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## **OP-MP135L1SD-10**

**BIDI SFP transceiver modules**

**155 Mbps SONET OC-3/SDH STM-1/125 Mbps Fast Ethernet**

### **Features**

- Single LC receptacle optical interface compliant
- Single +3.3V power supply
- Hot-pluggable
- Receiver Loss of Signal Output
- AC coupling of PECL signals
- Serial ID module on MOD(0-2)
- International Class 1 laser safety certified
- Transmitter disable input
- Distance up to 10km
- Operating temperature range: 0°C~70°C
- RoHS Compliant

### **Applications**

- Fast Ethernet
- Switch to switch interface
- Switched backplane applications

### **Standards**

- Compliant with SFP MSA (INF-8074i)
- Compliant with IEEE802.3ah
- ITU-T G.957 S-1.1
- Compliant with RoHS&WEEE

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## Ordering Information

	TX/RX	INPUT/OUTPUT	SIGNAL DETECT	TEMPERATURE	LD Type	Distance
OP-MPI35L1SD-10	1310/1550	AC/AC	TTL	0°C~70°C	1310 FP	10KM

## Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Storage Temperature	<i>TS</i>	-40	+100	°C	
Supply Voltage	<i>Vcc</i>	-0.5	6.0	V	
Input Voltage	<i>VIN</i>	-0.5	<i>Vcc</i>	V	
Output Current	<i>Io</i>		50	mA	
Operating Current	<i>IOP</i>		400	mA	
Case Operating Temperature	<i>TC</i>	-0	+70	°C	
Supply Voltage	<i>Vcc</i>	3.1	3.5	V	
Supply Current	<i>ITX + IRX</i>	---	250	mA	

## Transmitter Electro-optical Characteristics

*Vcc* = 3.1 V to 3.5 V, *TC* = 0°C to +70 °C

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Output Optical Power 9/125 μm fiber	<i>Pout</i>	-12	---	-3	dBm	Average
Extinction Ratio	<i>ER</i>	9	---	---	dB	
Center Wavelength	<i>λC</i>	1278	1310	1351	nm	
Spectral Width (RMS)	<i>Δλ</i>	---	---	3.5	nm	
Rise/Fall Time, (20–80%)	<i>Tr, f</i>	---	---	260	ps	
Relative Intensity Noise	<i>RIN</i>	---	---	-120	dB/Hz	
Total Jitter	<i>TJ</i>	---	---	267	ps	
Output Eye	Compliant with IEEE802.3z					
Max. <i>Pout</i> TX-DISABLE Asserted	<i>POFF</i>	---	---	-45	dBm	
Differential Input Voltage	<i>VDIFF</i>	0.4	---	2.0	V	

## Receiver Electro-optical Characteristics

*Vcc* = 3.1 V to 3.5 V, *TC* = 0°C to +70 °C

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Optical Input Power-maximum	<i>PIN</i>	0	---	---	dBm	BER < 10 <sup>-10</sup>
Optical Input Power-minimum (Sensitivity)	<i>PIN</i>	---	---	-32	dBm	BER < 10 <sup>-10</sup>

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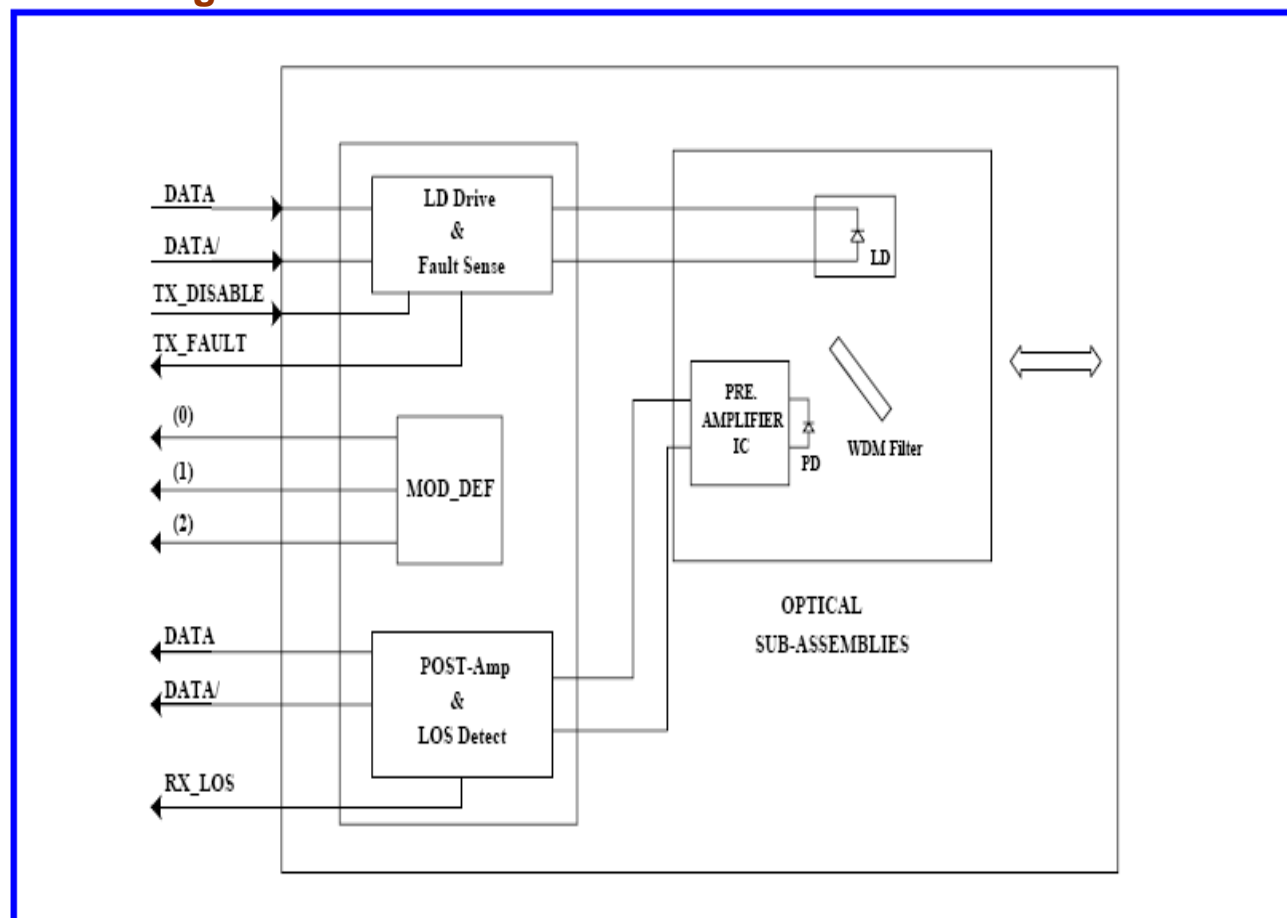
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Operating Center Wavelength	$\lambda_C$	1480		1580	nm	
Optical Return Loss	<i>ORL</i>	14	---	---	dB	$\lambda = 1480 \sim 1580 \text{nm}$
Optical isolation	<i>ISO</i>	---	---	-40	dB	$\lambda = 1480 \sim 1580 \text{nm}$
Signal Detect-Asserted	<i>PA</i>	---	---	-32	dBm	
Signal Detect-Deasserted	<i>PD</i>	-45	---		dBm	
Differential Output Voltage	<i>VDIFF</i>	0.5	---	1.6	V	
Data Output Rise, Fall Time (20–80%)	<i>T<sub>r,f</sub></i>	---	---	2	ns	
Receiver Loss of Signal Output Voltage-Low	<i>RX_LOSL</i>	0	---	0.5	V	
Receiver Loss of Signal Output Voltage-High	<i>RX_LOSH</i>	2.4	---	V <sub>cc</sub>	V	

## Block Diagram of Transceiver



## Transmitter and Receiver Optical Sub-assembly Section

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A 1310 nm InGaAsP laser and an InGaAs PIN photodiode integrate with an WDM filter to form a bi-directional single fiber optical subassembly (OSA). The laser of OSA is driven by a LD driver IC which converts differential input LVPECL logic signals into an analog laser driving current. And, The photodiode of OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

## **TX\_DISABLE**

The TX\_DISABLE signal is high (TTL logic "1") to turn off the laser output.

## **Receive Loss (RX\_LOS)**

The RX\_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.

## **Dimensions**

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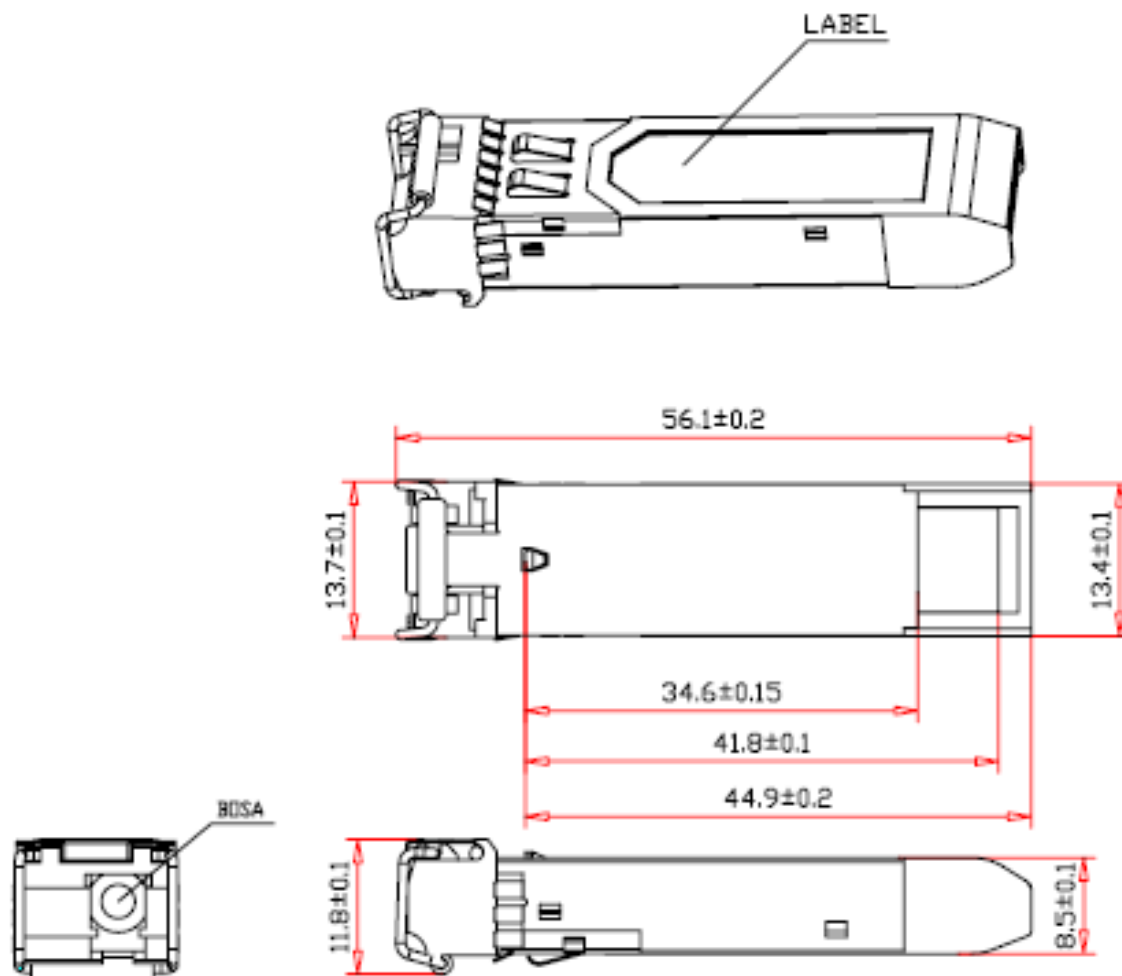
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## SFP host board mechanical layout

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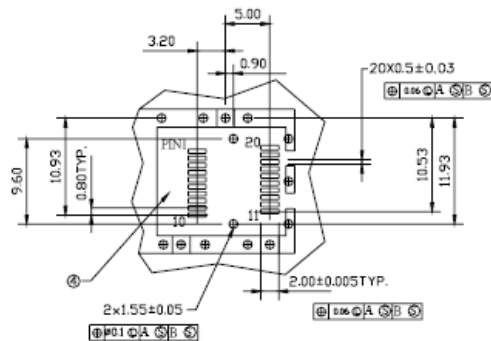
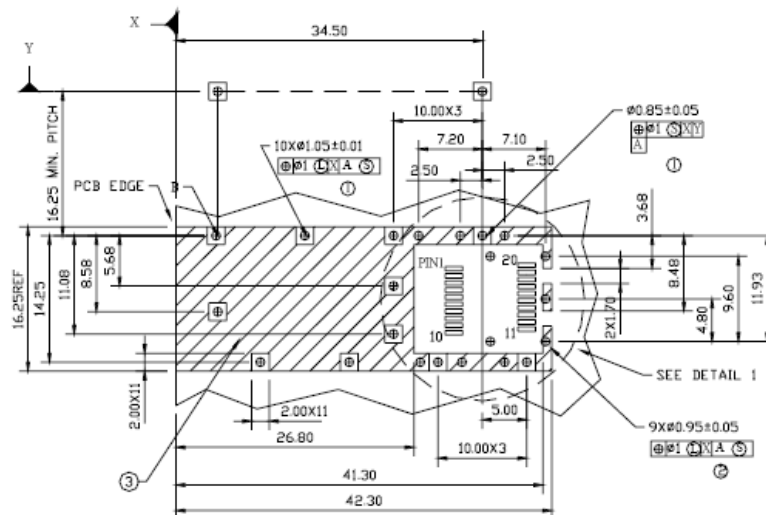
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### LEGEND

1. PADS AND VIAS ARE CHASSIS GROUND
2. THROUGH HOLES, PLATING OPTIONAL
3. HATCHED AREA DENOTES COMPONENT AND TRACE KEEPOUT (EXCEPT CHASSIS GROUND)
4. AREA DENOTES COMPONENT KEEPOUT (TRACES ALLOWED)

DIMENSIONS ARE IN MILLIMETERS

Unit: mm

## Pin Assignment

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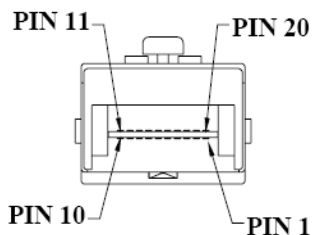
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Pin-Out



Pin	Signal Name	Description
1	$T_{GND}$	Transmit Ground
2	$TX\_FAULT$	Transmit Fault
3	$TX\_DISABLE$	Transmit Disable
4	$MOD\_DEF (2)$	SDA Serial Data Signal
5	$MOD\_DEF (1)$	SCL Serial Clock Signal
6	$MOD\_DEF (0)$	TTL Low
7	$RATE\_SELECT$	Open Circuit
8	$RX\_LOS$	Receiver Loss of Signal, TTL High, open collector
9	$R_{GND}$	Receiver Ground
10	$R_{GND}$	Receiver Ground
11	$R_{GND}$	Receiver Ground
12	$RX-$	Receive Data Bar, Differential PECL, ac coupled
13	$RX+$	Receive Data, Differential PECL, ac coupled
14	$R_{GND}$	Receiver Ground
15	$V_{CCR}$	Receiver Power Supply
16	$V_{CCT}$	Transmitter Power Supply
17	$T_{GND}$	Transmitter Ground
18	$TX+$	Transmit Data, Differential PCEL, ac coupled
19	$TX-$	Transmit Data Bar, Differential PCEL, ac coupled
20	$T_{GND}$	Transmitter Ground

## EEPROM Serial ID Memory Contents(A0h):

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Data Address	Field Size (Bytes)	Name of Field	Description and Contents
<b>Base ID Fields</b>			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Ext. Identifier	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07h=LC)
3-10	8	Transceiver	Gigabit Ethernet 1000Base-SX & Fiber Channel
11	1	Encoding	8B10B (01h)
12	1	BR,Nominal	Nominal baud rate, unit of 100Mbps
13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name: "Optostar" (ASCII)
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "" (ASCII)
56-59	4	Vendor rev	"31 30 20 20" means 1.0 revision (ASCII)
60-62	3	Reserved	
63	1	CC_BASE	Check sum of bytes 0 - 62
<b>Extended ID Fields</b>			
64-65	2	Option	Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Year(2 bytes), Month(2 bytes), Day (2 bytes)
92	1	Diagnostic type	"58" Diagnostics(Ext.Cal)
93	1	Enhanced option	"80" Diagnostics(Optional Alarm/warning flags)
94	1	SFF-8472	"01" Diagnostics(SFF-8472 Rev 9.3)
95	1	CC_EX	Check sum of bytes 64 - 94
<b>Vendor Specific ID fields</b>			
96-255	160	Readable	Vendor specific

## Serial ID Memory Contents: (A2H)

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Address	# Bytes	Name	Description
00-01	2	Temp High Alarm	MSB at low address
02-03	2	Temp Low Alarm	MSB at low address
04-05	2	Temp High Warning	MSB at low address
06-07	2	Temp Low Warning	MSB at low address
08-09	2	Voltage High Alarm	MSB at low address
10-11	2	Voltage Low Alarm	MSB at low address
12-13	2	Voltage High Warning	MSB at low address
14-15	2	Voltage Low Warning	MSB at low address
16-17	2	Bias High Alarm	MSB at low address
18-19	2	Bias Low Alarm	MSB at low address
20-21	2	Bias High Warning	MSB at low address
22-23	2	Bias Low Warning	MSB at low address
24-25	2	TX Power High Alarm	MSB at low address
26-27	2	TX Power Low Alarm	MSB at low address
28-29	2	TX Power High Warning	MSB at low address
30-31	2	TX Power Low Warning	MSB at low address
32-33	2	RX Power High Alarm	MSB at low address
34-35	2	RX Power Low Alarm	MSB at low address
36-37	2	RX Power High Warning	MSB at low address
38-39	2	RX Power Low Warning	MSB at low address
40-55	16	Reserved	Reserved for future monitored quantities
56-59	4	Rx_PWR(4)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 56 is MSB. Bit 0 of byte 59 is LSB.
60-63	4	Rx_PWR(3)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 60 is MSB. Bit 0 of byte 63 is LSB.
64-67	4	Rx_PWR(2)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 64 is MSB, bit 0 of byte 67 is LSB.
68-71	4	Rx_PWR(1)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 68 is MSB, bit 0 of byte 71 is LSB.
72-75	4	Rx_PWR(0)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 72 is MSB, bit 0 of byte 75 is LSB.
76-77	2	Tx_I(Slope)	Fixed decimal (unsigned) calibration data, laser bias current. Bit 7 of byte 76 is MSB, bit 0 of byte 77 is LSB.
78-79	2	Tx_I(Offset)	Fixed decimal (signed two's complement) calibration data, laser bias current. Bit 7 of byte 78 is MSB, bit 0 of byte 79 is LSB
80-81	2	Tx_PWR(Slope)	Fixed decimal (unsigned) calibration data,

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			transmittercoupled output power. Bit 7 of byte 80 is MSB, bit 0 of byte81 is LSB.
82-83	2	Tx_PWR(Offset)	Fixed decimal (signed two's complement) calibration data, transmitter coupled output power. Bit 7 of byte 82 is MSB, bit 0 of byte 83 is LSB.
84-85	2	T(Slope)	Fixed decimal (unsigned) calibration data, internal module temperature. Bit 7 of byte 84 is MSB, bit 0 of byte 85 is LSB.
86-87	2	T(Offset)	Fixed decimal (signed two's complement) calibration data, internal module temperature. Bit 7 of byte 86 is MSB, bit 0 of byte 87 is LSB.
88-89	2	V(Slope)	Fixed decimal (unsigned) calibration data, internal module supply voltage. Bit 7 of byte 88 is MSB, bit 0 of byte 89 is LSB.
90-91	2	V(Offset)	Fixed decimal (signed two's complement) calibration data, internal module supply voltage. Bit 7 of byte 90 is MSB. Bit 0 of byte 91 is LSB.
92-95	4	Reserved	Reserved

Byte	Bit	Name	Description
<b>Converted analog values. Calibrated 16 bit data</b>			
96	All	Temperature MSB	Internally measured module temperature.
97	All	Temperature LSB	
98	All	Vcc MSB	Internally measured supply voltage in transceiver.
99	All	Vcc LSB	
100	All	TX Bias MSB	Internally measured TX Bias Current.
101	All	TX Bias LSB	
102	All	TX Power MSB	Measured TX output power.
103	All	TX Power LSB	
104	All	RX Power MSB	Measured RX input power.
105	All	RX Power LSB	
106	All	Reserved MSB	Reserved for 1st future definition of digitized analog input
107	All	Reserved LSB	Reserved for 1st future definition of digitized analog input
108	All	Reserved MSB	Reserved for 2nd future definition of digitized analog input
109	All	Reserved LSB	Reserved for 2nd future definition of digitized analog input
<b>Optional Status/Control Bits</b>			
110	7	TX Disable State	Digital state of the TX Disable Input Pin. Not supported.
110	6	Soft TX Disable	Read/write bit that allows software disable of laser. Not supported.
110	5	Reserved	

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110	4	RX Rate Select State	Digital state of the SFP RX Rate Select Input Pin. Not supported.
110	3	Soft RX Rate Select	Read/write bit that allows software RX rate select. Not supported.
110	2	TX Fault	Digital state of the TX Fault Output Pin.
110	1	LOS	Digital state of the LOS Output Pin.
110	0	Data Ready	Indicates transceiver has achieved power up and data is ready
111	7-0	Reserved	Reserved.

Byte	Bit	Name	Description
<b>Reserved Optional Alarm and Warning Flag Bits</b>			
112	7	Temp High Alarm	Set when internal temperature exceeds high alarm level.
112	6	Temp Low Alarm	Set when internal temperature is below low alarm level.
112	5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level.
112	4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level.
112	3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level.
112	2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level.
112	1	TX Power High Alarm	Set when TX output power exceeds high alarm level.
112	0	TX Power Low Alarm	Set when TX output power is below low alarm level.
113	7	RX Power High Alarm	Set when Received Power exceeds high alarm level.
113	6	RX Power Low Alarm	Set when Received Power is below low alarm level.
113	5	Reserved Alarm	
113	4	Reserved Alarm	
113	3	Reserved Alarm	
113	2	Reserved Alarm	
113	1	Reserved Alarm	
113	0	Reserved Alarm	
114	All	Reserved	
115	All	Reserved	
116	7	Temp High Warning	Set when internal temperature exceeds high warning level.
116	6	Temp Low Warning	Set when internal temperature is below low warning level.
116	5	Vcc High Warning	Set when internal supply voltage exceeds high warning level.
116	4	Vcc Low Warning	Set when internal supply voltage is below low warning level.
116	3	TX Bias High Warning	Set when TX Bias current exceeds high warning level.
116	2	TX Bias Low Warning	Set when TX Bias current is below low warning level.
116	1	TX Power High Warning	Set when TX output power exceeds high warning level.

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116	0	TX Power Low Warning	Set when TX output power is below low warning level.
117	7	RX Power High Warning	Set when Received Power exceeds high warning level.
117	6	RX Power Low Warning	Set when Received Power is below low warning level.
117	5	Reserved Warning	
117	4	Reserved Warning	
117	3	Reserved Warning	
117	2	Reserved Warning	
117	1	Reserved Warning	
117	0	Reserved Warning	
118	All	Reserved	
119	All	Reserved	
120-127	8	Vendor Specific	00h.
128-255	128		Writable Memory

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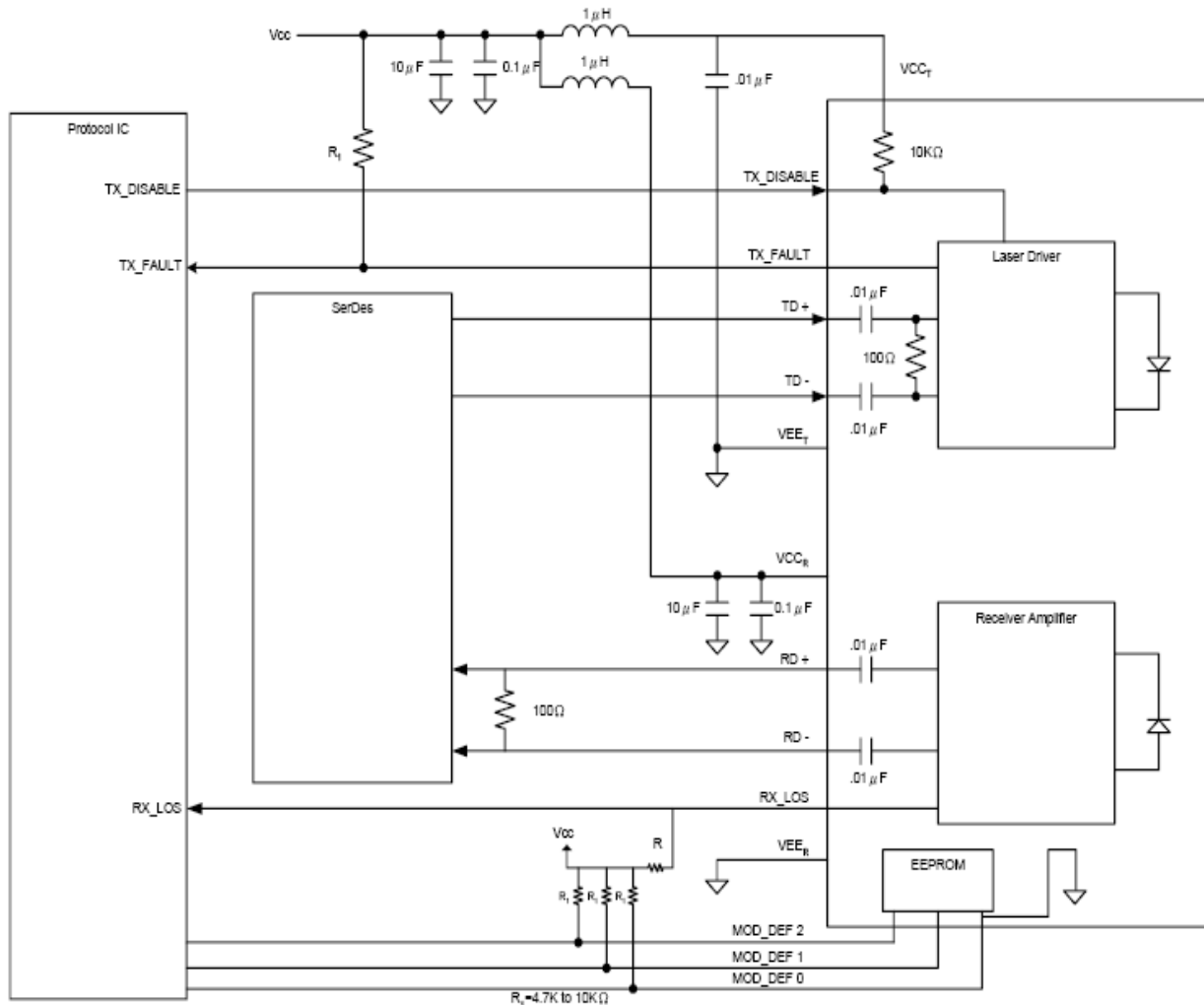
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## Suggested Transceiver Interface



### Warnings:

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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