

Product Features

- Compliant with IEEE Std 802.3-2005
10G Ethernet 10GBase-ZR/ZW
- Electrical interface specifications per SFF-8431
- Management interface specifications per
SFF-8431 and SFF-8472
- SFP+ MSA package with duplex LC connector
- Cooled 1550nm EML Laser
- 1.25Gb/s to 11.3Gb/s bi-directional data links
- Single +3.3V power supply
- Class 1 laser safety certified
- Operating temperature Options: -40°C to +85°C
- Up to 80km on 9/125µm SMF
- RoHS Compliant



Applications

- 10G Ethernet 10GBASE-ZR/ZW

Descriptions

LX4004IDR 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 10G Ethernet serial optical data communication up to 80km on single mode fiber. They are compliant with IEEE Std 802.3-2005 10Gb Ethernet 10GBase-ZR/ZW.

Ordering Information

Table 1. Ordering Information

Part Number	Transmitter	Output Power	Receiver	Sensitivity	Reach	Temp	DDM	RoHS
LX4004IDR	1550nm EML	0 ~ +4dBm	APD	< -24dBm	80km	-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.

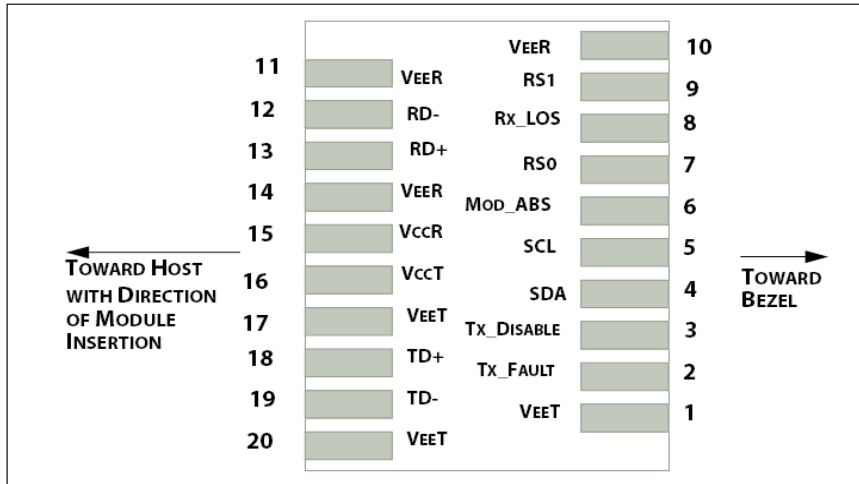


Figure 1. Host PCB SFP+ pad assignment top view

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 LX4004IDR	T _C	-40	25	85	°C
Supply Voltage	V _{CC}	3.135	3.3	3.465	V
Data Rate	-	1.25	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-Temp)	I _{CC}	-	-	550	mA	-
Power Dissipation (I-temp)	P _D	-	-	1800	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 100 Ω differential load termination.
2. 20–80%.
3. LOS is an open collector output. Should be pulled up with 4.7K Ω on the host board.

Transmitter Optical Characteristics

Table 6. Transmitter Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Optical Power	P_o	0	-	+4.0	dBm	1
Center Wavelength Range	λ_c	1530	1550	1565	nm	-
Extinction Ratio	EX	9.0	-	-	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	-
Pout @TX-Disable Asserted	P_{off}	-	-	-30	dBm	1
Eye Diagram	IEEE Std 802.3-2005 10Gb Ethernet 10GBASE-ZR compatible					

Notes:

1. The optical power is launched into 9/125 μ m 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	1530	-	1565	nm	-
Receiver Sensitivity (P_{avg})	$S@1\sim 10.5\text{Gb/s}$	-	-	-24	dBm	1
Receiver Sensitivity (P_{avg})	$S@10.7\sim 11.3\text{Gb/s}$	-	-	-23	dBm	2

Receiver Overload (P_{avg})	P_{OL}	-7.0	-	-	dBm	1
Optical Return Loss	ORL	26	-	-	dB	-
LOS De-Assert	LOS_D	-	-	-25	dBm	-
LOS Assert	LOS_A	-35	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	-

Notes:

1. Measured with PRBS $2^{31}-1$ test pattern, 1.25 Gb/s, 10.3125Gb/s, BER< 10^{-12} .
2. Measured with 11.3Gb/s ;BER< 10^{-12} .

Digital Diagnostic Memory Map

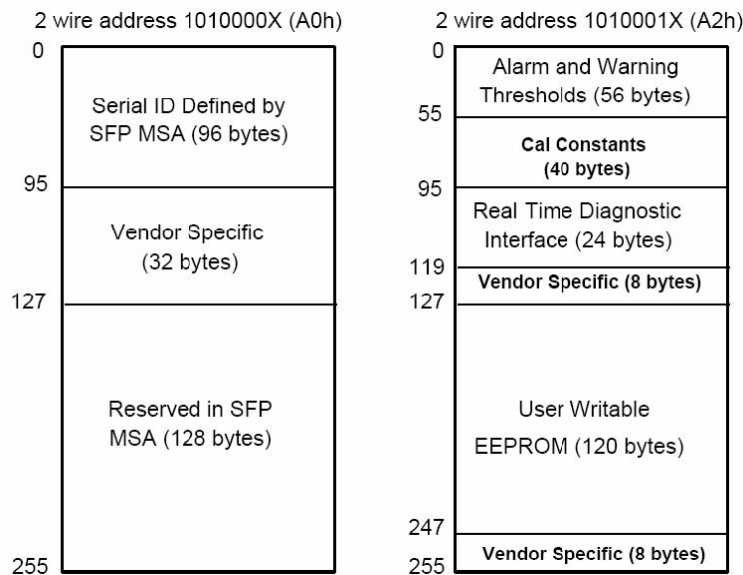


Figure 2. Digital Diagnostic Memory Map Specific Data Field Descriptions

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 8. 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	80 00 00 00 00 00 00 00	10G Base-ER
11	Encoding	06	64B/66B
12	BR, Nominal	67	10.3Gb/s
13	Reserved	00	-
14	Length (9µm) km	50	80km
15	Length (9µm) 100m	FF	80000m
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 34 49 44 52 20 20 20 20 20 20 20	"LX4004IDR " (ASCII)
56-59	Vendor rev	31 2E 30 20	Rev 1.0 (ASCII)
60-62	Wavelength	06 0E 00	1550nm
63	CC BASE	xx	Check sum of bytes 0 - 62
64-65	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	BR, max	00	-
67	BR, min	00	-
68-83	Vendor SN	33 31 36 30 30 38 32 32 31 30 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example "3160082210".
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	03	Diagnostics(SFF-8472 Rev 10.2)
95	CC_EXT	xx	Check sum for bytes 64-94
96-127	Reserved	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 10.2.

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

Table 9. Diagnostic Monitor Specifications

Parameter	Range	Accuracy	Calibration
Temperature	-43 to +88 C	±3 C	Internal
Voltage	3.0 to 3.6V	±3%	Internal
Bias Current	10 to 120mA	±10%	Internal
TX Power	-2 to +6dBm	±2dB	Internal
RX Power	-26 to -5dBm	±2dB	Internal

Recommended Host Board Power Supply Filter Network

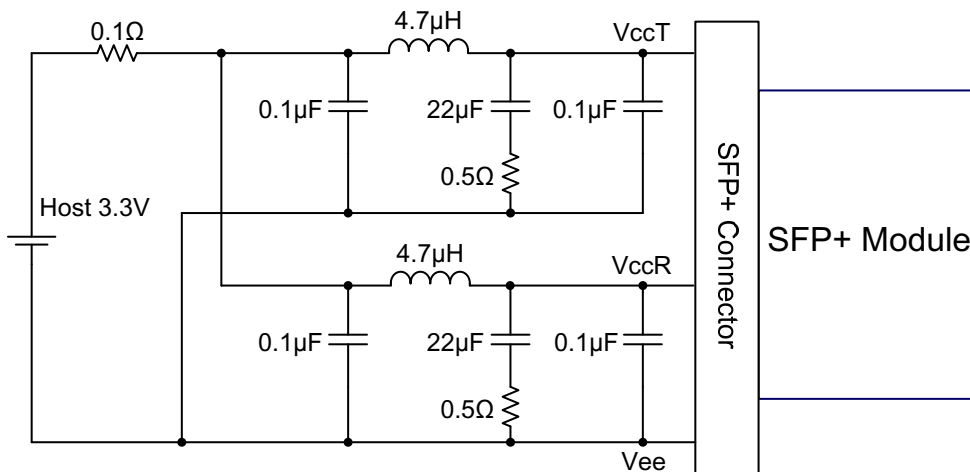


Figure 2. Recommended Host Board Power Supply Filter Network

Recommended Application Interface Block Diagram

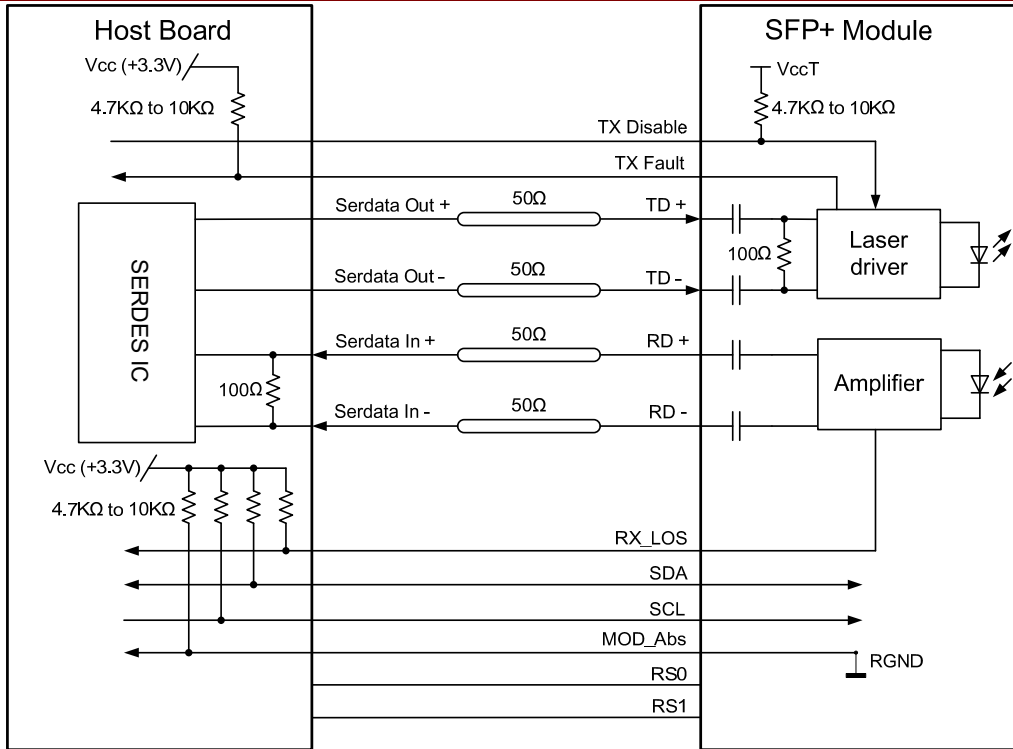


Figure 3. Recommended Application Interface Block Diagram

Mechanical specifications

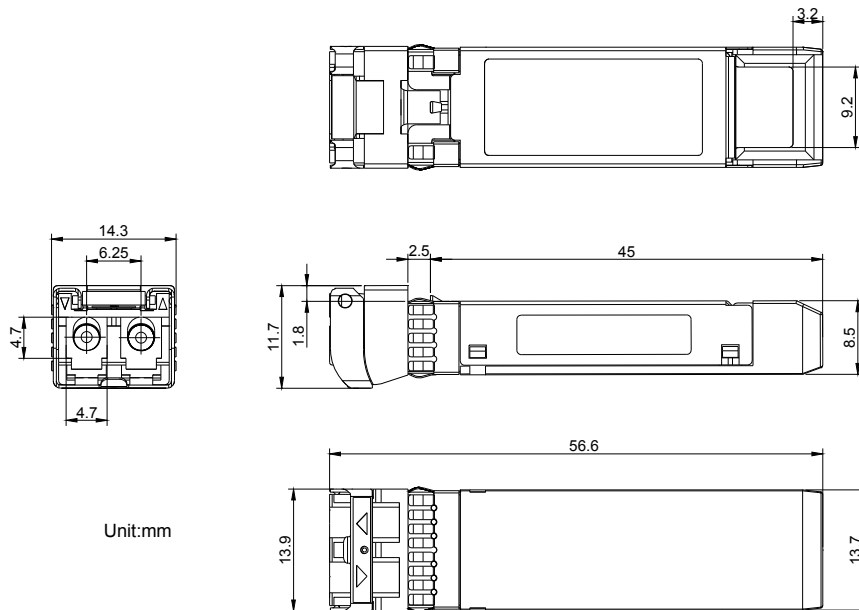


Figure 4. Outline Drawing

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

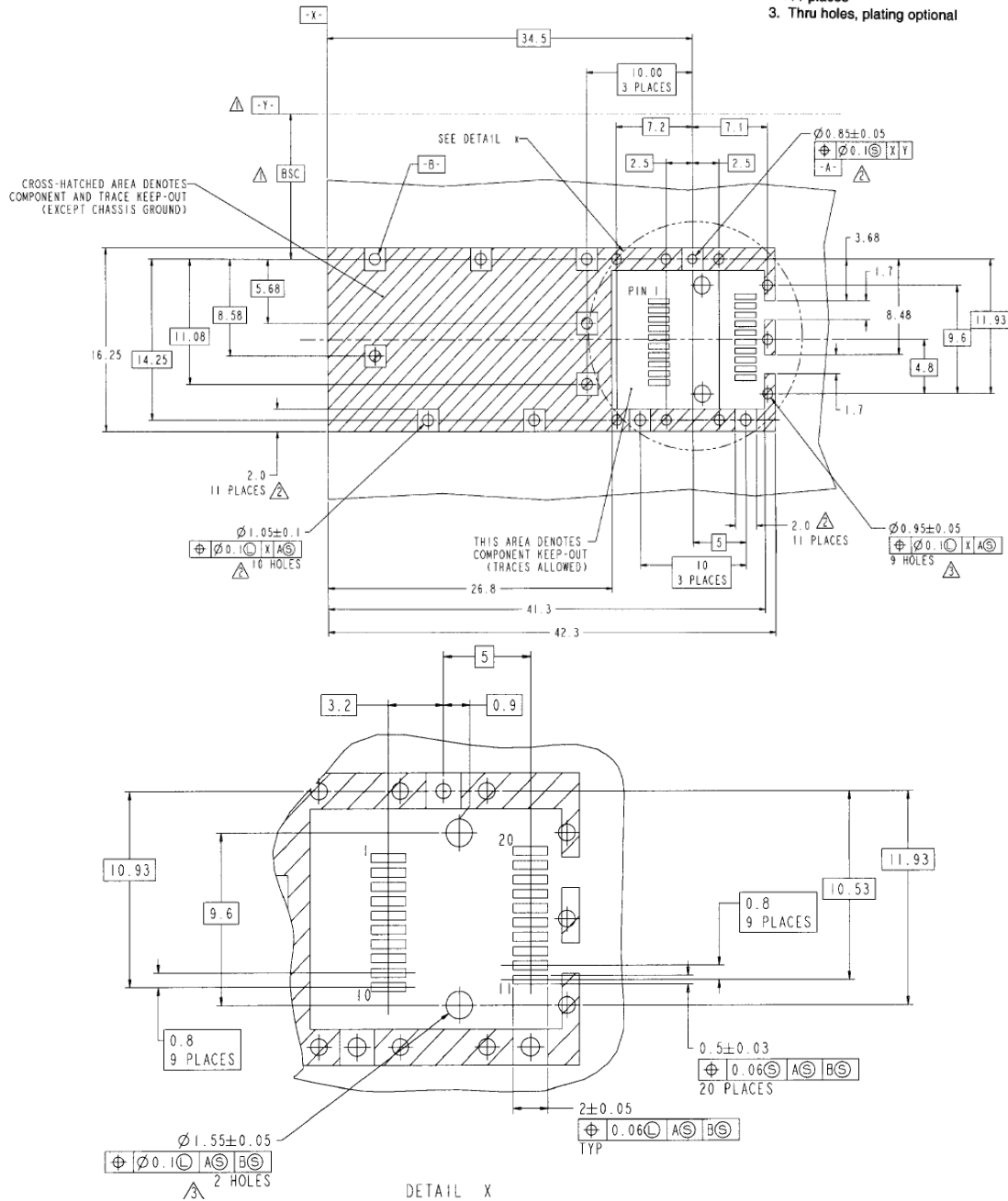


Figure 5. PCB layout recommendation

For More Information

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