

## Product Features

- Compliant with IEEE Std 802.3-2005  
10G Ethernet 10GBase-LR/LW
- Electrical interface specifications per SFF-8431
- Management interface specifications per SFF-8431 and SFF-8472
- SFP+ MSA package with duplex LC connector
- Uncooled 1310nm DFB Laser
- Dual CDR from 9.95 to 11.3Gb/s bi-directional data links
- Single +3.3V power supply
- Class 1 laser safety certified
- Operating temperature:
  - (Commercial) 0°C to +70°C
  - (Industrial) -40°C to +85°C
- Up to 40km on 9/125µm SMF
- RoHS 6/6 Compliant



## Applications

- 10G Ethernet 10GBASE-LR/LW
- 10G Fiber Channel 1200-SM-LL-L
- SDH STM64 I-64.1

## Descriptions

LX4002xSH 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 11.0, are high performance and cost effective transceivers. They meet the requirements for 10Gb/s SONET STM64 I-64.1, 40km 10G Ethernet 10GBase-SR/LW, and 40km 10G Fiber Channel.

LX4002xSH are compliant with RoHS.

## Ordering Information

**Table 1. Ordering Information**

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX4002CSH	1310nm DFB	0 ~ +5dBm	PIN	< -14.4dBm	40km	0 ~ 70°C	Available	Compliant
LX4002ISH	1310nm DFB	0 ~ +5dBm	PIN	< -14.4dBm	40km	-40 ~ 85°C	Available	Compliant

## Pin Description

**Table 2. Pin Description**

Pin	Name	Function/Description	Notes
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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.

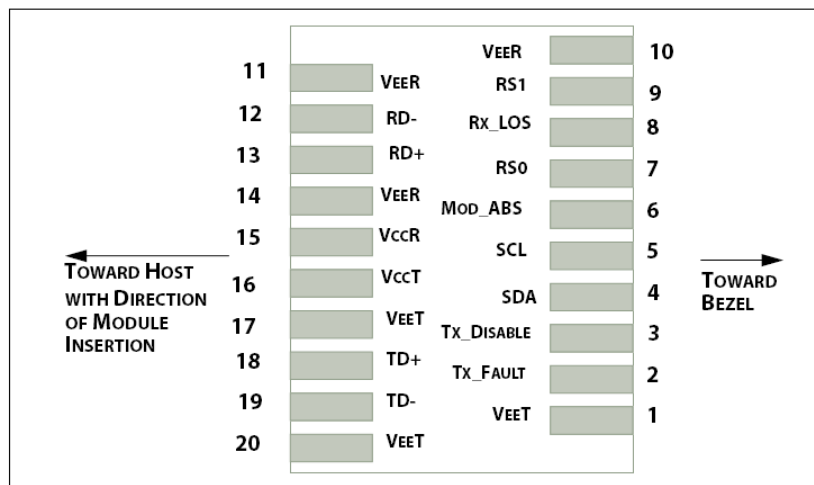


Figure 1. Host PCB SFP+ pad assignment top view

## 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 3. 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 4. Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Unit	
Operating Temperature	LX4002CSH	T <sub>c</sub>	0	25	70	°C
	LX4002ISH	T <sub>c</sub>	-40	25	85	°C
Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Data Rate	-	9.95	10.3125	11.3	Gb/s	

## Transceiver Electrical Characteristics

**Table 5. Transceiver Electrical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes	
Module Supply Current	I <sub>CC</sub>	-	330	450	mA	-	
Power Dissipation	P <sub>D</sub>	-	1100	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:**

- Internally AC coupled, but requires a external 100Ω differential load termination.
- 20 – 80 %.

3. LOS is an open collector output. Should be pulled up with 4.7kΩ on the host board.

## Transmitter Optical Characteristics

**Table 6. Transmitter Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Optical Power	P <sub>o</sub>	0	-	+5	dBm	1
Center Wavelength Range	λ <sub>c</sub>	1260	1310	1355	nm	-
Extinction Ratio	EX	5	-	-	dB	2
Spectral Width (-20dB)	Δλ	-	-	1	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Transmitter and Dispersion Penalty	TDP	-	-	3.2	dB	-
Optical Return Loss Tolerance	ORLT	-	-	12	dB	-
Pout @TX-Disable Asserted	P <sub>off</sub>	-	-	-30	dBm	1
Eye Diagram	ITU-T G.691 SDH STM-64 I-64.1 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 7. Receiver Optical Characteristics**

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Center Wavelength	λ <sub>c</sub>	1260	1310	1355	nm	-
Receiver Sensitivity (P <sub>avg</sub> )	S	-	-	-14.4	dBm	1
Receiver Sensitivity (OMA)	S <sub>OMA</sub>	-	-	-12.6	dBm	1
Receiver Overload (P <sub>avg</sub> )	P <sub>OL</sub>	0.5	-	-	dBm	1
Stressed Sensitivity (OMA)	-	-	-	-10.3	dBm	2
Optical Return Loss	ORL	12	-	-	dB	-
LOS De-Assert	LOS <sub>D</sub>	-	-	-16	dBm	-
LOS Assert	LOS <sub>A</sub>	-30	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	-

**Notes:**

1. Measured with PRBS 2<sup>31</sup>-1 test pattern, 10.3125Gb/s, BER<10<sup>-12</sup>.
2. Comply with IEEE 802.3-2005.

## Digital Diagnostic Memory Map

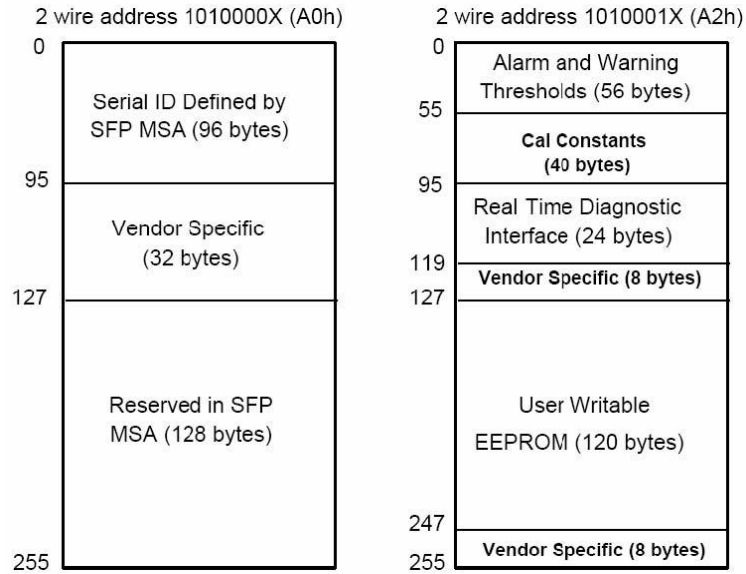


Figure 2. Digital Diagnostic Memory Map Specific Data Field Descriptions

## **Recommended Host Board Power Supply Filter Network**

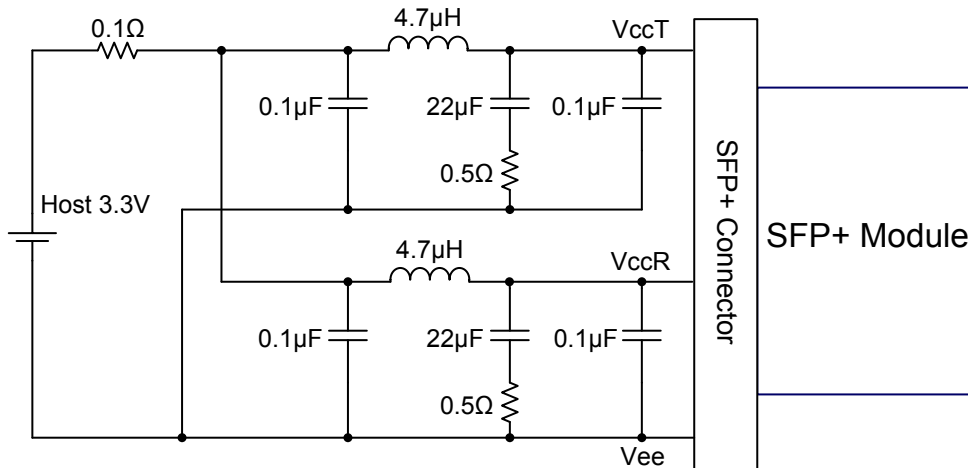


Figure 2. Recommended Host Board Power Supply Filter Network

## Recommended Application Interface Block Diagram

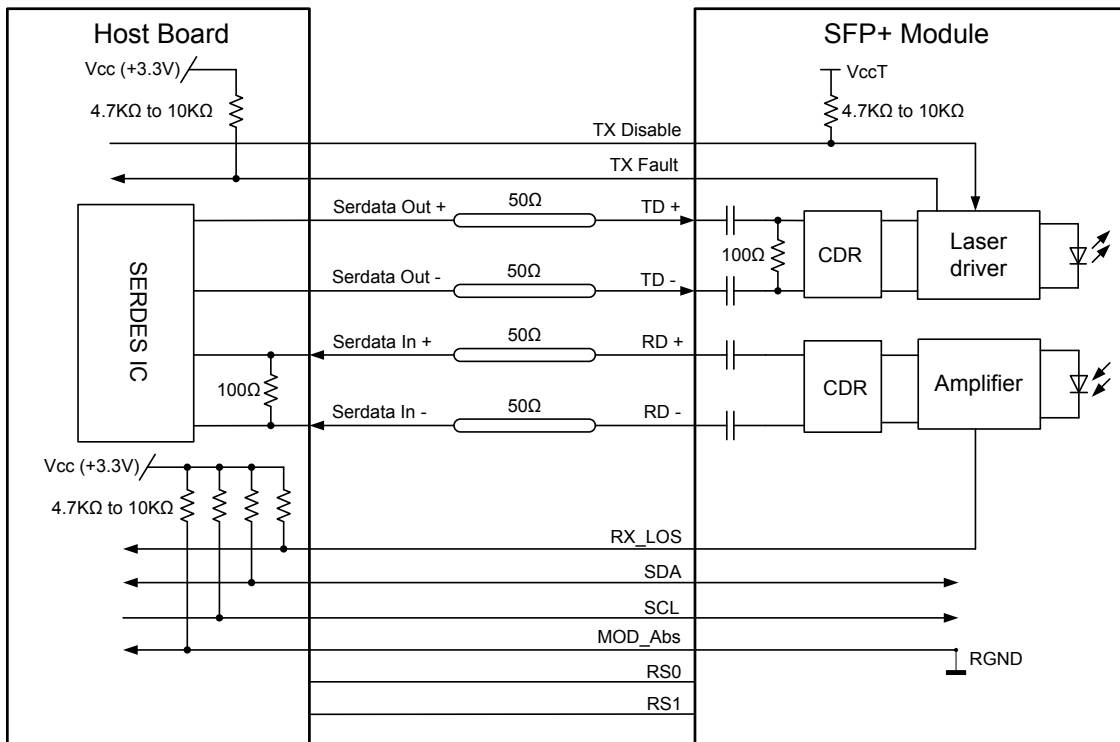


Figure 3. Recommended Application Interface Block Diagram

## Mechanical specifications

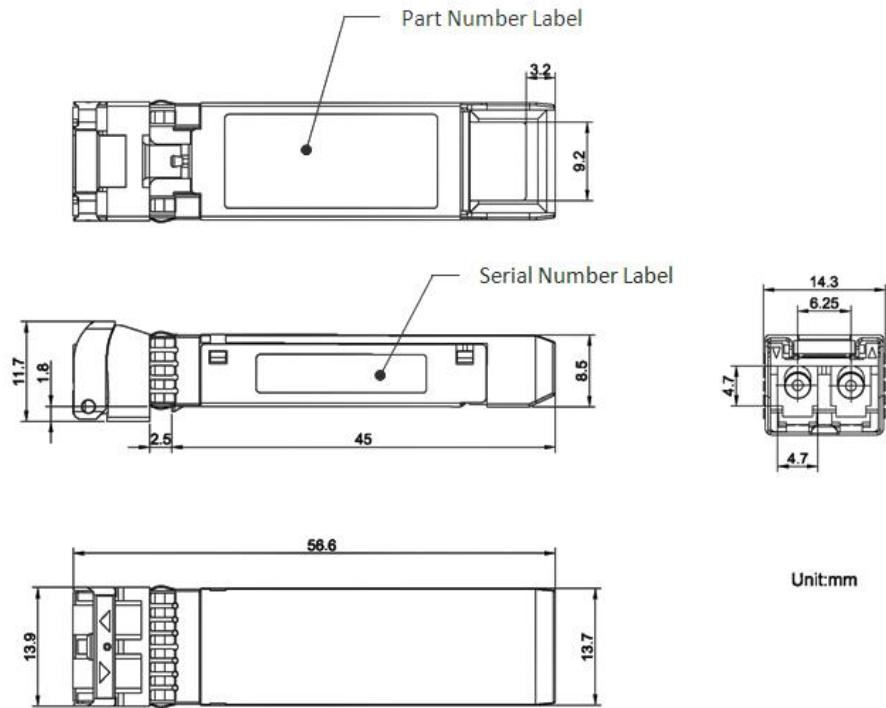
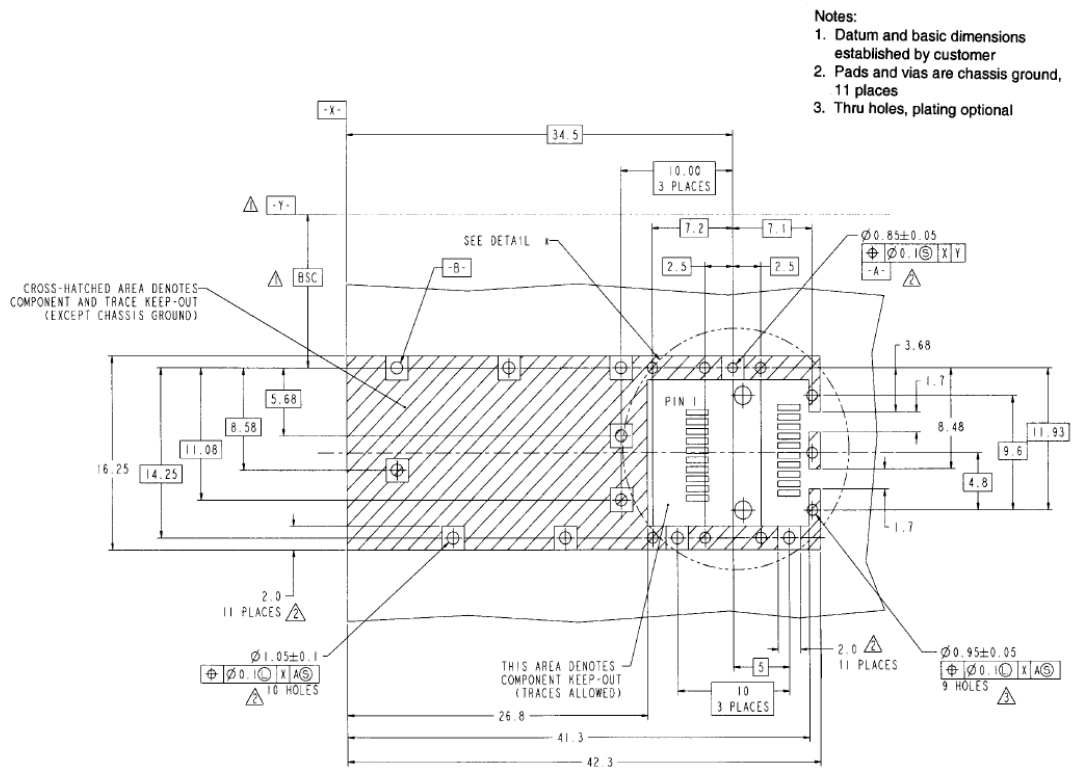


Figure 4. Outline Drawing

## PCB layout recommendation



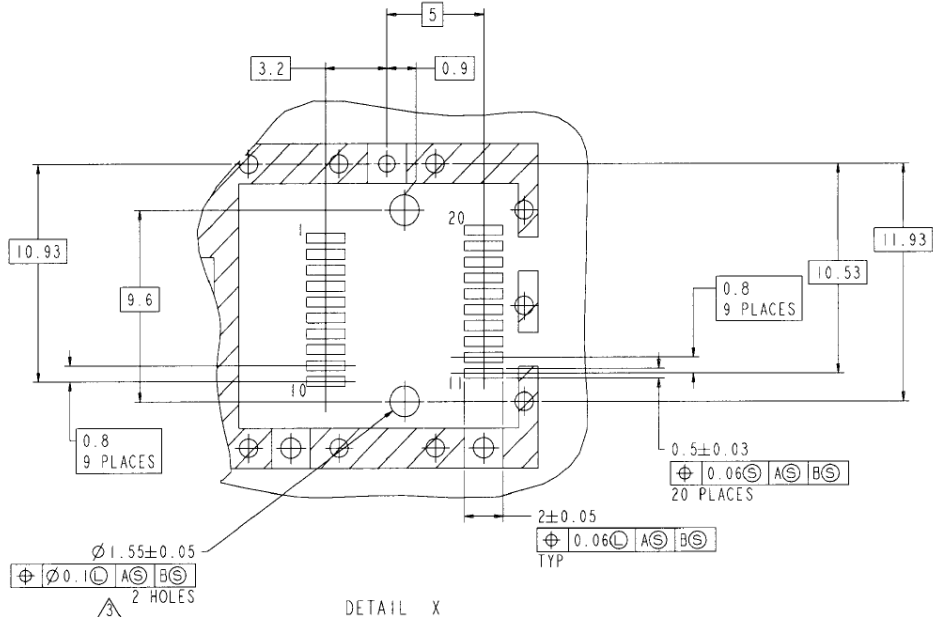


Figure 5. PCB layout recommendation

## For More Information

Linktel Technologies Co., Ltd





**LX4002CSH**  
**10G Ethernet 40km SFP+ Transceiver**  
**10G I-64.1 / 10GBASE-LR**

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