

LP-OSFPLRM01D

LC duplex 10GBASE-LRM 9.95 to 10.3 Gbps OM1 Multimode Fiber SFP+ 1310nm MSA Transceiver up to 220 m.

LPOSFPLRM01D_SS_ENB01W

Features

- Cost effective
- Supports 9.95 to 10.3 Gbps bit rates.
- Transmission distance up to 220m (OM1 fiber).
- Hot Pluggable SFP+ footprint.
- 1310nm FP transmitter, PIN photo-detector.
- Digital Status monitoring Interface.
- Duplex LC connector.
- RoHS compliant and Lead Free.
- Metal enclosure for lower EMI.
- Single 3.3V power supply.
- Power dissipation < 1W typical.
- Operating case temperature: 0 to 70°C.
- Compliant with FC-PI-4 800-Mx-SN-I, SFF-8431, SFF-8432 and SFF-8472.

Applications

- The LP-OSFPLRM01D is designed for use with Cisco network equipment and is equivalent to Cisco part number SFP-10G-LRM.
- 10GBASE-LRM 10G Gigabit Ethernet.
- Legacy FDDI multimode links.
- Switch to Switch interface.
- Switched backplane applications.
- Router/Server interface.
- Other optical transmission systems.



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The **LP-OSFPLRM01D** is compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA). The SFP+ LRM is an optical transceiver module for transmission at 1310nm over legacy multimode fiber.

Supporting 10GBASE-LRM Ethernet standard, it is ideally suited for 10G data communications. The very low power consumption and its excellent EMI performance allows for a system design with high port density.

The **LP-OSFPLRM01D** is designed for use with Cisco network equipment and is equivalent to Cisco part number SFP-10G-LRM.

The small form factor integrates a 1310nm Fabry-Perot (FP) laser in an LC package and a linear multimode PIN receiver. The module is lead free, RoHS compliant and is designed and tested in accordance with industry safety standards.

The **LP-OSFPLRM01D** SFP+ transceiver is a linear-interface transceiver that enables, in conjunction with an Electronic Dispersion Compensation (EDC) on the host board, an IEEE802.3aq 10GBASE-LRM compliant link. The host board EDC provides correction for the severe modal dispersion that may occur during propagation through multimode fiber links, including legacy installed FDDI multimode fiber (see IEEE802.3aq for detailed information regarding fiber coverage).



A Compatibility List

- Catalyst 3850 Series - 3850-24F-E
- Catalyst 3850 Series - 3850-48P-E
- Catalyst 3850 Series - 3850-24P-E
- Catalyst 3850 Series - 3850-48T-E
- Catalyst 3850 Series - 3850-24T-E
- Catalyst 3850 Series - 3850-48F-S
- Catalyst 3850 Series - 3850-48P-S
- Catalyst 3850 Series - 3850-24P-S
- Catalyst 3850 Series - 3850-48T-S
- Catalyst 3850 Series - 3850-24T-S
- Catalyst 3850 Series - 3850-48F-L
- Catalyst 3850 Series - 3850-48P-L
- Catalyst 3850 Series - 3850-24P-L
- Catalyst 3850 Series - 3850-48T-L
- Catalyst 3850 Series - 3850-24T-L
- Wide Area Virtualization Engine - WAVE-694
- Wide Area Virtualization Engine - WAVE-594
- 500 Series Stackable Managed Switch - SG500X-52P
- 500 Series Stackable Managed Switch - SG500X-52
- 500 Series Stackable Managed Switch - SG500X-48P
- 500 Series Stackable Managed Switch - SG500X-48
- 500 Series Stackable Managed Switch - SG500X-24P
- 500 Series Stackable Managed Switch - SG500X-24
- Catalyst 6500 Series - WS-X6908-10G-2TXL
- Catalyst 6500 Series - WS-X6908-10G-2T
- Catalyst 6500 Series - WS-X6816-10G-2TXL
- Catalyst 6500 Series - WS-X6816-10G-2T
- Catalyst 6500 Series - WS-X6716-10G-3CXL
- Catalyst 6500 Series - WS-X6716-10G-3C
- Nexus 7000 Series - N7K-M132XP-12L
- Nexus 7000 Series - N7K-M132XP-12
- Nexus 7000 Series - N7K-F248XP-25
- Catalyst 4500 Series Switch - WS-X45-SUP7L-E
- Catalyst 6500 Series - VS-S2T-10G-XL
- Catalyst 6500 Series - VS-S2T-10G
- Catalyst 3750-X Series - WS-C3750X-24S
- Catalyst 3750-X Series - WS-C3750X-12S
- ME 3800X - ME-3800X-24FS-M (SFP+ ports)
- Nexus 7000 Series - N7K-F132XP-15
- Catalyst 2360 Series - 2360-48TD-S
- Catalyst 4900 Series Switch - WS-C4948E
- Catalyst 4500 Series Switch - WS-X45-SUP7-E
- Catalyst 4500 Series Switch - WS-X4712-SFP+E
- Catalyst 3750-X Series - WS-C3750X-48PF
- Catalyst 3750-X Series - WS-C3750X-48P
- Catalyst 3750-X Series - WS-C3750X-24P
- Catalyst 3750-X Series - WS-C3750X-48T
- Catalyst 3750-X Series - WS-C3750X-24T
- Catalyst 3560-X Series - WS-C3560X-48PF
- Catalyst 3560-X Series - WS-C3560X-48P
- Catalyst 3560-X Series - WS-C3560X-24P
- Catalyst 3560-X Series - WS-C3560X-48T
- Catalyst 3560-X Series - WS-C3560X-24T
- Catalyst 2960-S Series - WS-C2960S-24TD-L
- Catalyst 2960-S Series - WS-C2960S-48TD-L
- Catalyst 2960-S Series - WS-C2960S-24PD-L
- Catalyst 2960-S Series - WS-C2960S-48LPD-L
- Catalyst 2960-S Series - WS-C2960S-48FPD-L
- Catalyst 2960-S Series - WS-C2960S-24TS-L
- ME 3600X - ME-3600X-24TS-M (SFP+ Ports)
- ME 3600X - ME-3600X-24FS-M (client ports)
- Catalyst 4500 Series Switch - WS-X45-SUP6L-E
- ME 4900 Series Ethernet Switch - ME-4924-10GE
- Catalyst 6500 Series - WS-X6708-10G-3CXL
- Catalyst 6500 Series - WS-X6708-10G-3C
- Catalyst 4900 Series Switch - WS-X4908-10GE
- Catalyst 4900 Series Switch - WS-X4904-10GE
- Catalyst 4900 Series Switch - WS-C4928-10GE
- Catalyst 4900 Series Switch - WS-C4948-10GE
- Catalyst 4500 Series Switch - WS-X4606-X2-E
- Catalyst 3560-E Series - WS-C3560E-12SD
- Catalyst 3100 Series Blade Switch- WS-CBS-3130X-S
- Catalyst 3100 Series Blade Switch - WS-CBS-3120X-S
- Catalyst 6500 Series - VS-S720-10G-3CXL
- Catalyst 6500 Series - VS-S720-10G-3C
- Catalyst 4500 Series Switch - WS-X45-SUP6-E
- Catalyst 4500 Series Switch - WS-X4516-10GE
- Catalyst 4500 Series Switch - WS-X4013+10GE
- Catalyst 3750-E Series - WS-C3750E-48PDF
- Catalyst 3750-E Series - WS-C3750E-48PD
- Catalyst 3750-E Series - WS-C3750E-48TD
- Catalyst 3750-E Series - WS-C3750E-24PD
- Catalyst 3750-E Series - WS-C3750E-24TD
- Catalyst 3560-E Series - WS-C3560E-12D
- Catalyst 3560-E Series - WS-C3560E-48PDF
- Catalyst 3560-E Series - WS-C3560E-48PD
- Catalyst 3560-E Series - WS-C3560E-48TD
- Catalyst 3560-E Series - WS-C3560E-24PD
- Catalyst 3560-E Series - WS-C3560E-24TD
- Nexus 7000 Series - N7K-F248XP-32E
- OmniSwitch 6900 Series - OS-HNI-U6 Expansion Module
- OmniSwitch 6900 Series - OS-XNI-U4 Expansion Module
- OmniSwitch 6900 Series - OS-XNI-U12 Expansion Module
- OmniSwitch 6900 Series - OS6900-T40
- OmniSwitch 6900 Series - OS6900-X40
- OmniSwitch 6900 Series - OS6900-T20
- OmniSwitch 6900 Series - OS6900-X20
- Nexus 2000 Series - N2K-C2248TP-E-1GE
- Catalyst 6500 VS-720-10G-3CXL
- Catalyst 6500 VS-720-10G-3C
- Catalyst 4500-X Series WS-C4500-X-F-16SFP+
- Catalyst 4500X Series WS-C4500-X-24X-ES
- Catalyst 4500X Series WS-C4500X-16SFP+
- Catalyst 4500X Series WS-C4500-X-32SFP+
- Catalyst 4500 Series WS-X45-SUP8-E
- Catalyst 3850 Series 3850-NM-10G
- Catalyst C2960-XR Series WS-C2960XR-24TS-LL
- Catalyst C2960-XR Series WS-C2960XR-48FPD-I
- Catalyst C2960-XR Series WS-C2960XR-48LPD-I
- Catalyst C2960-XR Series WS-C2960XR-24PD-I
- Catalyst C2960-XR Series WS-C2960XR-48TD-I
- Catalyst C2960-XR Series WS-C2960XR-24TD-I
- Catalyst C2960-XR Series WS-C2960XR-24FPS-I
- Catalyst C2960-XR Series WS-C2960XR-48LPS-I
- Catalyst C2960-XR Series WS-C2960XR-24PS-I
- Catalyst C2960-XR Series WS-C2960XR-48TS-I
- Catalyst C2960-XR Series WS-C2960XR-24TS-I
- Catalyst C2960-X Series WS-C2960-X-48FPD-L
- Catalyst C2960-X Series WS-C2960-X-48LPD-L
- Catalyst C2960-X Series WS-C2960-X-48TD-L
- Catalyst C2960-X Series WS-C2960-X-24PD-L
- Catalyst C2960-X Series WS-C2960-X-24TD-L
- Catalyst C2960-X Series WS-C2960-X-48FPS-L
- Catalyst C2960-X Series WS-C2960-X-24TS-L

A Compatibility List

- Catalyst C2960-X Series WS-C2960-X-24PS-L
- Catalyst C2960-X Series WS-C2960-48TS-LL
- Nexus 7000 Series - N7K-M224XP-23L
- Nexus 7000 Series - N7K-F248XP-25E
- Catalyst 6500 Series WS-X6904-40G-2TXL
- Catalyst 6500 Series WS-X6904-40G-2T
- Catalyst 4900 Series Switch - WS-C4900M
- Catalyst 2960-X Series - WS-C2960X-18TS-LL
- Catalyst 2960-X Series - WS-C2960X-48FPD-L
- Catalyst 2960-X Series - WS-C2960X-48TD-L
- Cisco Catalyst 3650-48P Layer 3 Switch - WS-C3650-48PD-S
- Cisco Catalyst 3650 Series Switch - WS-C3650-48FD-L
- Cisco Catalyst WS-C3650-24TS
- Cisco Catalyst 3650 Series...
- Cisco Catalyst WS-C3650-24PS
- Cisco Catalyst WS-C3850-12S

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B Información del EEPROM:

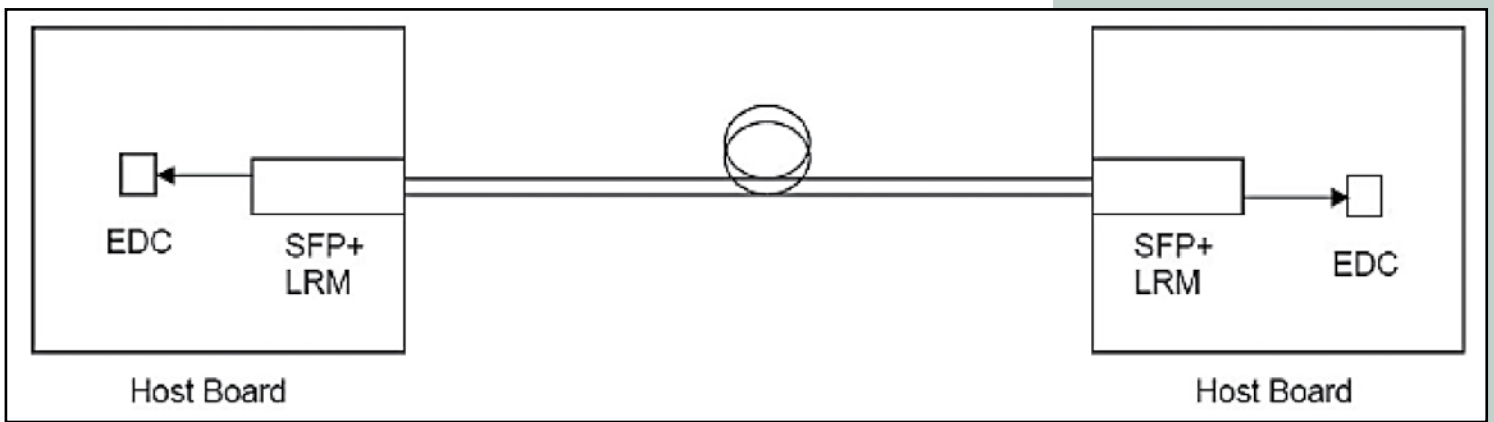


Figure 1. Block Diagram of SFP+ LRM Module on Host Board with with EDC

Unlike the XFP MSA transceiver requirements, the SFP+ transceiver does not contain internal retiming circuitry, and thus some of the Transmitter Optical Characteristics stated in this data sheet require that the Host Board is compliant to the SFP+ MSA specifications. See Chapter 3 in Reference [1] for further details.

C Absolute maximum ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

Parameter	Symbol	Min	Max	Unit
Power Supply Voltage	V _{ccT}	0	+3.6	V
Storage Temperature	T _c	-40	+85	°C
Opetating Case Temperature	T _c	0	+70	°C
Relative Humidity	RH	5	95	%

D Recommended operating environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameter	Symbol	Min	Typical	Max	Unit
Power Supply Voltage	V _{CC}	3.135	3.300	3.465	V
Storage Temperature	T _C	0	25	70	°C

E Low Speed Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
Power Consumption			0.8	1	W
TX_Fault, RX_LOS	VOL	0		0.4	V
	VOH	Host_V _{CC} -0.5		Host_V _{CC} +0.3	V
TX_DIS	VIL	-0.3		0.8	V
	VIH	2.0		VCCT+0.3	V
RS0, RS1	VIL	-0.3		0.8	V
	VIH	2.0		VCCT+0.3	V

F Electrical Characteristics

Parameter	Conditions	Symbol	Min	Typical	Max	Unit
Nominal Data Rate		VID		10.3125		Gbps
Supply Voltage		V _{CC}	3.14		3.46	V
Supply Current		I _{CC}		200	300	mA
Power Dissipation		P			1	W
Transmitter						
Input differential impedance	2	R _{in}		100		
Single ended data input swing	3	V _{in} , pp	90		350	
Transmit Disable Voltage	4	V _D	2		V _{CC}	
Transmit Enable Voltage		V _{EN}	V _{EE}		V _{EE} + 0.8	V
Receiver						
Termination Mismatch at 1 MHz		ΔZ _M	-0.3			%
Single Ended Output Voltage Tolerance						V
Output AC Common Voltage			30			mV _{rms}
Output Rise and Fall time (20% to 80%)	5	T _r , T _f				Ps
Relative Noise LRM Links with crosstalk	6	dRN _x				dB/HZ
Difference Waveform Distorsion Penalty	7	dWDP	per SFF-8431			dB
Differential Voltage Modulation Amplitude		V _{MA}	180		600	mV
LOS Fault	8	V _{LOS fault}	2		V _{CCHOST}	V
LOS Normal	8	V _{LOS norm}	V _{EE}		V _{EE} +0.8	V
Power Supply Noise Tolerance	9	V _{CC} T/V _{CC} R	per SFF-8431			mV _{pp}

Notes:

1. Non-condensing.
2. Connected directly to TX data input pins. C coupling from pins into laser driver IC.
3. Per SFF-8431 Rev 3.0
4. Into 100 ohms differential termination.
5. Measured with Module Compliance Test Board and OMA test pattern.
6. Crosstalk source rise/fall time (20%-80%) is 35 ps.
7. Defined with reference receiver with 14 T/2 spaced FFE taps and 5 T spaced DFE taps.
8. LOS is an open collector output. Should be pulled up with 4.7k - 10kΩ on the host board.
Normal operations is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.
9. As described in Section 2.8.1, SFF-8431 Rev 3.0.

G General Specifications

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Bit Rate	BR		10.3125		Gb/sec	1
Bit Error Ratio	BER			10-12		2
Maximum Supported Distances						
Fiber Type	1310nm OFL Bandwidth					
62.5µm	"FDDI" 160MHz/km	Lmax		220	m	3
	OM1 200MHz/km			220		
50µm	400MHz/km	Lmax		100	m	3
	OM2 500MHz/km			220		
	OM3 2000MHz/km			220		

Notes:

1. 10GBASE-LRM
2. Tested with a 231 - 1 PRBS
3. Operating range as defined by IEEE standards. Longer reach possible depending upon link implementation.

H Optical Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_t	1260		1355	nm	
RMS spectral width	$\lambda_{rms}@1260nm$	-	-	2.4	nm	2
	$\lambda_{rms}@1260-1300nm$	-		2.4		
	$\lambda_{rms}@1300nm-1355$	-		4		
Average Optical Power	P_{avg}	-6.5	-	0.5	dBm	1
Extinction Ratio	ER	3.5	-	-	dB	
Optical Modulation Amplitude (OMA)	POMA	-4.5		+1.5	dBm	
Peak Launch Power	PMAX			3	dBm	
Transmitter Waveform Dispersion Penalty	TWDP			4.7	dB	3
Average Launch power of OFF transmitter	POFF			-30	dBm	
Uncorrelated Jitter (rms)	(rms)			0.033	UI	
Encircled Flux	<5µm	30			%	
	<11µm	81				

H Optical Characteristics

Parámetro	Símbolo	Mínimo	Típico	Máximo	Unidad	Notas
Transmitter Reflectance				-12	dB	
Optical Return Loss Tolerance		20			dB	
Relative Intensity Noise	Rin			-128	Db/Hz	
Receiver						
Comprehensive Stressed Reciver Sensivity (OMA) @10.3125Gb/s	Procyrsir			-6.5	dBm	
	Symmetrical			-6	dBm	
	Postcursor			-6.5	dBm	
LOS Assert	L _{os} A	-30			dBm	
LOS De-Assert	L _{os} D			-11	dBm	
Overload	P _{MAX}	+1.5			dBm	
Receiver Reflectance		-		-12	dB	
LOS Hysteresis		0.5			dB	

Notes:

1. Average power figures are informative only, per IEEE802.3aq
2. Maximum RMS spectral width as specified by Figure 3
3. Optical Eye Mask requires the host board to be SFF-8431 compliant. Optical eye mask per IEEE802.3aq.
4. TWDP figure requires the host board to be SFF-8431compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3aq
5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.
6. Conditions of stressed receiver tests per IEEE802.3aq. CSRS testing requires the host board to be SFF-8431 compliant.

I Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev9.2 with internal calibration mode. For external calibration mode please contact our sales stuff.

Parameter	Symbol	Min	Max	Unit	Notes
Accuracy					
Transceiver Temperature	DMI_Temp	-3	+3	degC	Over operating temp
TX Output optical power	DMI_TX	-3	+3	dBm	
RX Input optical power	DMI_RX	-3	+3	dBm	-3dBm to -12dBm range
Transceiver Supply voltage	DMI_VCC	-0.08	+0.08	V	Full operating range
Bias current monitor	DMI_Ibias	-10%	10%	mA	
Dynamic Range Accuracy					
Tranceiver Temperature	DMI_Temp	-5	70	degC	
TX Output optical power	DMI_TX	-9	-1	dBm	
RX Input optical power	DMI_RX	-18	0	dBm	
Transceiver Supply voltage	DMI_VCC	3.0	3.6	V	
Bias current monitor	DMI_Ibias	0	70	mA	

J Pin Assignment

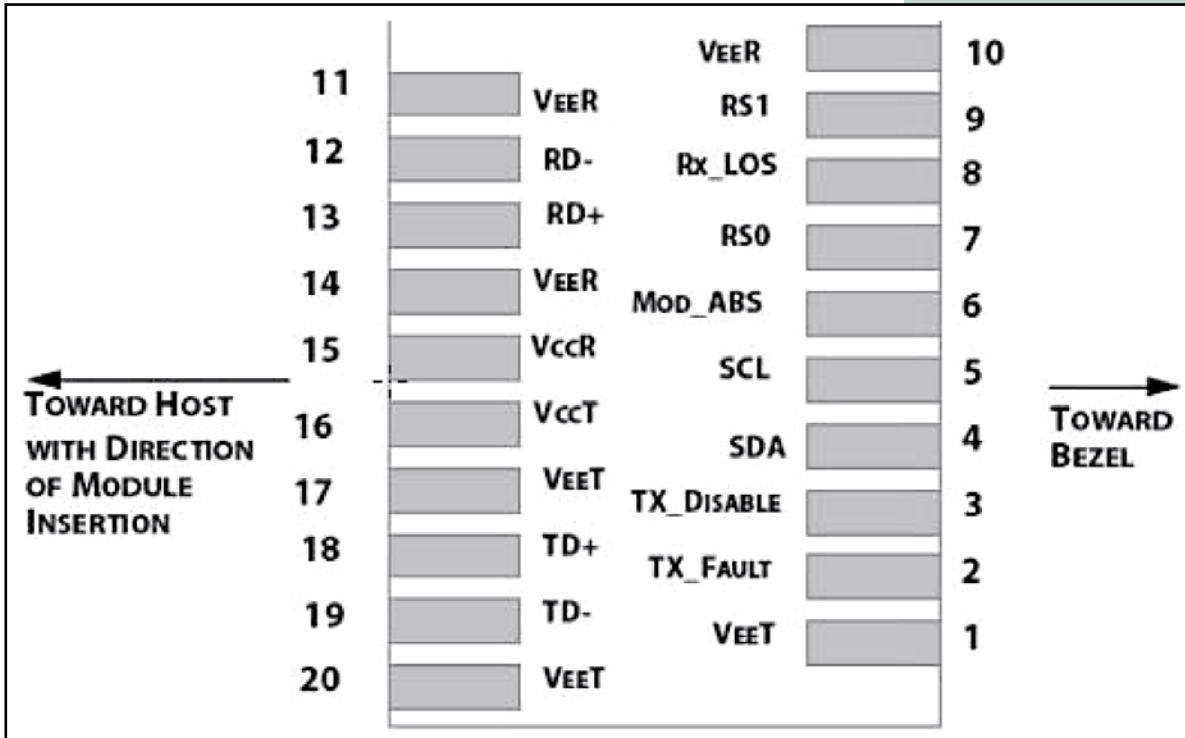


Figure 2: Interface to Host PCB

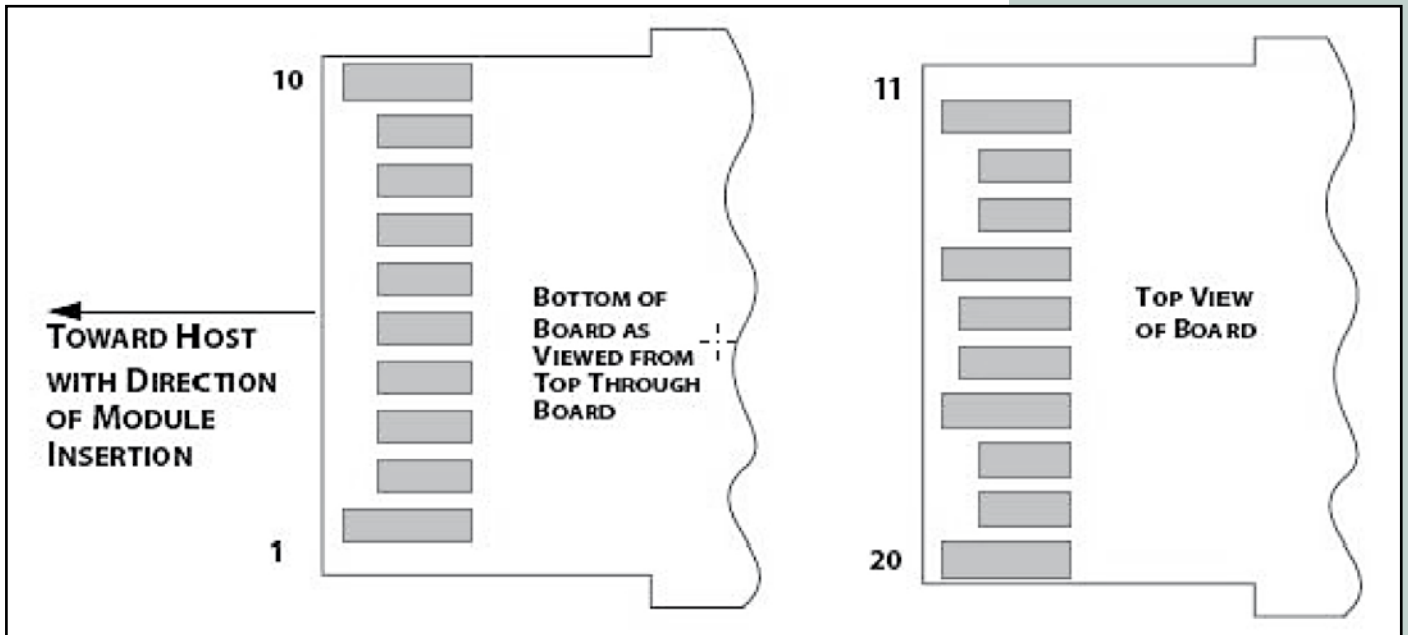


Figure 3. Module Contact Assignment

K Pin Descriptions

Pin	Signal Name	I/O Typ.	Functional Description
1	VeeT[1]		Transmitter Ground
2	TX_FAULT[2]		Transmitter Fault Indication, Logic high, open collector Compatible , 4.7K to 10K Ohm pull up to VDDT on host
3	TX_DISABLE[3]		Transmitter Disable – Module disable on high or open
4	SDA[2]	I/O	2-wire Serial Interface Data Line
5	SCL[2]	Input	2-wire Serial Interface Clock Line
6	MOD_ABS[4]	Output	Module Absent. Grounded within the module
7	RSO[5]	Input	Rate Select 0
8	RX_LOS[2]		Loss of Signal indication. Logic 0 indicates normal operation
9	RS1[5][1]		Rate select 1
10	VeeR[1]		Receiver Ground
11	VeeR[1]		Receiver Ground
12	RD-	Output	Inverse Received Data Out, AC coupled
13	RD+	Output	Received Data Out, AC coupled
14	VeeR[1]		Receiver Ground
15	VccR	Input	Receiver Power Supply
16	VccT	Input	Transmitter Power
17	VeeT[1]		Transmitter Ground
18	TD+	Input	Transmitter Data In, AC coupled
19	TD-	Input	Inverse Transmitter Data In, AC coupled
20	VeeT[1]		Transmitter Ground

Notes:

[1] Module circuit ground is isolated from module chassis ground within the module.

[2] Should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

[3] Tx_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VccT inside the module.

[4] Mod_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc_Host with a resistor in the range 4.7 kΩ to 10 kΩ. Mod_ABS is asserted "High" when the SFP+ module is physically absent from a host slot.

[5] RSO and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.

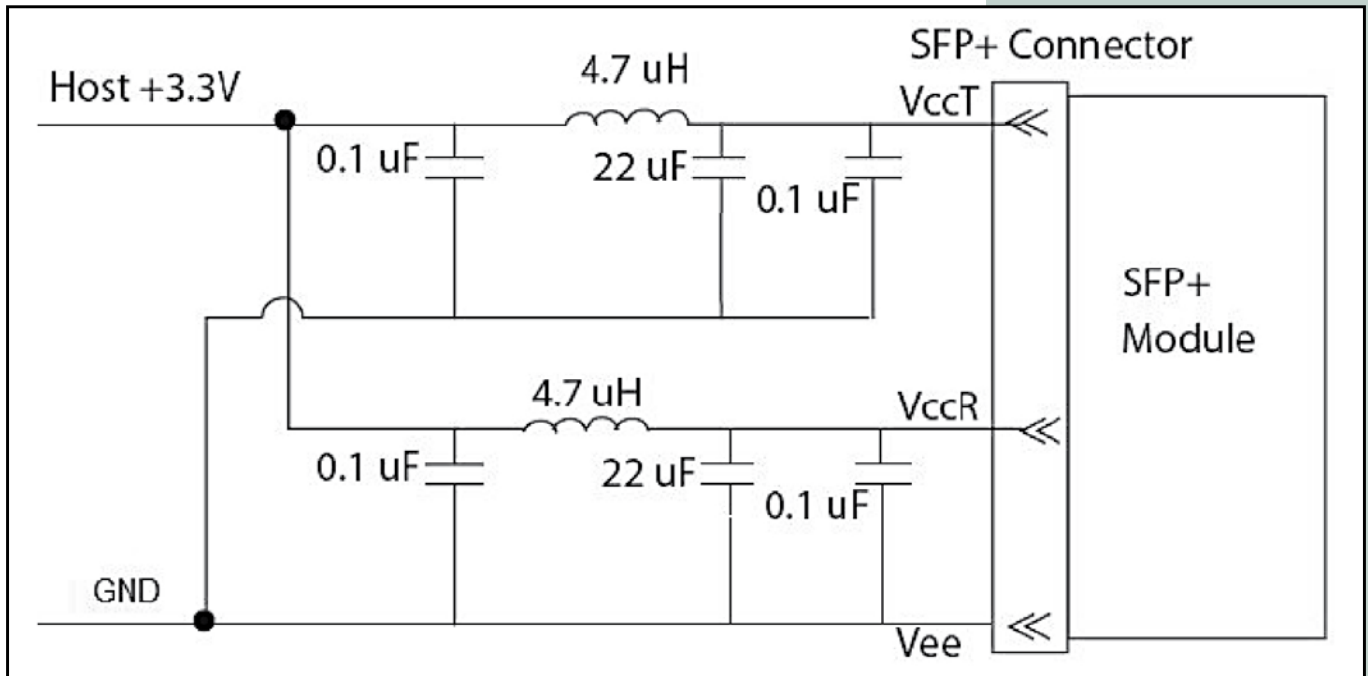


Figure 4. Host Board Power Supply Filters Circuit

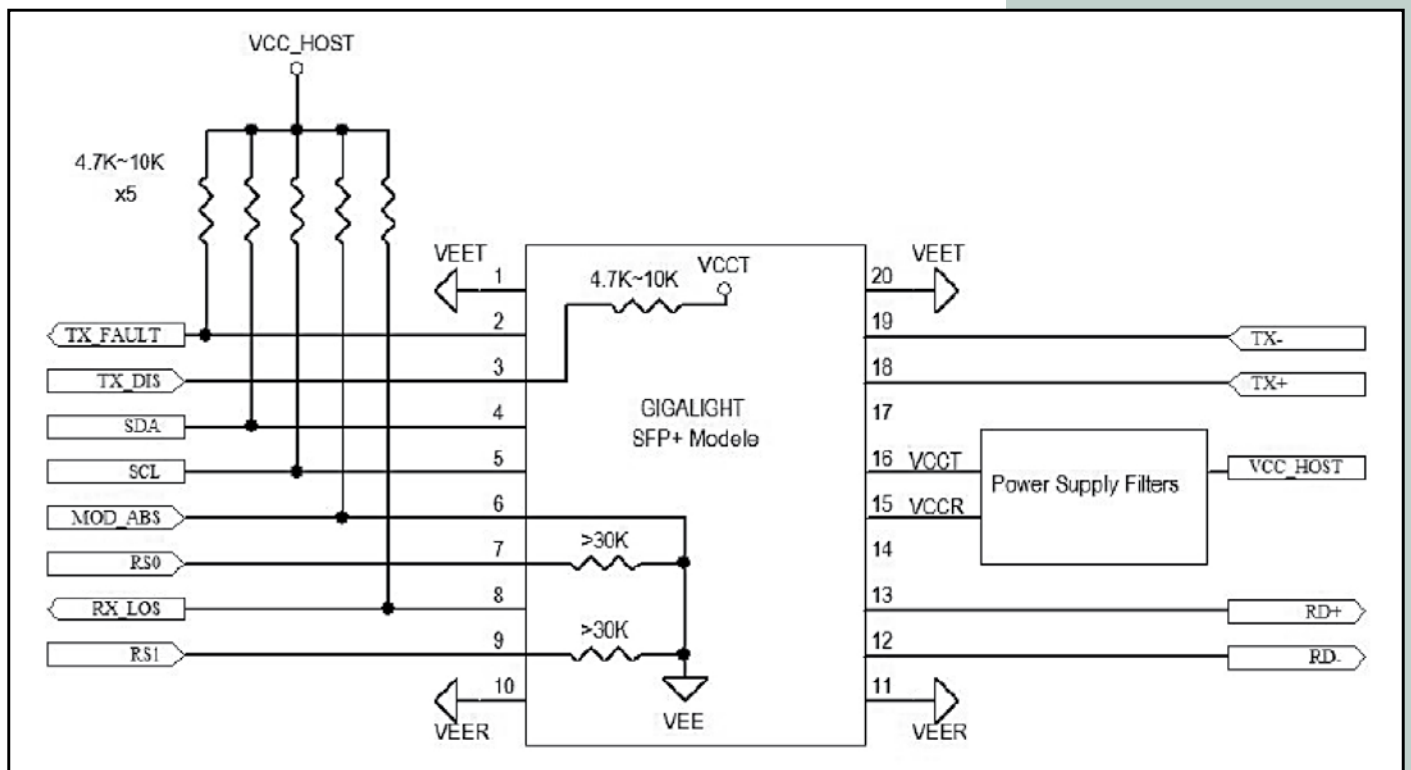


Figure 5. Host-Module Interface

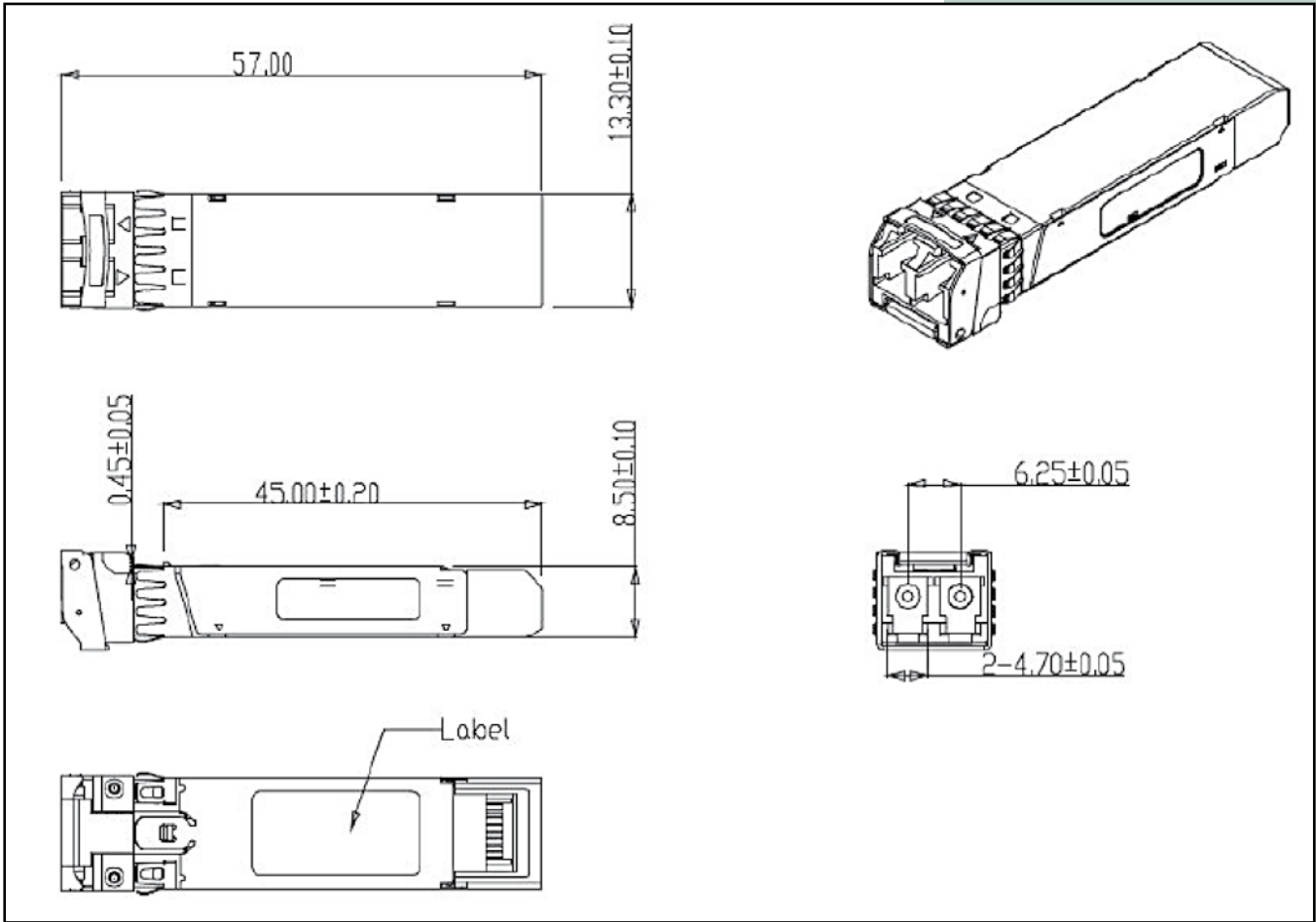


Figure 6. Mechanical Specifications

L Regulatory Compliance

The SFP+ transceiver is designed to be Class I Laser safety compliant and is certified per the following standards:

Feature	Agency	Standard	Certificate / Comments
Laser Safety	FDA	CDRH 21 CFR 1040 and Laser Notice No. 50	1120292-000
Product Safety	UL	UL and CUL EN60950-2:2007	E347511
Environmental protection	SGS	RoHS Directive 2002/95/EC	GZ1001008918/CHEM
EMC	WALTEK	EN 55022:2006+A1:2007 EN 55024:1998+A1+A2:2003	WT10093759-D-E-E

References:

1. "Specifications for Enhanced Small Form Factor Pluggable Module SFP+", SFF-8431, Rev 4.1, July 6, 2009.
2. "Improved Pluggable Formfactor", SFF-8432, Rev 4.2, Apr 18, 2007.
3. IEEE802.3aq.
4. "Diagnostic Monitoring Interface for Optical Transceivers" SFF-8472, Rev 10.3, Dec 1, 2007.

Important Notice:

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by us before they become applicable to any particular order or contract. In accordance with the policy of continuous improvement specifications may change without notice.

The publication of information in this data sheet does not imply freedom from patent or other protective rights of ours. Further details are available from any our sales representative.

M How to Order:

LP-OSFPLRM01D LC duplex 10GBASE-LRM 9.95 to 10.3 Gbps OM1 Multimode Fiber SFP+ 1310nm MSA Transceiver up to 220 m.