

FWLF16217DXX

Multi-rate CWDM Pluggable SFP Transceiver

FWLF16217Dxx CWDM Small Form Factor Pluggable (SFP) transceivers are designed for operation in Metro Access Rings and Point-to-Point networks using SONET, Gigabit Ethernet and Fibre Channel networking equipment. They are available in eight different CWDM wavelengths. Digital diagnostics functions are available via an I2C serial bus. In addition, they comply with the Small Form Factor Pluggable Multi_x005F_xFFFE_Sourcing Agreement (MSA)¹.



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
- APD Receiver
- Very low jitter
- Metal enclosure, for lower EMI
- Single 3.3V power supply
- Operating temperature range: 0°C to 70°C

APPLICATIONS

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

Product Selection

FWLF16217Dxx

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

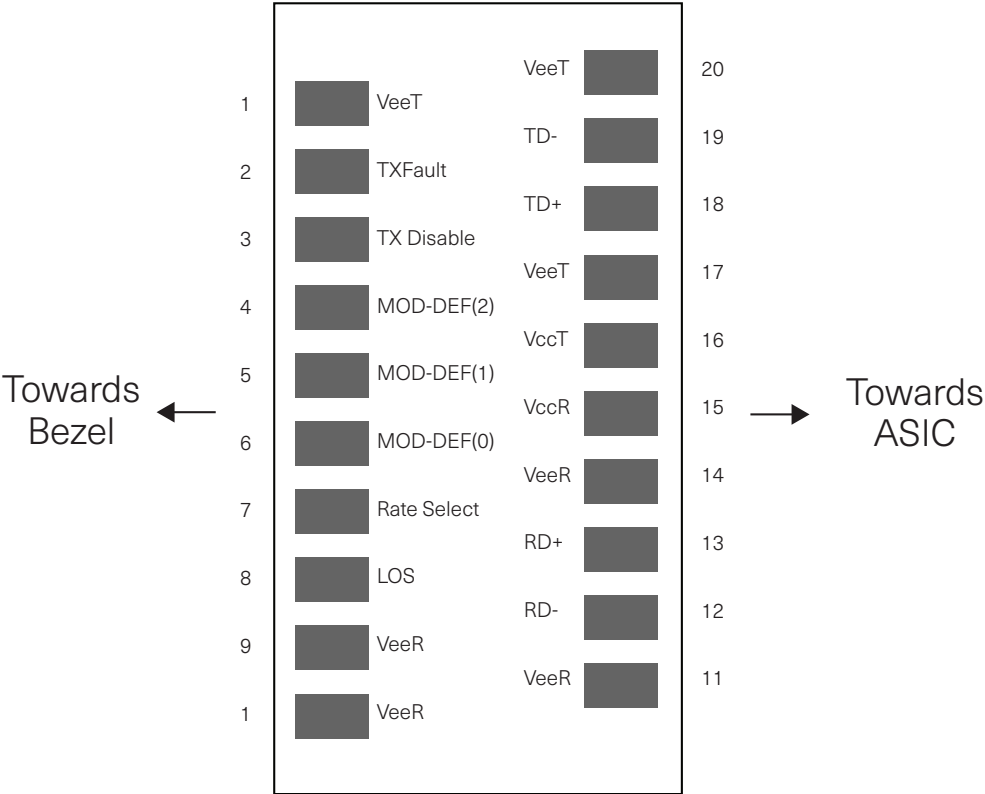


Diagram of Host Board Connector Block Pin Numbers and names

Pin	Symbol	Name/Description	Notes
1	V _{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T _{FAULT}	Transmitter Fault.	
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	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	4
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. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
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. Receiver achieves multi-rate 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.

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Maximum Supply Voltage	V _{CC}	-0.5		4.7	V
Storage Temperature	T _S	-40		85	°C
Case Operating Temperature	T _{OP}	0		70	°C

III. Electrical Characteristics ($T_{OP} = 0$ to $70\text{ }^{\circ}\text{C}$, $V_{CC} = 3.15$ to 3.60 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	V_{CC}	3.15		3.60	V	
Supply Current	I_{CC}		210	300	mA	
Transmitter						
Input differential impedance	R_{in}		100		Ω	1
Single ended data input swing	$V_{in,pp}$	250		1200	mV	
Transmit Disable Voltage	V_D	$V_{CC} - 1.3$		V_{CC}	V	
Transmit Enable Voltage	V_{EN}	Vee		$V_{ee} + 0.8$	V	2
Transmit Disable Assert Time				10	us	
Receiver						
Single ended data output swing	$V_{out,pp}$	250		800	mV	3
Data output rise time	t_r		100	180	ps	4
Data output fall time	t_f		100	180	ps	4
LOS Fault	$V_{LOS\ fault}$	$V_{CC} - 0.5$		V_{CC_HOST}	V	5
LOS Normal	$V_{LOS\ norm}$	Vee		$V_{ee} + 0.5$	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 – 80 %, 2.488Gb/s
5. Loss Of Signal is LVTTTL. 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 1.5 MHz up to specified value applied through the recommended power supply filtering network.

IV. Low Speed Signals

Parameter	Symbol	Min	Typ	Max	Unit	Notes/Conditions
RX_LOS Assert Level		-41			dBm	
RX_LOS Deassert Level				-30	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	ms	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	nm	From fault to assertion of TX_FAULT
Initialization Time				300		From power on to negation of TX_FAULT using TX_DISABLE

IV. Optical Characteristics ($T_{OP} = 0$ to 70°C , $V_{CC} = 3.15$ to 3.60 Volts)

Parameter	Symbol	Min	Typ	7BMax	Unit	Ref.
Transmitter						
Output Opt. Pwr (End of Life)	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/ $^{\circ}\text{C}$	
Spectral Width (-20dB)	σ			1	nm	4
Optical Extinction Ratio	ER	8.2			dB	5
Sidemode Suppression ratio	SSR_{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 50km				1.5	dB	8
Receiver						
Optical Input Power	P_{in}	-28		-9	dBm	9
Optical Center Wavelength	λ_c	1450		1620	nm	
Receiver Jitter Generation				75	mUI	7
Optical Return Loss		27			dB	

Notes:

- Parameters are specified over temperature and voltage, at end of life unless otherwise noted
- Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- Over case temperature of 0 to 70°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.
- Full width, -20dB from peak
- Measured filtered at 2.488 Gb/s. Min represents worst-case ER over temperature and at end of life.
- Unfiltered, 20% to 80%
- Measured per GR-253 section 5.6 for OC-48 B.
- SMF-28 fiber used. 80kms represents 1600ps/nm at 1610nm. Measured at 2.488Gb/s with a PRBS $2^{23}-1$ pattern at a $BER < 10^{-12}$
- Pin represents the range of input powers where $BER < 10^{-12}$. Pin is valid over all data rates specified in Section IV.

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Notes/Conditions
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 System Budget	--	28	30		dB	@2.67 Gb/s, $BER < 10^{-12}$ w/ PRBS $2^{23}-1$. Does not include dispersion penalty

VI. Environmental Specifications

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref
Operating Temp	T_{op}	0		70	°C	
Storage Temp	T_{sto}	-40		85	°C	

VII. 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
Electrical Safety	TÜV	EN 60950 EN 60825-1 EN 60825-2
	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 MSA⁵. These SFPs use an Atmel AT-24C01A 128 byte E²PROM with an address of A0h (see table below for E²PROM contents). For details on interfacing with the E²PROM, see the Atmel data sheet titled “AT24C01A/02/04/08/16 2-Wire Serial CMOS E²PROM.”⁶

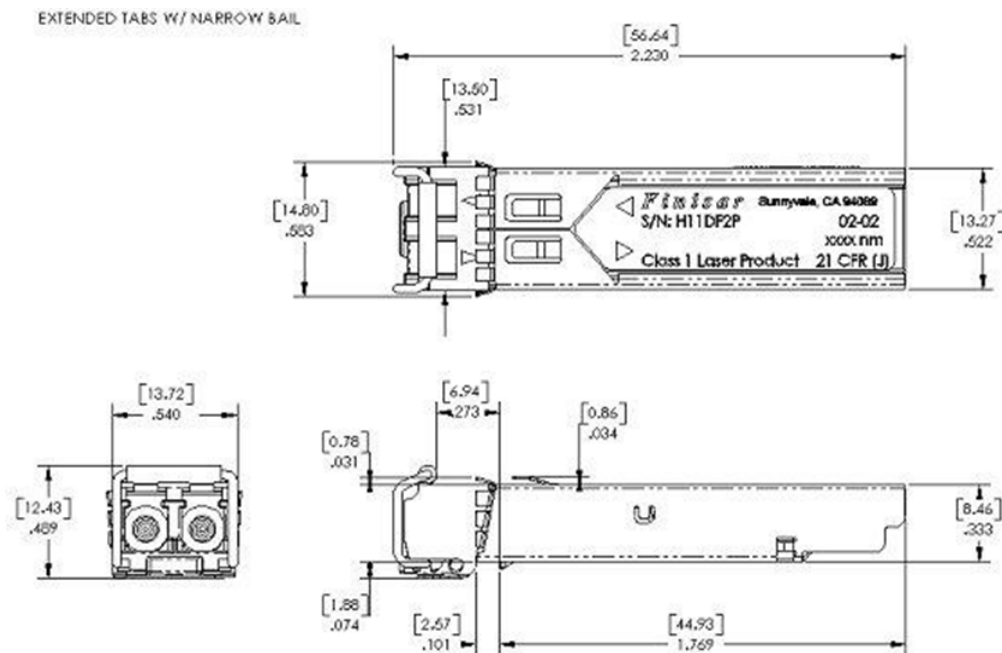
Finisar’s CWDM SFPs also support extended diagnostic features as described in Finisar Applications Note AN-2030, “Digital Diagnostic Monitoring Interface for Optical Transceivers”, and additional information is available in SFF standard titled: “Digital Diagnostic Monitoring Interface for Optical Transceivers8 (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	Units	Min	Max	Accuracy	Ref.
I2C Clock Speed		0		100,000	Hz	Bus can be driven blind
Accuracy						
Internally measured transceiver temperature	DD _{Temperature}	-3		+3	°C	Measured at controller IC
Internally measured transceiver supply voltage	DD _{Voltage}	-3		+3	mV	Measured at controller IC
Measured TX bias current	DD _{Bias}	-10		+10	%	
Measured TX output power	DD _{Tx-Power}	-3		+3	dB	100% tested in production tested at room temp to ±2 dB
Measured RX received average optical power	DD _{Rx-Power}	-3		+3	dB	100% tested in production tested at room temp to ±2 dB
Range						
Internally measured transceiver temperature	DD _{Temperature}	-40		85	°C	
Internally measured transceiver supply voltage	DD _{Voltage}	3.0		4.0	V	
Measured TX bias current	DD _{Bias}	0		90	mA	
Measured TX output power	DD _{Tx-Power}	-10		5	dBm	
Measured RX received average optical power	DD _{Rx-Power}	-30		-7	dBm	

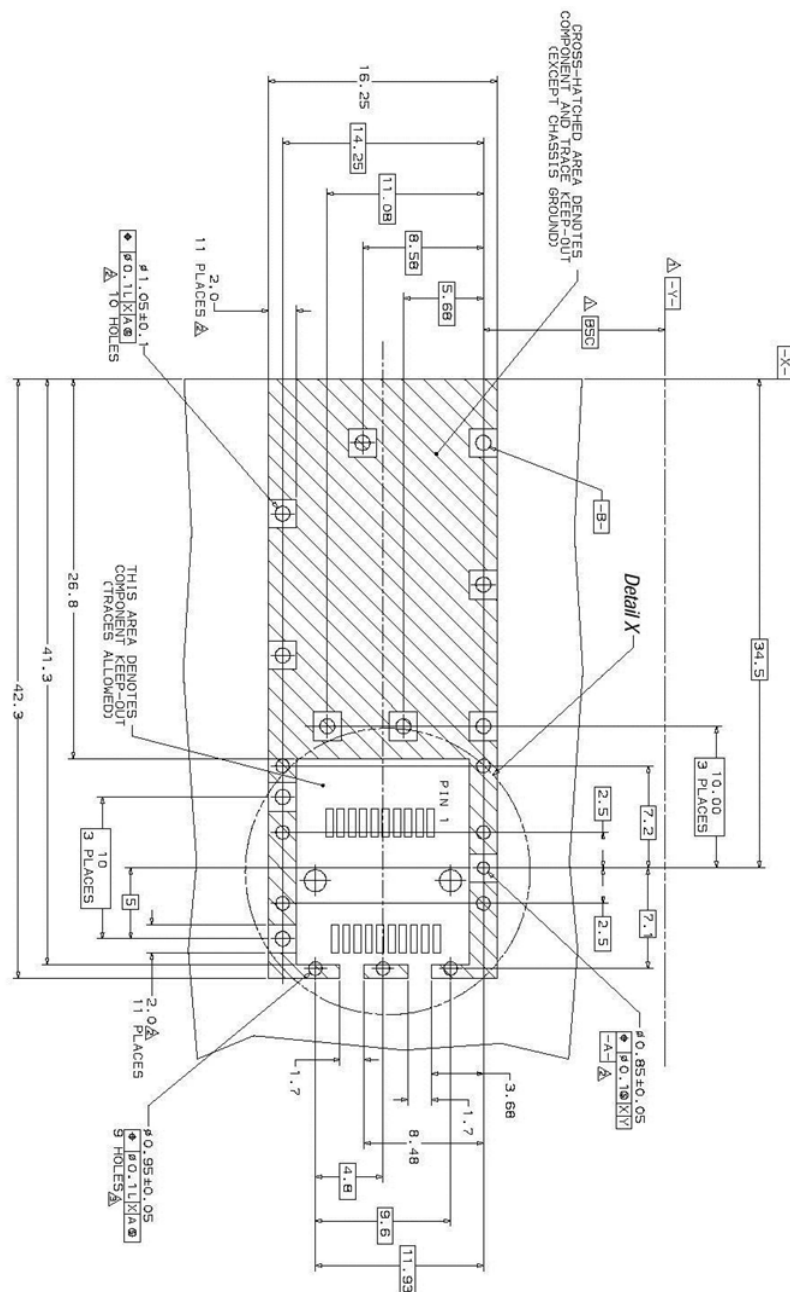
X. Mechanical Specifications

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



FWLF16217Dxx Outline Drawing – units in inches [mm]

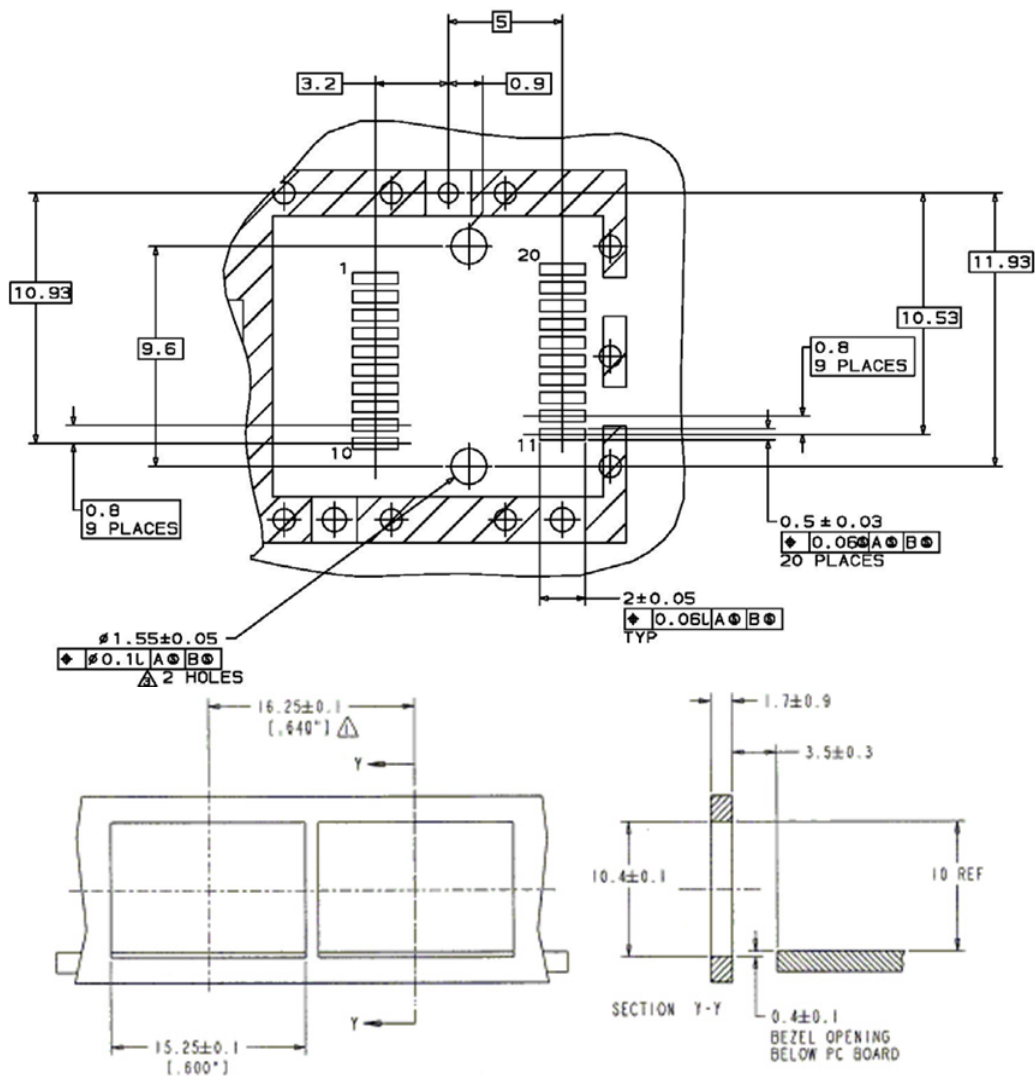
X. PCB Layout and Bezel Recommendations



△ Datum and Basic Dimension Established by Customer

△ Rads and Vias are Chassis Ground, 11 Places

△ Through Holes are Unplated



NOTES:

△ 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, September 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. "AT24C01A/02/04/08/16 2-Wire Serial CMOS E²PROM", Atmel Corporation. www.Atmel.com
7. "Application Note AN-2030: Digital Diagnostic Monitoring Interface for Optical Transceivers", Finisar Corporation, April 2002.
8. "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 FWLF16217Dxx complies with these specifications except for the following optical parameters, which have different values: transmitter wavelength, receiver sensitivity, and transmit output power. See Section IV for details.