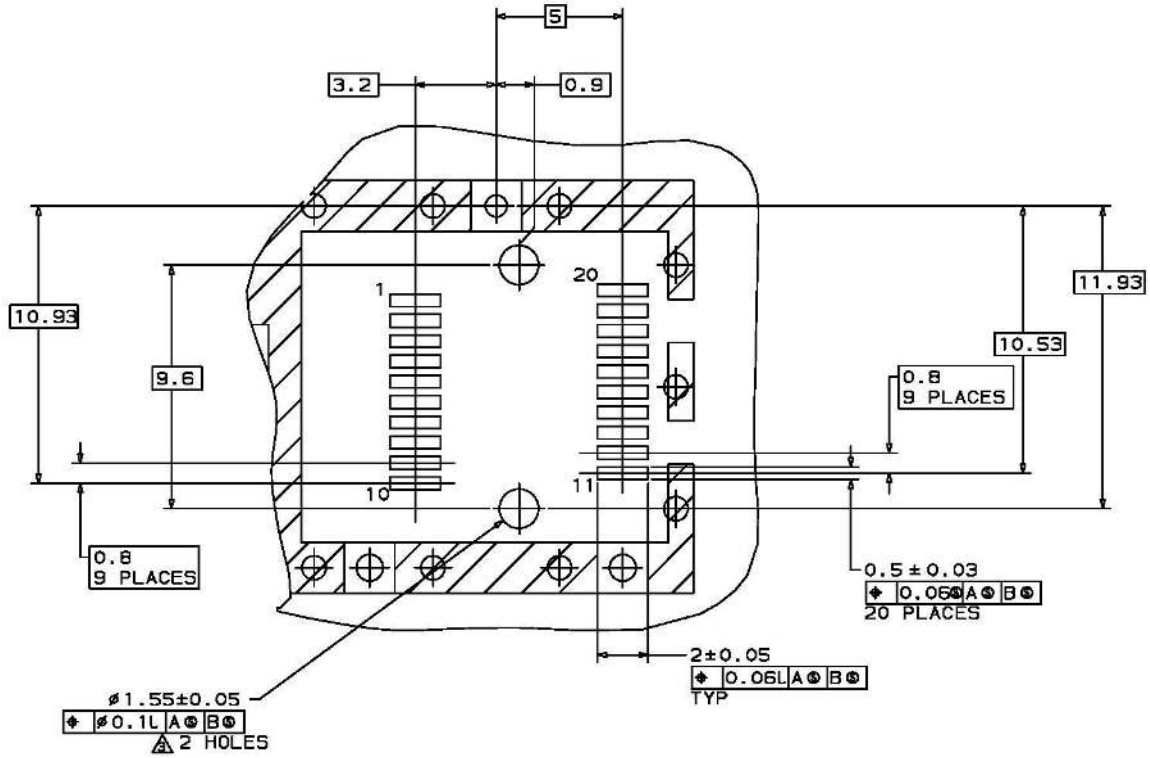
Finisar's Multi-rate CWDM Small Form Factor Pluggable (SFP) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).

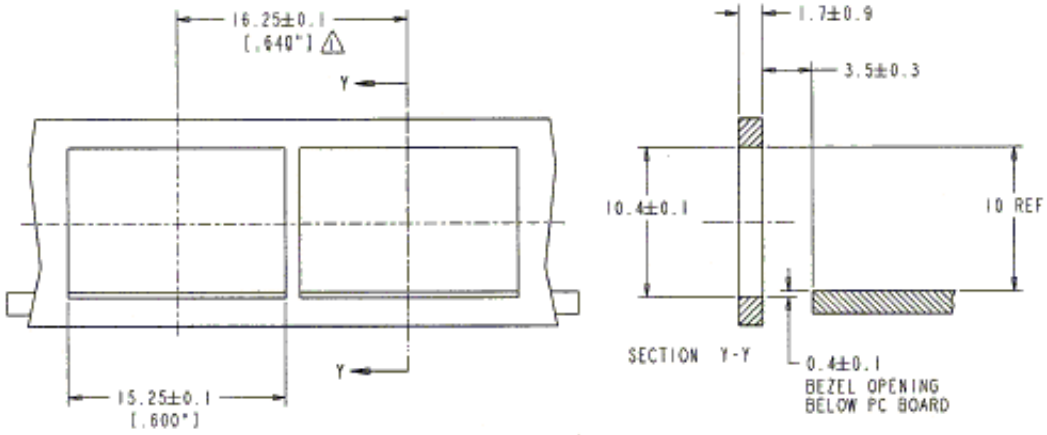


FWLF1521P2Nxx Outline Drawing - units in inches [mm]

XI. PCB Layout and Bezel Recommendations







NOTES:

1. MINIMUM PITCH ILLUSTRATED, ENGLISH DIMENSIONS ARE FOR REFERENCE ONLY
2. NOT RECOMMENDED FOR PCI EXPANSION CARD APPLICATIONS

XII. References

1. "SONET Transport Systems: Common Generic Criteria", Telcordia Technologies, GR-253-CORE, Issue 3, Sept 2000.

2. IEEE Std 802.3. IEEE Standards Department, 2000.(*)

3. "Fibre Channel Draft Physical Interface Specification (FC-PI 10.0)". American National Standard for Information Systems.(*)

4. "Optical Interfaces for Course Wavelength Division Multiplexing Applications", ITU-T recommendation G.695, January 2005.

5. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000. Documentation is currently available at Finisar upon request.

6. 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.

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

8. "AT24C01A/02/04/08/16 2-Wire Serial CMOS E^2PROM", Atmel Corporation. www.Atmel.com

9. "Application Note AN-2030: Digital Diagnostic Monitoring Interface for Optical Transceivers", Finisar Corporation, April 2002.

10. "Digital Diagnostic Monitoring Interface For Optical Transceivers Rev 9.3". SFF Document No. SFF-8472.

(*) Neither IEEE 802.3 nor FC-PI 10.0 specifies a 1621 nm DFB single mode interface. The FWLF1521P2Nxx complies with these specifications except for the following optical parameters, which have different values: transmitter wavelength, extinction ratio, receiver sensitivity, and transmit output power. See Section V for details.

For More Information

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Revision History

Revision	Date	Description
A	1-29-2008	• Document created with 2dB DP
	3-13-2008	• Receiver max input power modified to -3dBm; wavelength ranges corrected to reflect CWDM standards.
B	11-05-2008	• Official release
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