

## Product Features

- Electrical interface specifications per SFF-8431
- Management interface specifications per SFF-8431 and SFF-8472
- SFP+ MSA package with duplex LC connector
- DWDM-rated EML Transmitter
- Up to 10.3Gb/s bi-directional data links
- 50GHz ITU Grid, C-Band
- Single +3.3V power supply
- Class 1 laser safety certified
- Commercial operating temperature: 0°C to +70°C
- Up to 40km on 9/125µm SMF
- RoHS Compliant



## Applications

- 10G Ethernet 10GBASE-ER/EW
- 40km 10G DWDM Network

## Descriptions

LX41xxxCDR SFP+ transceivers, according to Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable “SFP+” Multi-Sourcing Agreement (MSA) SFF-8431 and SFF-8472, revision 10.4, are designed for DWDM 10G ethernet data communications up to 40km over single mode fiber. They are compliant with IEEE Std 802.3-2005 10Gb Ethernet 10GBase-ER/EW.

LX41xxxCDR are compliant with RoHS.

## Ordering Information

**Table 1. Ordering Information**

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX41xxxCDR	DWDM EML	-1~ +2dBm	PIN	< -15.8dBm	40km	0 ~ 70 °C	Available	Compliant

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

**Table 2. Wavelength Guide for “xxx” value (50GHz ITU-T channel)**

Channel #	Product Part Number	Frequency (THz)	Center Wavelength (nm)
170	LX41170CDR	191.70	1563.863
175	LX41175CDR	191.75	1563.455
180	LX41180CDR	191.80	1563.047
185	LX41185CDR	191.85	1562.640



**LX41xxxCDR**  
**10GEthernet 40km DWDM SFP+ Transceiver**  
**10GBASE-ER / 10GBASE-EW**

190	LX41190CDR	191.90	1562.233
195	LX41195CDR	191.95	1561.826
200	LX41200CDR	192.00	1561.419
205	LX41205CDR	192.05	1561.013
210	LX41210CDR	192.10	1560.606
215	LX41215CDR	192.15	1560.200
220	LX41220CDR	192.20	1559.794
225	LX41225CDR	192.25	1559.389
230	LX41230CDR	192.30	1558.983
235	LX41235CDR	192.35	1558.578
240	LX41240CDR	192.40	1558.173
245	LX41245CDR	192.45	1557.768
250	LX41250CDR	192.50	1557.364
255	LX41255CDR	192.55	1556.959
260	LX41260CDR	192.60	1556.555
265	LX41265CDR	192.65	1556.151
270	LX41270CDR	192.70	1555.747
275	LX41275CDR	192.75	1555.344
280	LX41280CDR	192.80	1554.940
285	LX41285CDR	192.85	1554.537
290	LX41290CDR	192.90	1554.134
295	LX41295CDR	192.95	1553.732
300	LX41300CDR	193.00	1553.329
305	LX41305CDR	193.05	1552.927
310	LX41310CDR	193.10	1552.525
315	LX41315CDR	193.15	1552.123
320	LX41320CDR	193.20	1551.721
325	LX41325CDR	193.25	1551.320
330	LX41330CDR	193.30	1550.918
335	LX41335CDR	193.35	1550.517
340	LX41340CDR	193.40	1550.116
345	LX41345CDR	193.45	1549.716
350	LX41350CDR	193.50	1549.315
355	LX41355CDR	193.55	1548.915
360	LX41360CDR	193.60	1548.515
365	LX41365CDR	193.65	1548.115
370	LX41370CDR	193.70	1547.716

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375	LX41375CDR	193.75	1547.316
380	LX41380CDR	193.80	1546.917
385	LX41385CDR	193.85	1546.518
390	LX41390CDR	193.90	1546.119
395	LX41395CDR	193.95	1545.721
400	LX41400CDR	194.00	1545.322
405	LX41405CDR	194.05	1544.924
410	LX41410CDR	194.10	1544.526
415	LX41415CDR	194.15	1544.128
420	LX41420CDR	194.20	1543.731
425	LX41425CDR	194.25	1543.333
430	LX41430CDR	194.30	1542.936
435	LX41435CDR	194.35	1542.539
440	LX41440CDR	194.40	1542.142
445	LX41445CDR	194.45	1541.746
450	LX41450CDR	194.50	1541.35
455	LX41455CDR	194.55	1540.953
460	LX41460CDR	194.60	1540.558
465	LX41465CDR	194.65	1540.162
470	LX41470CDR	194.70	1539.766
475	LX41475CDR	194.75	1539.371
480	LX41480CDR	194.80	1538.976
485	LX41485CDR	194.85	1538.581
490	LX41490CDR	194.90	1538.186
495	LX41495CDR	194.95	1537.792
500	LX41500CDR	195.00	1537.397
505	LX41505CDR	195.05	1537.003
510	LX41510CDR	195.10	1536.609
515	LX41515CDR	195.15	1536.216
520	LX41520CDR	195.20	1535.822
525	LX41525CDR	195.25	1535.429
530	LX41530CDR	195.30	1535.036
535	LX41535CDR	195.35	1534.643
540	LX41540CDR	195.40	1534.25
545	LX41545CDR	195.45	1533.858
550	LX41550CDR	195.50	1533.465
555	LX41555CDR	195.55	1533.073

560	LX41560CDR	195.60	1532.681
565	LX41565CDR	195.65	1532.290
570	LX41570CDR	195.70	1531.898
575	LX41575CDR	195.75	1531.507
580	LX41580CDR	195.80	1531.116
585	LX41585CDR	195.85	1530.725
590	LX41590CDR	195.90	1530.334
595	LX41595CDR	195.95	1529.944
600	LX41600CDR	196.00	1529.554
605	LX41605CDR	196.05	1529.163
610	LX41610CDR	196.10	1528.774

## Pin Description

**Table 3. Pin Description**

Pin	Name	Function/Description	Notes
1	VeeT	Transmitter Ground	1
2	TX_Fault	Transmitter Fault (LVTTTL-O) - High indicates a fault condition	2
3	TX_Disable	Transmitter Disable (LVTTTL-I) – High or open disables the transmitter	3
4	SDA	Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2)	4
5	SCL	Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1)	4
6	MOD_ABS	Module Absent (Output), connected to VeeT or VeeR in the module	5
7	RS0	Rate Select 0 – Not used, Presents high input impedance	-
8	RX_LOS	Receiver Loss of Signal (LVTTTL-O)	2
9	RS1	Rate Select 1 – Not used, Presents high input impedance	-
10	VeeR	Receiver Ground	1
11	VeeR	Receiver Ground	1
12	RD-	Inverse Received Data out (CML-O)	-
13	RD+	Received Data out (CML-O)	-
14	VeeR	Receiver Ground	-
15	VccR	Receiver Power - +3.3V	-
16	VccT	Transmitter Power - +3.3 V	-
17	VeeT	Transmitter Ground	1
18	TD+	Transmitter Data In (CML-I)	-
19	TD-	Inverse Transmitter Data In (CML-I)	-
20	VeeT	Transmitter Ground	1

**Notes:**

1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

3. This input is internally biased high with a 4.7KΩ to 10KΩ pull-up resistor to VccT.
4. Two-Wire Serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
5. This is a ground return that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

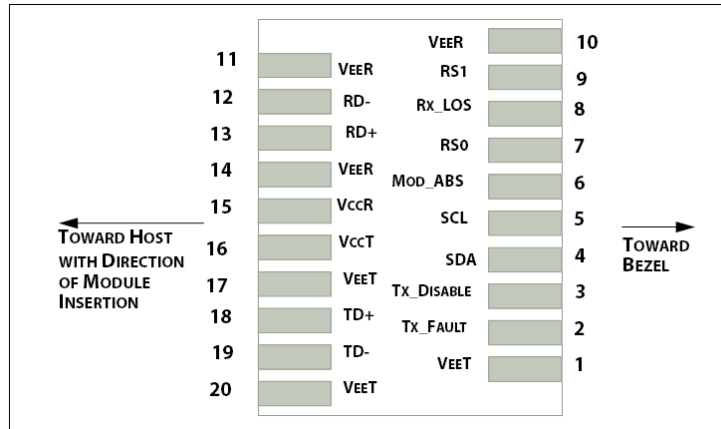


Figure 1. Host PCB SFP+ pad assignment top view

## 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>cc</sub>	-0.5	4.0	V

## Recommended Operating Conditions

**Table 5. Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	T <sub>c</sub>	0	25	70	°C
Supply Voltage	V <sub>cc</sub>	3.135	3.3	3.465	V
Data Rate	-	-	10.3125	-	Gb/s

## Transceiver Electrical Characteristics

**Table 6. Transceiver Electrical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes	
Module Supply Current	I <sub>cc</sub>	-	-	450	mA	-	
Power Dissipation	P <sub>D</sub>	-	-	1500	mW	-	
<b>Transmitter</b>							
Input Differential Impedance	Z <sub>IN</sub>	-	100	-	Ω	-	
Differential Data Input Swing	V <sub>IN, P-P</sub>	180	-	700	mV <sub>P-P</sub>	-	
TX_FAULT	Transmitter Fault	V <sub>OH</sub>	2.0	-	V <sub>CCHOST</sub>	V	-
	Normal Operation	V <sub>OL</sub>	0	-	0.8	V	-
TX_DISABLE	Transmitter Disable	V <sub>IH</sub>	2.0	-	V <sub>CCHOST</sub>	V	-
	Transmitter Enable	V <sub>IL</sub>	0	-	0.8	V	-
<b>Receiver</b>							
Output Differential Impedance	Z <sub>O</sub>	-	100	-	Ω	-	
Differential Data Output Swing	V <sub>OUT, P-P</sub>	300	-	850	mV <sub>P-P</sub>	1	
Data Output Rise Time, Fall Time	t <sub>r</sub> , t <sub>f</sub>	28	-	-	ps	2	
RX_LOS	Loss of signal (LOS)	V <sub>OH</sub>	2.0	-	V <sub>CCHOST</sub>	V	3
	Normal Operation	V <sub>OL</sub>	0	-	0.8	V	3

**Notes:**

1. Internally AC coupled, but requires a external 100Ω differential load termination.
2. 20–80%.
3. LOS is an open collector output. Should be pulled up with 4.7KΩ on the host board.

## Transmitter Optical Characteristics

**Table 7. Transmitter Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Optical Power	P <sub>o</sub>	-1	-	+2.0	dBm	1
Center Wavelength Range	λ <sub>c</sub>	1528.77	-	1563.86	nm	-
Center Wavelength Spacing	-	-	50	-	GHz	-
Center Wavelength Tolerance	Δλ <sub>c</sub>	-50	-	50	pm	-
Extinction Ratio	EX	8.2	-	-	dB	2
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Transmitter and Dispersion Penalty	TDP	-	-	3.0	dB	-
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	-
Optical Return Loss Tolerance	ORLT	-	-	21	dB	-
P <sub>out</sub> @TX-Disable Asserted	P <sub>off</sub>	-	-	-30	dBm	1
Eye Diagram	IEEE Std 802.3-2005 10Gb Ethernet 10GBASE-ER compatible					

**Notes:**

1. The optical power is launched into 9/125μm SMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps.

## Receiver Optical Characteristics

**Table 8. Receiver Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Center Wavelength	$\lambda_c$	1528	-	1565	nm	-
Receiver Sensitivity ( $P_{avg}$ )	S	-	-	-15.8	dBm	1
Receiver Overload ( $P_{avg}$ )	$P_{OL}$	-1.0	-	-	dBm	1
Optical Return Loss	ORL	26	-	-	dB	-
LOS De-Assert	$LOS_D$	-	-	-16	dBm	-
LOS Assert	$LOS_A$	-35	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	-

**Notes:**

1. Measured with PRBS  $2^{31}-1$  test pattern, 10.3125Gb/s, BER $<10^{-12}$ .
2. Comply with IEEE 802.3-2005.

### Recommended Host Board Power Supply Filter Network

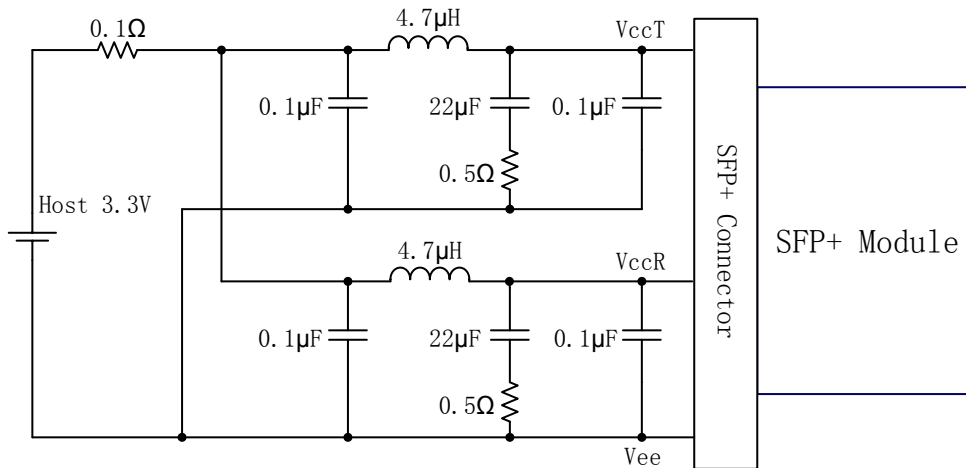


Figure 2. Recommended Host Board Power Supply Filter Network

### Recommended Application Interface Block Diagram

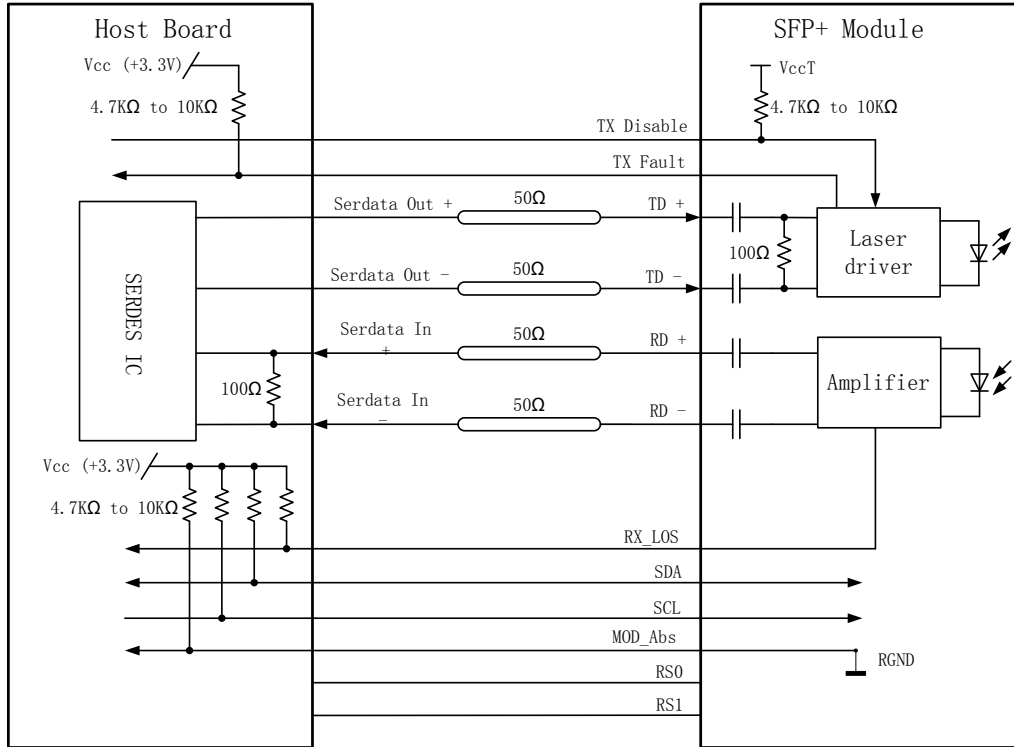


Figure 3. Recommended Application Interface Block Diagram

## Mechanical specifications

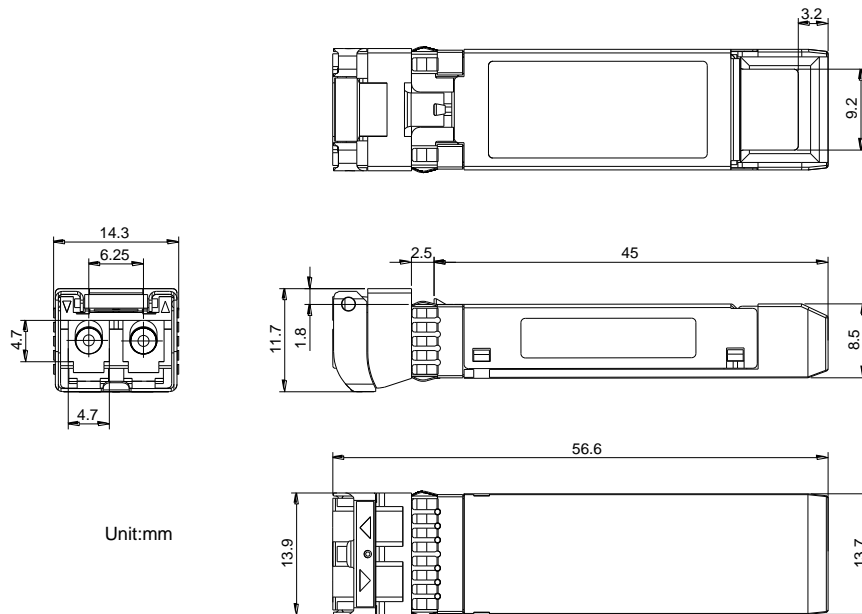


Figure 4. Outline Drawing

## PCB layout recommendation



- Notes:
1. Datum and basic dimensions established by customer
  2. Pads and vias are chassis ground, 11 places
  3. Thru holes, plating optional

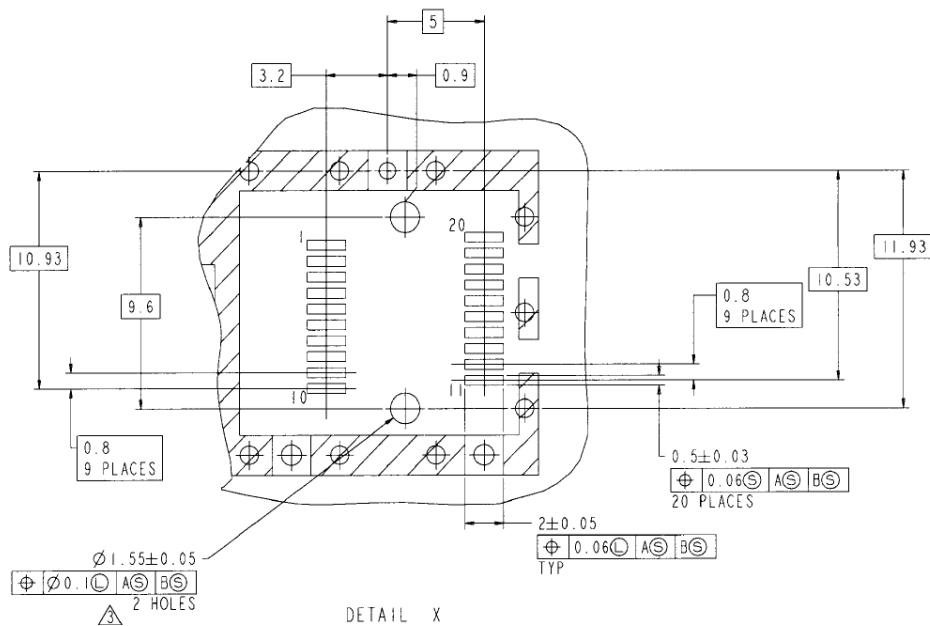
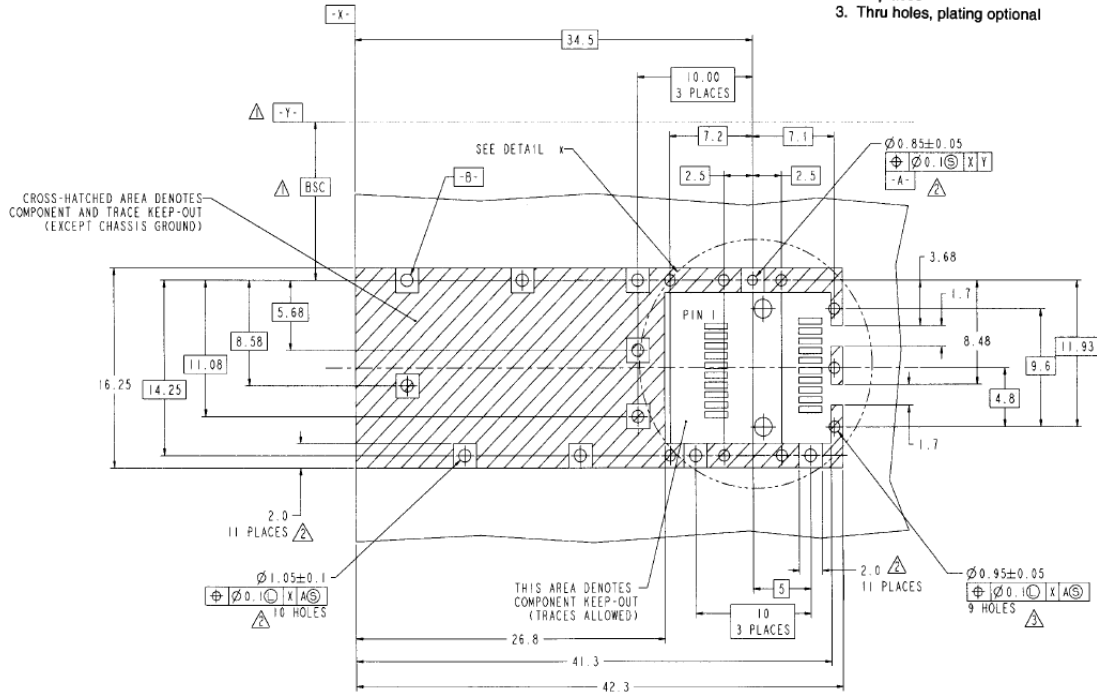


Figure 5. PCB layout recommendation

**For More Information**



**LX41xxxCDR  
10GEthernet 40km DWDM SFP+ Transceiver  
10GBASE-ER / 10GBASE-EW**

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