

## Product Features

- Compliant with ITU-T G.691 STM-64 L-64.2
- Compliant to IEEE Std 802.3-2005 10Gb Ethernet 10GBase-ZR/ZW
- XFP MSA Rev. 4.5 compliant
- Full digital diagnostic management interface
- XFP MSA package with duplex LC connector
- Cooled EML Transmitter
- Dual CDR from 9.95 to 11.3Gb/s bi-directional data links
- Class 1 laser safety certified
- Commercial operating temperature: 0°C to +70°C
- Up to 80km on 9/125 μm SMF
- RoHS Compliant



## Applications

- 80km 10G DWDM Network
- 80km 10G Ethernet 10GBASE-ZR/ZW
- 80km 10G Fiber Channel

## Descriptions

LX32xxCDR XFP transceivers, according to 10 Gigabit Small Form Factor Pluggable Module Multi-Sourcing Agreement (XFP-MSA) INF-8077i Revision 4.5, are designed for serial optical data communications at 9.95 Gb/s to 11.3 Gb/s. They meet the requirements for 80km 10G DWDM Network, IEEE Std 802.3-2005 10G Ethernet 10GBase-ZR/ZW and 80km 10G Fiber Channel.

LX32xxCDR are compliant with RoHS.

## Ordering Information

**Table 1. Ordering Information**

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX32xxCDR	DWDM EML	0 ~ +4dBm	APD	< -23dBm	80km	0 ~ 70°C	Available	Compliant

**Notes:** See Table 2 – Wavelength Guide for “xx” value.

**Table 2. Wavelength Guide for “xx” value (100GHz ITU-T channel)**

Channel #	Product Part Number	Frequency (THz)	Center Wavelength (nm)
17	LX3217CDR	191.7	1563.86
18	LX3218CDR	191.8	1563.05
19	LX3219CDR	191.9	1562.23
20	LX3220CDR	192.0	1561.42

21	LX3221CDR	192.1	1560.61
22	LX3222CDR	192.2	1559.79
23	LX3223CDR	192.3	1558.98
24	LX3224CDR	192.4	1558.17
25	LX3225CDR	192.5	1557.36
26	LX3226CDR	192.6	1556.55
27	LX3227CDR	192.7	1555.75
28	LX3228CDR	192.8	1554.94
29	LX3229CDR	192.9	1554.13
30	LX3230CDR	193.0	1553.33
31	LX3231CDR	193.1	1552.52
32	LX3232CDR	193.2	1551.72
33	LX3233CDR	193.3	1550.92
34	LX3234CDR	193.4	1550.12
35	LX3235CDR	193.5	1549.32
36	LX3236CDR	193.6	1548.51
37	LX3237CDR	193.7	1547.72
38	LX3238CDR	193.8	1546.92
39	LX3239CDR	193.9	1546.12
40	LX3240CDR	194.0	1545.32
41	LX3241CDR	194.1	1544.53
42	LX3242CDR	194.2	1543.73
43	LX3243CDR	194.3	1542.94
44	LX3244CDR	194.4	1542.14
45	LX3245CDR	194.5	1541.35
46	LX3246CDR	194.6	1540.56
47	LX3247CDR	194.7	1539.77
48	LX3248CDR	194.8	1538.98
49	LX3249CDR	194.9	1538.19
50	LX3250CDR	195.0	1537.40
51	LX3251CDR	195.1	1536.61
52	LX3252CDR	195.2	1535.82
53	LX3253CDR	195.3	1535.04
54	LX3254CDR	195.4	1534.25
55	LX3255CDR	195.5	1533.47
56	LX3256CDR	195.6	1532.68

57	LX3257CDR	195.7	1531.90
58	LX3258CDR	195.8	1531.12
59	LX3259CDR	195.9	1530.33
60	LX3260CDR	196.0	1529.55
61	LX3261CDR	196.1	1528.77

## Electrical Pin Description

**Table 3. Electrical Pin Description**

Pin	Logic	Symbol	Name/Description	Note
1	-	GND	Module Ground	1
2	-	V <sub>EE5</sub>	Optional -5.2V Power Supply - <b>Not Required</b>	-
3	LVTTL-I	Mod_DeSel	Module De-select; When held low allows module to respond to 2-wire serial interface	-
4	LVTTL-O	Interrupt	Interrupt; Indicates presence of an important condition which can be read over the 2-wire serial interface	2
5	LVTTL-I	TX_DIS	Transmitter Disable; Turns off transmitter laser output	-
6	-	V <sub>CC5</sub>	+5V Power Supply	-
7	-	GND	Module Ground	1
8	-	V <sub>CC3</sub>	+3.3V Power Supply	-
9	-	V <sub>CC3</sub>	+3.3V Power Supply	-
10	LVTTL-I/O	SCL	2-Wire Serial Interface Clock	2
11	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
12	LVTTL-O	Mod_Abs	Indicates Module is not present. Grounded in the Module	2
13	LVTTL-O	Mod_NR	Module Not Ready; Indicating Module Operational Fault	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	-	V <sub>CC2</sub>	+1.8V Power Supply - <b>Not Required</b>	-
21	LVTTL-I	P_Down/RST	Power down; When high, requires the module to limit power consumption to 1.5W or below. 2-Wire serial interface must be functional in the low power mode. Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle.	-
22	-	V <sub>CC2</sub>	+1.8V Power Supply - <b>Not Required</b>	-
23	-	GND	Module Ground	1
24	PECL-I	RefCLK+	Reference Clock Non-Inverted Input, AC coupled on the host board - <b>Not Required</b>	3
25	PECL-I	RefCLK-	Reference Clock Inverted Input, AC coupled on the host board - <b>Not Required</b>	3

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 ground pins Gnd are isolated from the module case.
2. Shall be pulled up with 4.7K $\Omega$  to 10K $\Omega$  to a voltage between 3.15V and 3.45V on the host board.
3. Reference Clock is not required. If present, it will be ignored.

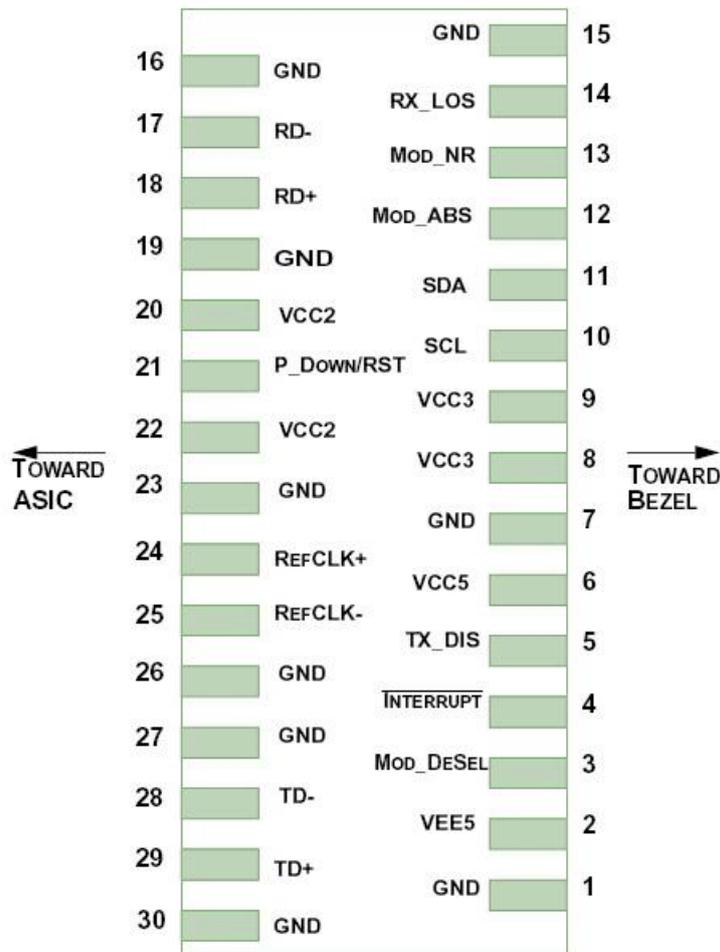


Figure 1. Host PCB XFP Pinout Top View

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

**Table 4. Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T <sub>S</sub>	-40	85	°C
Relative Humidity	RH	5	95	%
Supply Voltage	V <sub>CC3</sub>	-0.5	4.0	V
Supply Voltage	V <sub>CC5</sub>	-0.5	6.0	V

## Recommended Operating Conditions

**Table 5. Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	T <sub>C</sub>	0	-	70	°C
Supply Voltage	V <sub>CC3</sub>	3.135	3.3	3.465	V
Supply Voltage	V <sub>CC5</sub>	4.75	5.00	5.25	V
Data Rate	-	9.95	-	11.3	Gb/s

## Transceiver Electrical Characteristics

**Table 6. Transceiver Electrical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Supply Current	I <sub>CC3</sub>	-	-	750	mA	-
Supply Current	I <sub>CC5</sub>	-	-	500	mA	-
Power Dissipation	P <sub>D</sub>	-	-	3500	mW	-
<b>Transmitter</b>						
Input Differential Impedance	Z <sub>IN</sub>	-	100	-	Ω	-
Differential Data Input Swing	V <sub>IN, P-P</sub>	120	-	1000	mV <sub>P-P</sub>	-
Tx_Disable, P_Down/RST	V <sub>IH</sub>	2.0	-	V <sub>CC3</sub> +0.3	V	-
	V <sub>IL</sub>	-0.3	-	0.8	V	-
Transmit Disable Assert Time	-	-	-	10	us	-
<b>Receiver</b>						
Output Differential Impedance	Z <sub>O</sub>	-	100	-	Ω	-

Differential Data Output Swing	$V_{OUT, P-P}$	340	-	850	$mV_{P-P}$	1
Data Output Rise Time, Fall Time	$t_r, t_f$	24	-	-	ps	2
Rx_LOS, Mod_NR, Interrupt	$V_{OH}$	$V_{CCHOST-0.5}$	-	$V_{CCHOST+0.3}$	V	3
	$V_{OL}$	0	-	0.4	V	3

**Notes:**

1. Internally AC coupled, but requires a external 100Ω differential termination.
2. 20–80%.
3. Loss Of Signal is an open collector output. Should be pulled up with a 4.7kΩ-10kΩ resistor on the host board.

## Transmitter Optical Characteristics

**Table 7. Transmitter Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Average Optical Power	$P_o$	0	-	+4	dBm	1
Center Wavelength Range	$\lambda_c$	1528.77	-	1563.86	nm	-
Center Wavelength Spacing	-	-	100	-	GHz	-
Center Wavelength Tolerance	$\Delta\lambda_c$	-100	-	100	pm	-
Extinction Ratio	EX	9	-	-	dB	2
Spectral Width (-20dB)	$\Delta\lambda$	-	-	0.3	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Average Optical Power (Laser Off)	$P_{OFF}$	-	-	-30	dBm	1
Eye Diagram	ITU-T G.691 SDH STM-64 L-64.2 compatible					2

**Notes:**

1. The optical power is launched into 9/125 μm SMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @ 9.953Gbps.

## Receiver Optical Characteristics

**Table 8. Receiver Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Center Wavelength	$\lambda_c$	1528	-	1565	nm	-
Receiver Sensitivity @ 9.953Gb/s	S	-	-	-24.0	dBm	1
Receiver Sensitivity @ 11.1Gb/s	S	-	-	-23.0	dBm	2
Receiver Overload ( $P_{avg}$ )	$P_{OL}$	-7.0	-	-	dBm	1
Path Penalty @ 1600ps @ 9.953Gb/s	PP1	-	-	2	dB	1
Path Penalty @ 1600ps @ 11.1Gb/s	PP2	-	-	3	dB	2
Optical Return Loss	ORL	27	-	-	dB	-
LOS De-Assert	$LOS_D$	-	-	-27	dBm	-
LOS Assert	$LOS_A$	-38	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	-

**Notes:**

1. Measured with worst ER; 1550nm; PRBS 2<sup>31</sup>-1 test pattern @ 9.953Gb/s, BER<10<sup>-12</sup>.
2. Measured with worst ER; 1550nm; PRBS 2<sup>31</sup>-1 test pattern @ 11.1Gb/s, BER<10<sup>-12</sup>.

## OSNR Characteristics

Bit Rate (Gbps)	Dispersion (ps/nm)	OSNR(dB)	Receiver Sensitivity(dBm)	BER
9.95/10.3	0	>30	-24 ~ -7	10E-12
		>25	-18 ~ -7	
	1200	>30	-23 ~ -7	
		>27	-18 ~ -7	
	1600	>30	-22 ~ -7	
		>28	-18 ~ -7	
10.7/11.1 with FEC	0	>30	-26 ~ -7	10E-4
		>16	-18 ~ -7	
	1200	>30	-25 ~ -7	
		>18	-18 ~ -7	
	1600	>30	-22 ~ -7	
		>20	-18 ~ -7	

## Management Interface

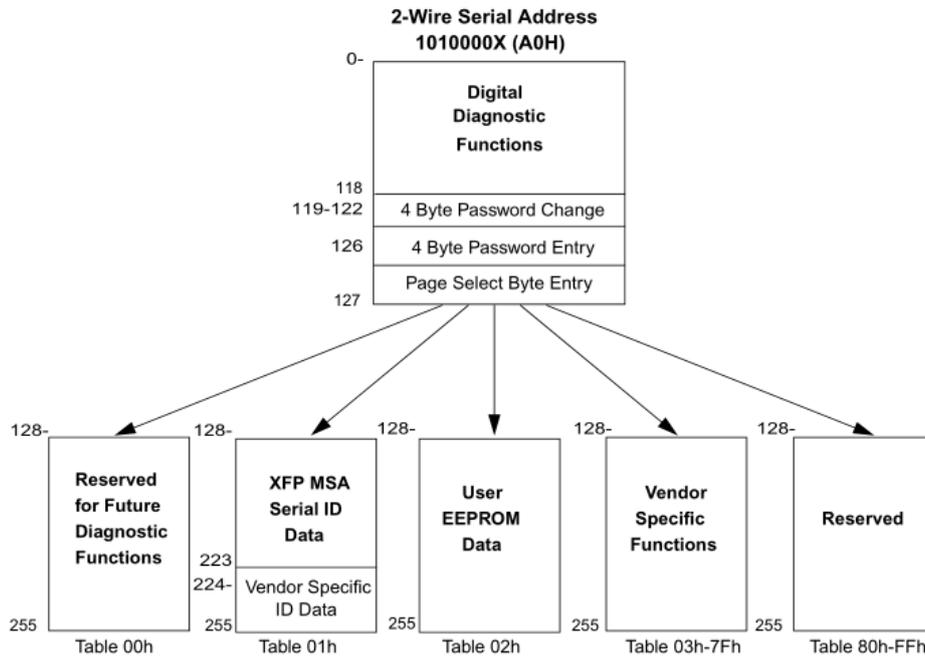


Figure 2. 2-wire Serial Digital Diagnostic Memory Map

## EEPROM Serial ID Memory Contents

The XFP SMA defines the operation of the XFP 2-wire serial interface which is used for serial ID, digital diagnostics, and certain control functions. The 2-wire serial interface is mandatory for all XFP modules.

Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The memory contents are shown in Table 9.

**Table 9. Serial ID Memory Contents**

Data Address	Name of Field	Contents(Hex)	Description
128	Identifier	06	XFP
129	Ext. Identifier	90	3.5W max, No TX Ref Clock Input
130	Connector	07	LC
131-138	Transceiver	00 00 00 00 00 00 04 00	G.959.1 PIL1-2D2
139	Encoding	B0	64B/66B,SONET Scrambled NRZ
140	BR-Min	63	9.953Gb/s
141	BR-Max	71	11.3Gb/s
142	Length (SMF)-km	50	80km
143	Length (E-50µm)	00	-
144	Length (50µm)	00	-

145	Length(62.5μm)	00	-
146	Length (Copper)	00	-
147	Device Tech	76	Cooled EML, APD Detector
148-163	Vendor name	4C 49 4E 4B 54 45 4C 20 20 20 20 20 20 20 20 20	LINKTEL (ASCII)
164	CDR Support	F8	CDR supports 9.953Gbps to 11.1Gbps
165-167	Vendor OUI	00 00 00	
168-183	Vendor PN	4C 58 33 32 32 37 41 44 52 20 20 20 20 20 20 20 20	LX3227CDR
184-185	Vendor rev	31 30	Rev 10 ( ASCII)
186-187	Wavelength(1/20nm)	79 8B	1555.75nm
188-189	Wavelength Tolerance	00 14	+/-0.1nm
190	Max Case Temp	46	70°C
191	CC_BASE	xx	Check sum of bytes 128 - 190
192-195	Power Supply	AF 96 A8 00	3.5W (max), 1.5W (max, power down mode), 800mA (max, +3.3V), 500mA (max, +5V)
196-211	Vendor SN	33 31 33 34 39 30 37 31 39 33 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example "3134907193".
212-219	Date code	xx xx xx xx xx xx 20 20	Year (2 bytes), Month (2 bytes), Day (2 bytes)
220	Diagnostic Monitoring Type	08	No BER Support, Average Power
221	Enhanced Options	60	Diagnostics(Optional Soft TX_DISABLE implemented, Optional Soft P_down implemented)
222	Aux Monitoring	76	Aux1 input: +3.3V Supply; Aux2 input: +5V Supply
223	CC_EXT	xx	Check sum for bytes 192-222
224-255	Reserved	00	

**Note:** The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of XFP\_SFF\_INF\_8077i Rev 4.5;

## Diagnostic Monitor Specifications

The monitoring specification of this product is described in Table 10.

**Table 10. Diagnostic Monitor Specifications**

Parameter	Range	Accuracy	Calibration
96-97	Temperature	-10 to +80 °C	±3 °C
100-101	Bias Current	0 to 130mA	±10%
102-103	TX Power	-1 to +5dBm	±3dB
104-105	RX Power	-25 to -7dBm	±3dB
106-107	AUX1(3.3V)	3.0 to 3.7V	±3%
108-109	AUX2(5.0V)	4.0 to 6.0V	±3%

## Recommended Host Board Power Supply Filter Network

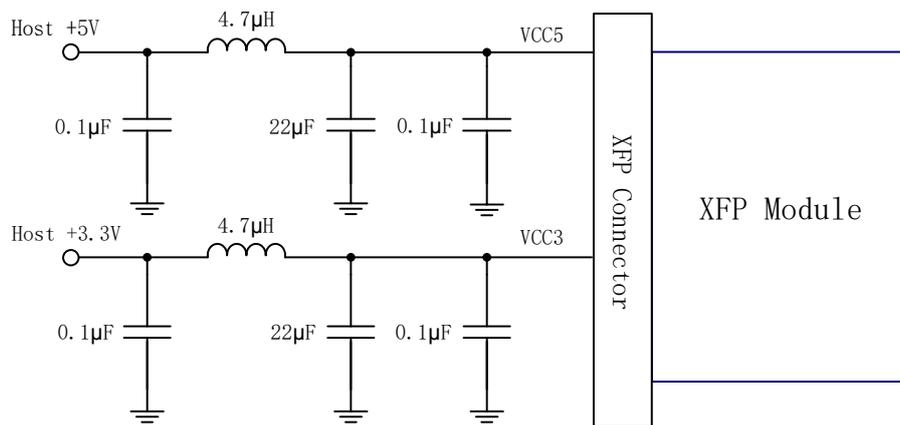


Figure 2. Recommended Host Board Power Supply Filter Network

## Recommended Application Interface Block Diagram

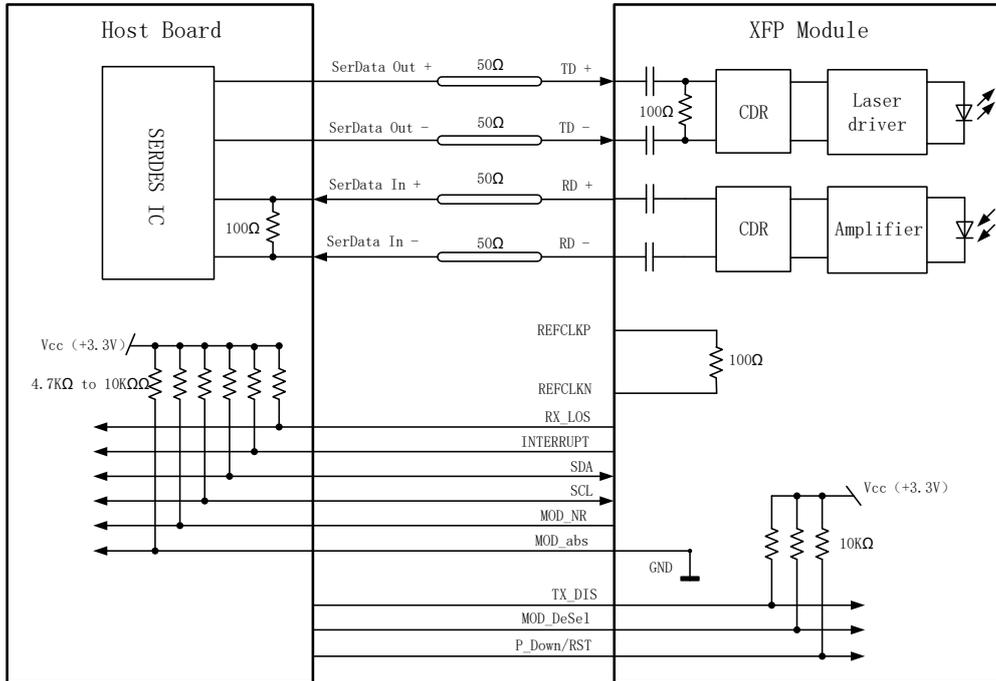


Figure 3. Recommended Application Interface Block Diagram

## Mechanical specifications

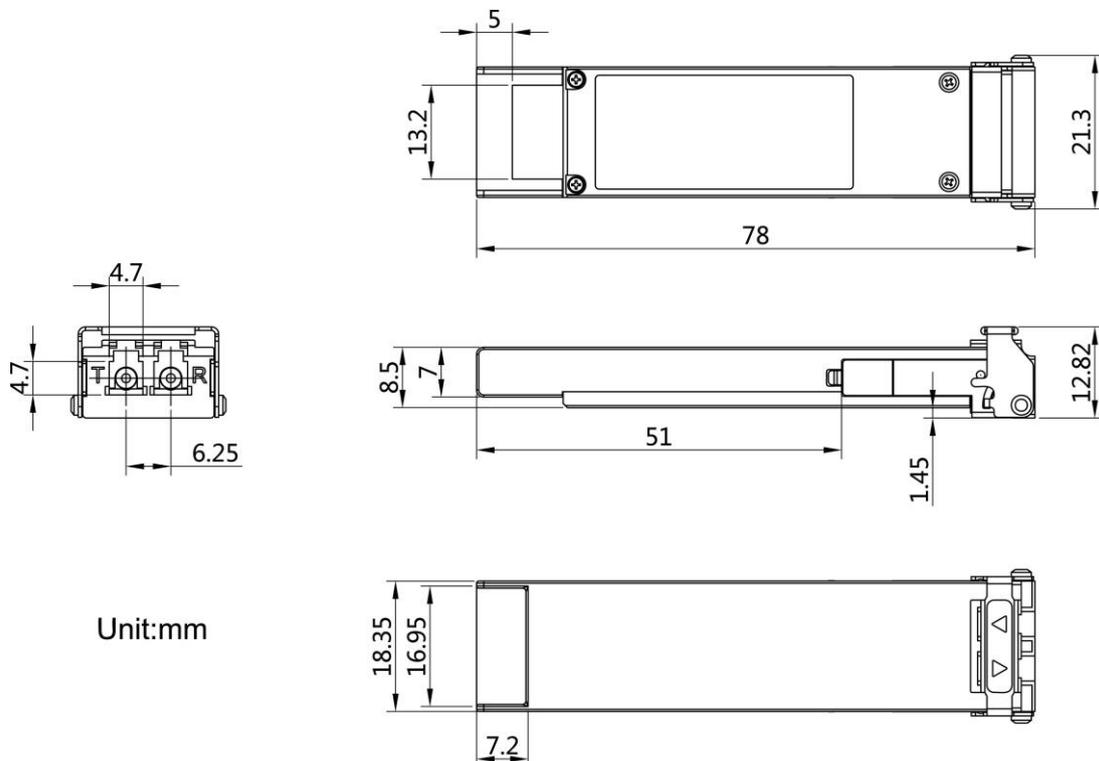


Figure 4. Outline Drawing



**LX32xxCDR**  
**10Gb/s 80km DWDM XFP Optical Transceiver**  
**10Gb/s 80km DWDM SDH / 10GBASE-ZR**

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## **For More Information**

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