

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 10km 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

LX4002xDH 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, 10km 10G Ethernet 10GBase-LR/LW, and 10km 10G Fiber Channel.

LX4002xDH are compliant with RoHS.

Ordering Information

Table 1. Ordering Information

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX4002CDH	1310nm DFB	-8.2 ~ +0.5dBm	PIN	< -14.4dBm	10km	0 ~ 70 °C	Available	Compliant
LX4002IDH	1310nm DFB	-8.2 ~ +0.5dBm	PIN	< -14.4dBm	10km	-40 ~ 85 °C	Available	Compliant

Pin Description

Table 2. 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.

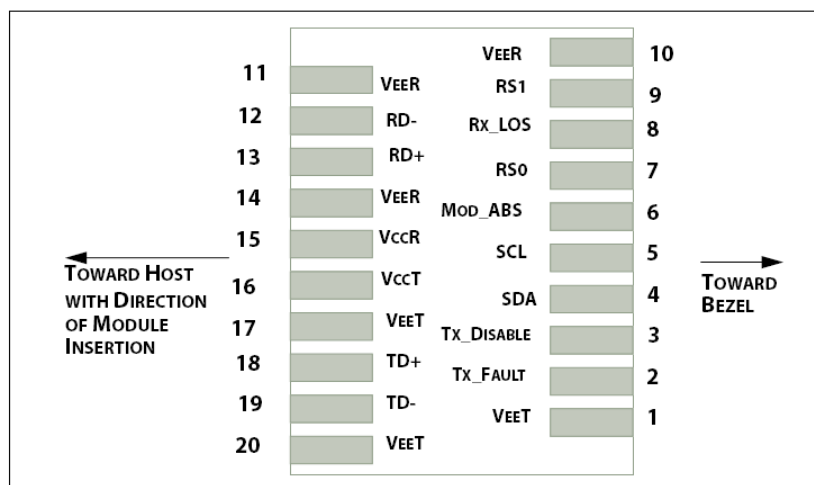


Figure 1. Host PCB SFP+ pad assignment top view

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 3. Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T _s	-40	85	°C
Relative Humidity	RH	5	95	%
Supply Voltage	V _{CC}	-0.5	4.0	V

Recommended Operating Conditions

Table 4. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	
Operating Temperature	LX4002CDH	T _c	0	25	70	°C
	LX4002IDH	T _c	-40	25	85	°C
Supply Voltage	V _{CC}	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 _{CC}	-	330	450	mA	-	
Power Dissipation	P _D	-	1100	1500	mW	-	
Transmitter							
Input Differential Impedance	Z _{IN}	-	100	-	Ω	-	
Differential Data Input Swing	V _{IN, P-P}	180	-	700	mV _{P-P}	-	
TX_FAULT	Transmitter Fault	V _{OH}	2.0	-	V _{CCHOST}	V	-
	Normal Operation	V _{OL}	0	-	0.8	V	-
TX_DISABLE	Transmitter Disable	V _{IH}	2.0	-	V _{CCHOST}	V	-
	Transmitter Enable	V _{IL}	0	-	0.8	V	-
Receiver							
Output Differential Impedance	Z _O	-	100	-	Ω	-	
Differential Data Output Swing	V _{OUT, P-P}	300	-	850	mV _{P-P}	1	
Data Output Rise Time, Fall Time	t _r , t _f	28	-	-	ps	2	

RX_LOS	Loss of signal (LOS)	V_{OH}	2.0	-	V_{CCHOST}	V	3
	Normal Operation	V_{OL}	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 6. Transmitter Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Optical Power	P_o	-8.2	-	+0.5	dBm	1
Center Wavelength Range	λ_c	1260	1310	1355	nm	-
Extinction Ratio	EX	5	-	-	dB	2
Spectral Width (-20dB)	$\Delta\lambda$	-	-	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_{off}	-	-	-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 2³¹-1 test pattern @10.3125Gbps.

Receiver Optical Characteristics

Table 7. Receiver Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Center Wavelength	λ_c	1260	1310	1355	nm	-
Receiver Sensitivity (P_{avg})	S	-	-	-14.4	dBm	1
Receiver Sensitivity (OMA)	S _{OMA}	-	-	-12.6	dBm	1
Receiver Overload (P_{avg})	P _{OL}	0.5	-	-	dBm	1
Stressed Sensitivity (OMA)	-	-	-	-10.3	dBm	2
Optical Return Loss	ORL	12	-	-	dB	-
LOS De-Assert	LOS _D	-	-	-17	dBm	-
LOS Assert	LOS _A	-30	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	-

Notes:

1. Measured with PRBS 2³¹-1 test pattern, 10.3125Gb/s, BER<10⁻¹².
2. Comply with IEEE 802.3-2005.

Digital Diagnostic Memory Map

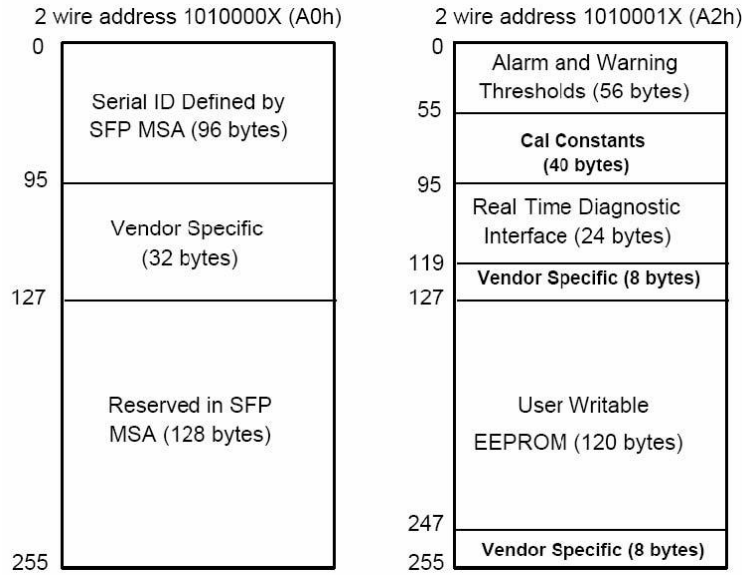


Figure 2. Digital Diagnostic Memory Map Specific Data Field Descriptions

EEPROM Serial ID Memory Contents

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver’s capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h), and the clock frequency up to 100KHz. The memory contents are shown in Table 9.

Table 9. Serial ID Memory Contents

Data Address	Name of Field	Contents(Hex)	Description
0	Identifier	03	SFP
1	Ext. Identifier	04	SFP function is defined by serial ID
2	Connector	07	LC
3-10	Transceiver	20 30 00 00 00 00 00 00	10G Base-LR , SDH STM64 I-64.1
11	Encoding	06	64B/66B
12	BR, Nominal	67	10.3Gb/s
13	Reserved	00	-
14	Length (9µm) km	0A	10km
15	Length (9µm) 100m	64	10000m
16	Length (50µm) 10m	00	-
17	Length(62.5µm)10m	00	-
18	Length (Copper)	00	-
19	Reserved	00	-

20-35	Vendor name	4C 49 4E 4B 54 45 4C 20 20 20 20 20 20 20 20 20	LINKTEL (ASCII)
36	Reserved	00	
37-39	Vendor OUI	00 00 00	
40-55	Vendor PN	4C 58 34 30 30 32 43 44 48 2D 20 20 20 20 20 20	LX4002CDH
56-59	Vendor rev	31 2E 30 20	Rev 1.0 (ASCII)
60-62	Wavelength	05 1E 00	1310nm
63	CC BASE	xx	Check sum of bytes 0 - 62
64-65	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	BR, max	01	
67	BR, min	03	
68-83	Vendor SN	31 33 33 30 30 38 32 32 31 30 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example "3130082210".
84-91	Vendor date code	xx xx xx xx xx xx 20 20	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92	Diagnostic type	68	Diagnostics (Internally Cal)
93	Enhanced option	F0	Diagnostics(Optional Alarm/warning flags, Soft TX_DIS, Soft TX_FAULT and Soft TX_LOS monitoring)
94	SFF-8472	05	Diagnostics(SFF-8472 Rev 11.0)
95	CC_EXT	xx	Check sum for bytes 64-94
96	Revision	00	
97-102			
103-105	NULL	00 00 00	
106-114	Part number	00 00 00 00 00 00 00 00 00	
115-124	CLEI	00 00 00 00 00 00 00 00 00 00	
125-126	NULL	00 00	
127	Even Parity	00	

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFF-8472 Rev 11.0.

Diagnostic Monitor Specifications

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X (A2h). Please see Figure 2. For detail EEPROM information, please refer to the related document of SFF-8472 Rev 11.0. The monitoring specification of this product is described in Table 10.

Table 10. Diagnostic Monitor Specifications

Parameter	Range	Accuracy	Calibration
Temperature	-40 to +85°C	±3°C	Internal

Voltage	3.0 to 3.6V	±3%	Internal
Bias Current	0 to 100mA	±10%	Internal
TX Power	-8.2 to +1dBm	±2dB	Internal
RX Power	-16 to 0dBm	±2dB	Internal

Recommended Host Board Power Supply Filter Network

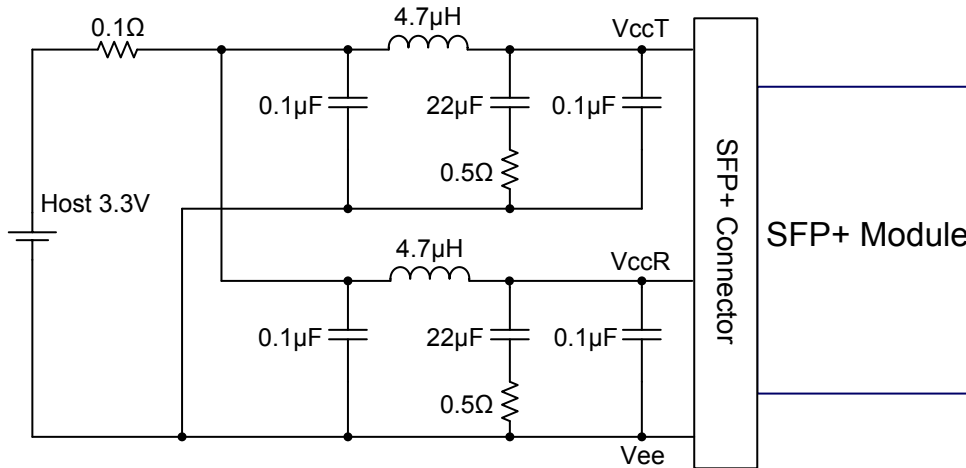


Figure 2. Recommended Host Board Power Supply Filter Network

Recommended Application Interface Block Diagram

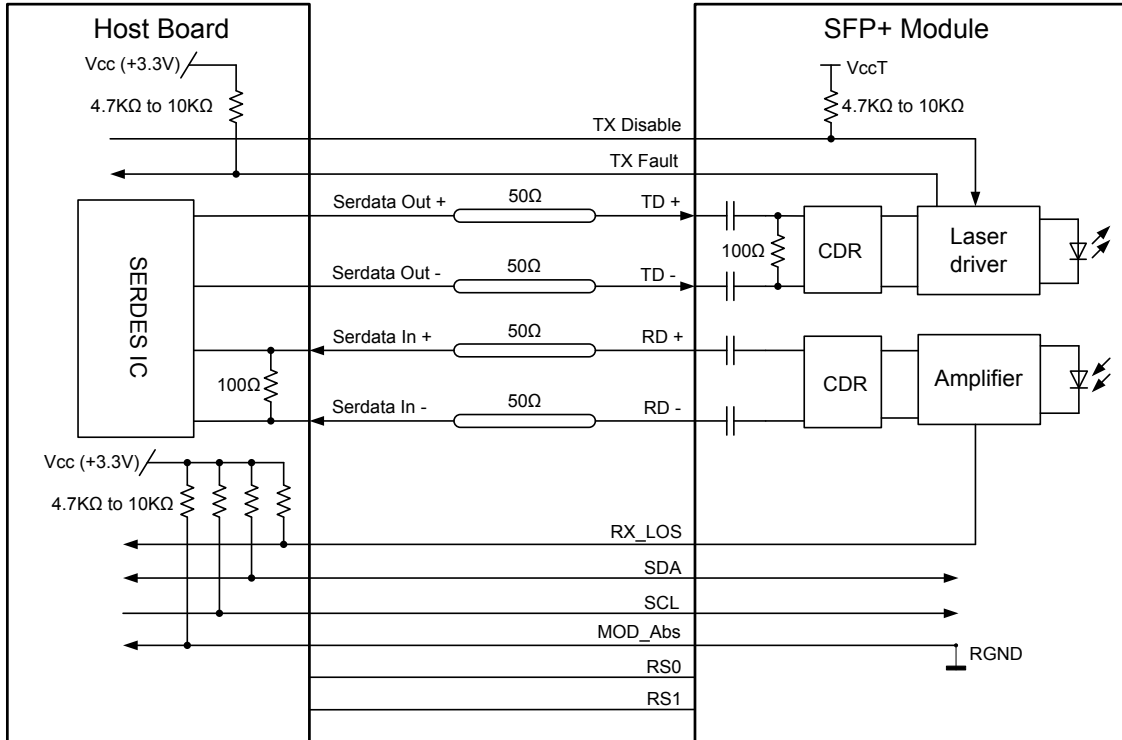


Figure 3. Recommended Application Interface Block Diagram

Mechanical specifications

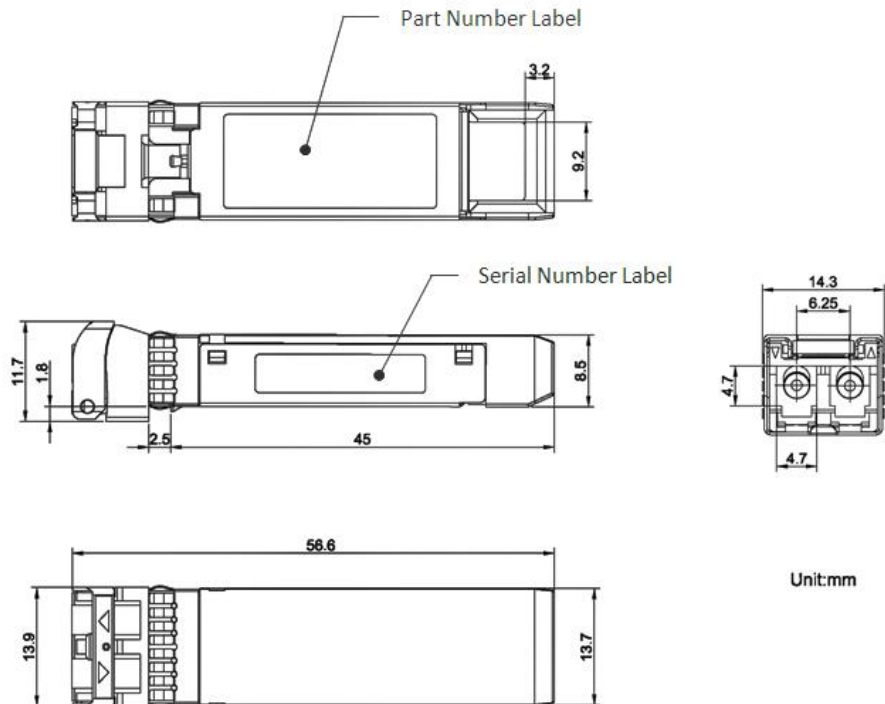


Figure 4. Outline Drawing

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

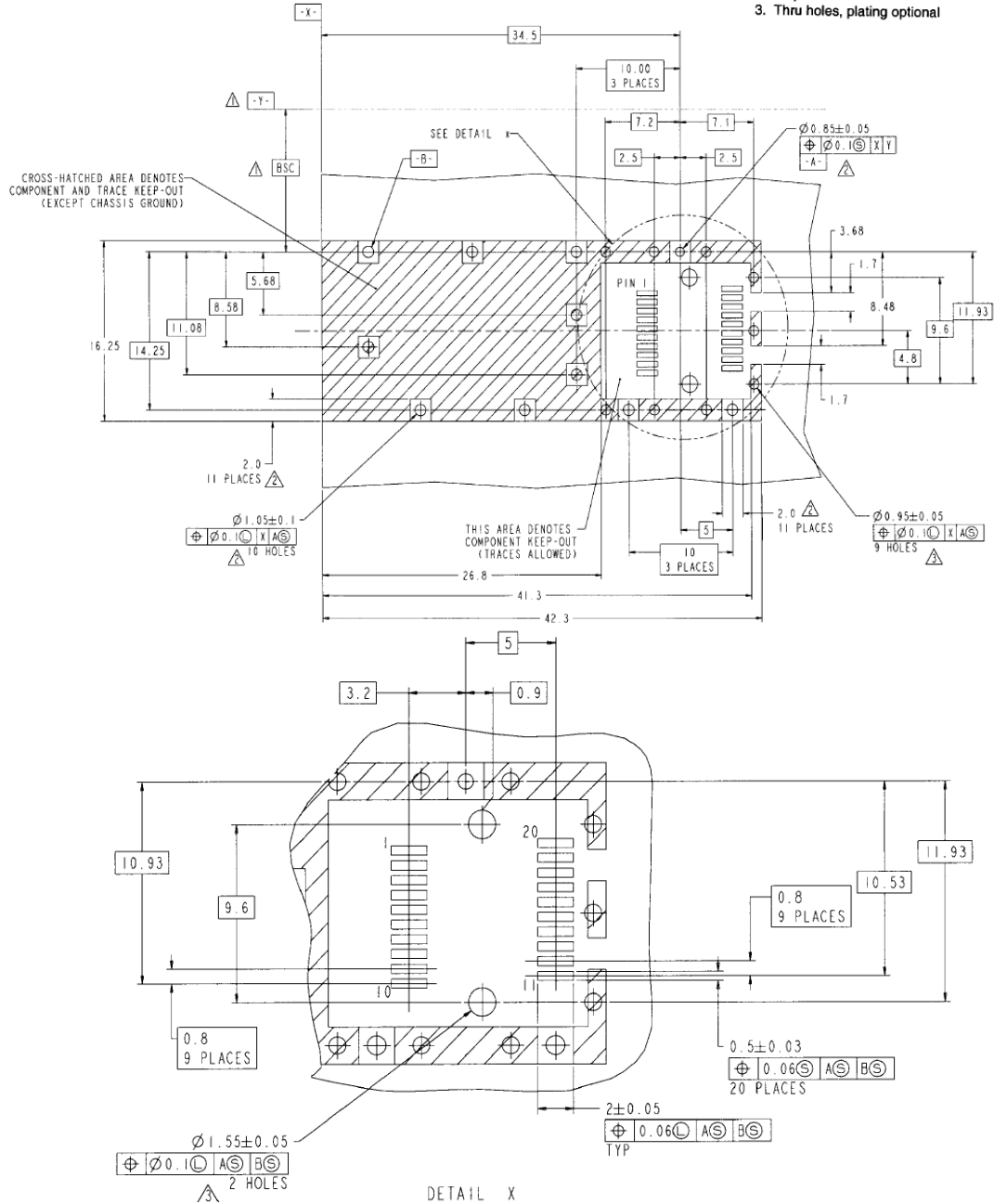


Figure 5. PCB layout recommendation



LX4002CDH
10G Ethernet 10km SFP+ Transceiver
10G I-64.1 / 10GBASE-LR

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