



**RoHS compliant**  
**850 nm Multi-mode Transceiver, 1000Base-SX**  
**Small Form Pluggable (SFP), with Diagnostic Monitoring**  
**1.0625Gbd Fiber Channel/1.25 Gigabit Ethernet**



**Features**

- Compliant with IEEE802.3z Gigabit Ethernet Standard
- Compliant with SFF8472 diagnostic monitoring interface
- Duplex LC connector
- Differential LVPECL inputs and outputs
- Single power supply 3.3V
- TTL signal detect indicator
- Hot Pluggable
- Class 1 laser product complies with EN 60825-1

**Ordering Information**

PART NUMBER	INPUT/OUTPUT	SIGNAL DETECT	VOLTAGE	TEMPERATURE	DISTANCE
LM28-C3S-TI-N-DA	AC/AC	TTL	3.3V	-40°C to 85 °C	275m (62.5/125) 550m (50/125)

**Diagnostics**

Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 95	± 3	°C	External
Voltage	0 to VCC	± 0.1	V	
Bias Current	0 to 120	± 5	mA	
TX Power	-12 to +1	± 3 dB	dBm	
RX Power	-18 to 0	± 3 dB	dBm	



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### Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Storage Temperature	$T_S$	-40	85	°C	
Supply Voltage	$V_{CC}$	-0.5	4.0	V	
Input Voltage	$V_{IN}$	-0.5	$V_{CC}$	V	
Output Current	$I_o$	---	50	mA	
Operating Current	$I_{OP}$	---	300	mA	

### Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Case Operating Temperature	$T_C$	-40	85	°C	
Supply Voltage	$V_{CC}$	3.1	3.5	V	
Supply Current	$I_{TX} + I_{RX}$	---	200	mA	



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### Transmitter Electro-optical Characteristics

$V_{CC} = 3.1\text{ V to }3.5\text{ V}$ ,  $T_C = -40\text{ }^\circ\text{C to }85\text{ }^\circ\text{C}$

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Output Optical Power 62.5/125, 50/125 $\mu\text{m}$ fiber	$P_{out}$	-9.5	---	-4	dBm	Average
Extinction Ratio	$ER$	9	---	---	dB	
Center Wavelength	$\lambda_C$	830	850	860	nm	
Spectral Width (RMS)	$\Delta\lambda$	---	---	0.85	nm	
Rise/Fall Time, (20–80%)	$T_{r,f}$	---	---	260	ps	
Relative Intensity Noise	$RIN$	---	---	-116	dB/Hz	
Total Jitter	$TJ$	---	---	227	ps	
Output Eye						Compliant with IEEE802.3z
Max. $P_{out}$ TX-DISABLE Asserted	$P_{OFF}$	---	---	-45	dBm	
Differential Input Voltage	$V_{DIFF}$	0.4	---	2.0	V	



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### Receiver Electro-optical Characteristics

$V_{CC} = 3.1\text{ V to }3.5\text{ V}$ ,  $T_C = -40\text{ }^\circ\text{C to }85\text{ }^\circ\text{C}$

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Optical Input Power-maximum	$P_{IN}$	0	---	---	dBm	BER < $10^{-12}$
Optical Input Power-minimum (Sensitivity)	$P_{IN}$	---	---	-18	dBm	BER < $10^{-12}$
Operating Center Wavelength	$\lambda_C$	770	---	860	nm	
Optical Return Loss	$ORL$	12	---	---	dB	
Signal Detect-Asserted	$P_A$	---	---	-18	dBm	
Signal Detect-Deasserted	$P_D$	-35	---	---	dBm	
Differential Output Voltage	$V_{DIFF}$	0.5	---	1.2	V	
Data Output Rise, Fall Time (20–80%)	$T_{r,f}$	---	---	0.35	ns	
Receiver Loss of Signal Output Voltage-Low	$RX\_LOS_L$	0	---	0.5	V	
Receiver Loss of Signal Output Voltage-High	$RX\_LOS_H$	2.4	---	$V_{CC}$	V	



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**EEPROM Serial ID Memory Contents (2-Wire Address A0h)**

Address	Description	Hex	Real Value
0	Identifier	03	SFP or SFP+
1	Ext. Identifier	04	GBIC/SFP function is defined by two-wire interface ID only
2	Connector	07	LC
3	Specification Compliance	00	
4		00	
5		00	
6		01	1000BASE-SX;
7		40	short distance(S);
8		40	Shortwave laser w/o OFC(SN);
9		0C	Multimode;50um(M5;M5E);Multimode;62.5um(M6);
10		01	100MBytes/sec;
11	Encoding	01	64B/66B
12	BR, nominal	00	
13	Extended rate select Compliance	0D	
14	Length(SMF)	00	10km
15	Length(OM3 50 um)	00	Not compliant
16	Length(OM2 50 um)	00	Not compliant
17	Length(OM1 62.5 um)	37	Not compliant
18	Length(Copper)	1E	Not compliant
19	Device tech	00	1310nm DFB
20-35	Vendor name	41, 50, 41, 43, 20, 4F, 70, 74, 6F, 20, 20, 20, 20, 20, 20, 20	APAC Opto
36	Extended Module	00	
37-39	Vendor OUI	00, 0F, 99	
40-55	Vendor PN	4C, 4D, 32, 38, 2D, 43, 33, 53,	LM28-C3S-TI-N-DA



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		2D, 54, 49, 2D, 4E, 2D, 44, 41	
56-59	Vendor rev	00,00,00,00	Unspecified
60-61	Wave length	03, 52	850nm
62	Unallocated	00	
63	CC_BASE.	63	Check sum of byte 0 ~ 62
64-65	Options	00,1A	Loss of Signal;Tx_Fault;Tx_Disable;
66-67	BR	00, 00	
68-83	Vendor SN		
84-91	Date Code		
92	Diagnostic Monitoring Type	58	Received Power Measurement Type;Externally Calibrated;Digital diagnostic monitoring implemented;
93	Enhanced Options	B0	Rx_Loss Monitoring;Tx_Fault Monitoring;Alarm/warning Flags;
94	SFF-8472 Compliance	01	includes functionality described in Rev 9.3 of SFF-8472
95	CC_EXT	2E	Check sum of byte 64 ~ 94
96-127	Vendor Specific		



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**EEPROM Serial ID Memory contents(A2h)**

Address	Description	Value
00-01	Temp High Alarm	85 Degree C
02-03	Temp Low Alarm	-15 Degree C
04-05	Temp High Warning	80 Degree C
06-07	Temp Low Warning	-10 Degree C
08-09	Voltage High Alarm	3.8 V
10-11	Voltage Low Alarm	2.8 V
12-13	Voltage High Warning	3.6 V
14-15	Voltage Low Warning	2.97 V
16-17	Bias High Alarm	25 mA
18-19	Bias Low Alarm	0.1 mA
20-21	Bias High Warning	20 mA
22-23	Bias Low Warning	0.5 mA
24-25	TX Power High Alarm	-2 dBm
26-27	TX Power Low Alarm	-11.5 dBm
28-29	TX Power High Warning	-3 dBm
30-31	TX Power Low Warning	-10.5 dBm
32-33	RX Power High Alarm	-2dBm
34-35	RX Power Low Alarm	-20 dBm
36-37	RX Power High Warning	-3 dBm
38-39	RX Power Low Warning	-17 dBm
40-55	Reserved for future monitored quantities	
56-91	Calibration constant	
92-94	Reserved	
95	Check sum	
96-97	Real Time temperature	
98-99	Real Time supply voltage	
100-101	Real Time TX bias current	
102-103	Real Time TX optical power	
104-105	Real Time RX received power	
106-109	Reserved	
110(bit7)	NA	
110(bit6)	NA	
110(bit5)	Reserved	
110(bit4)	NA	
110(bit3)	NA	
110(bit2)	Digital state of TX fault output pin	
110(bit1)	Digital state of LOS output pin	
110(bit0)	NA	
111	Reserved	
112(bit7)	Set when internal temperature exceeds high alarm level	
112(bit6)	Set when internal temperature exceeds is below alarm level	
112(bit5)	Set when internal supply voltage exceeds high alarm level	
112(bit4)	Set when internal supply voltage is below alarm level	
112(bit3)	Set when TX bias exceeds high alarm level	
112(bit2)	Set when TX bias voltage is below alarm level	
112(bit1)	Set when TX output power exceeds high alarm level	
112(bit0)	Set when TX output power voltage is below alarm level	
113(bit7)	Set when RX received power exceeds high alarm level	
113(bit6)	Set when RX received power is below alarm level	
113(bit5-0)	Reserved	



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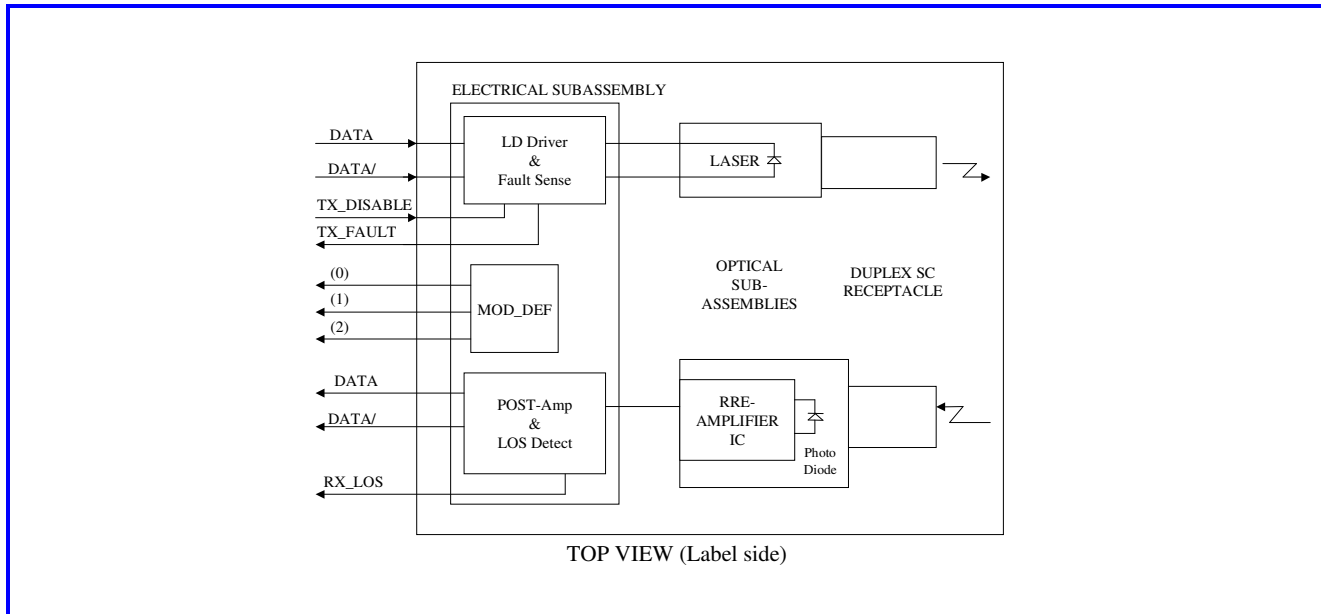
114-115	Reserved	
116(bit7)	Set when internal temperature exceeds high warning level	
116(bit6)	Set when internal temperature exceeds is below warning level	
116(bit5)	Set when internal supply voltage exceeds high warning level	
116(bit4)	Set when internal supply voltage is below warning level	
116(bit3)	Set when TX bias exceeds high warning level	
116(bit2)	Set when TX bias voltage is below warning level	
116(bit1)	Set when TX output power exceeds high warning level	
116(bit0)	Set when TX output power voltage is below warning level	
117(bit7)	Set when RX received power exceeds high warning level	
117(bit6)	Set when RX received power is below warning level	
117(bit5-0)	Reserved	
118-119	Reserved	
120-127	Vendor specific	





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**Block Diagram of Transceiver**



**Transmitter Section**

The transmitter section consists of a 850 nm laser in an eye safe optical subassembly (OSA) which mates to the fiber cable. The laser OSA is driven by a LD driver IC which converts differential input LVPECL logic signals into an analog laser driving current.

**TX\_DISABLE**

The TX\_DISABLE signal is high (TTL logic “1”) to turn off the laser output. The laser will turn on when TX\_DISABLE is low (TTL logic “0”).

**Receiver Section**

The receiver utilizes an InGaAs PIN photodiode mounted together with a trans-impedance preamplifier IC in an OSA. This OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

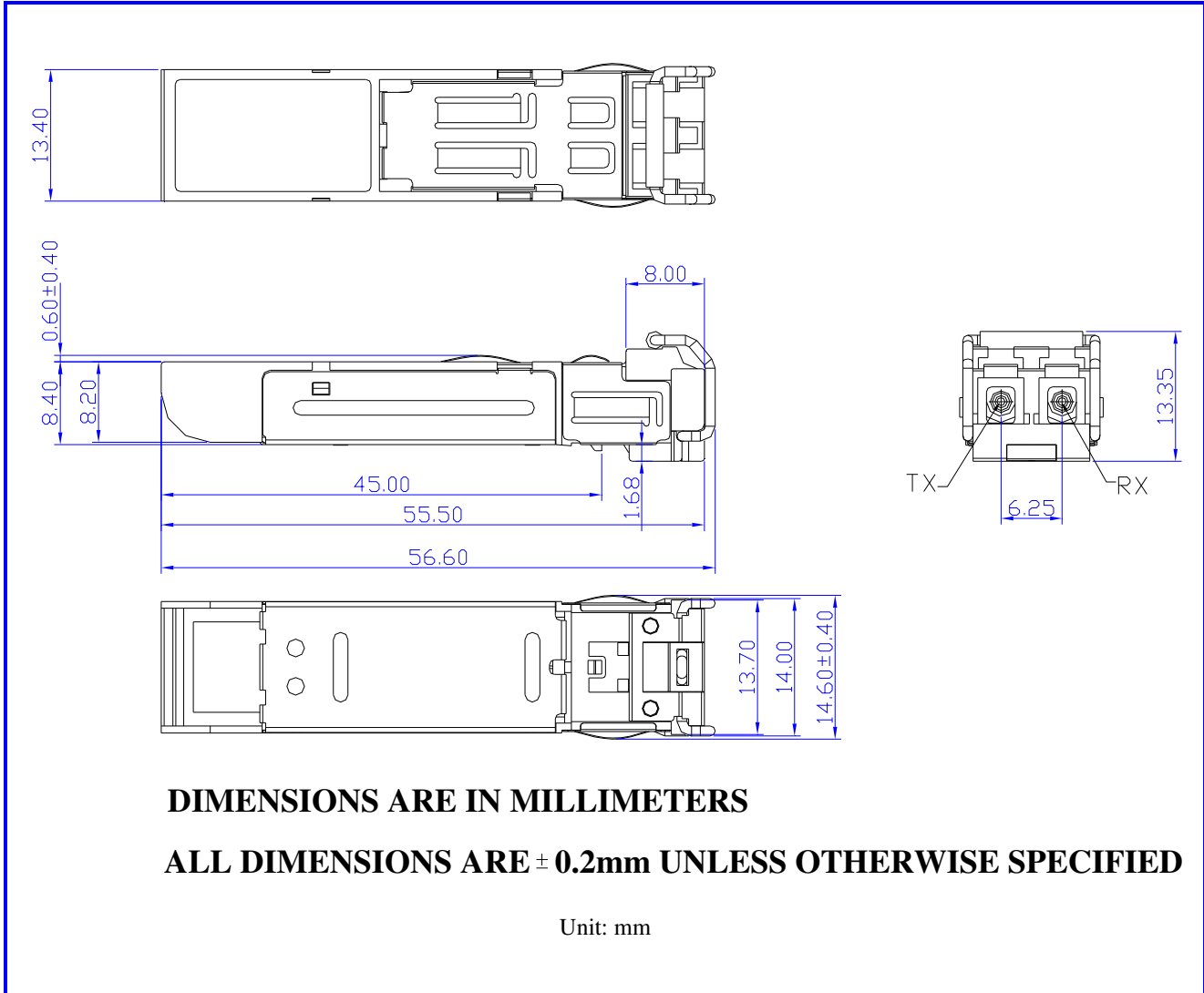
**Receive Loss (RX\_LOS)**

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 LVTTTL level.



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Dimensions



**DIMENSIONS ARE IN MILLIMETERS**

**ALL DIMENSIONS ARE ± 0.2mm UNLESS OTHERWISE SPECIFIED**

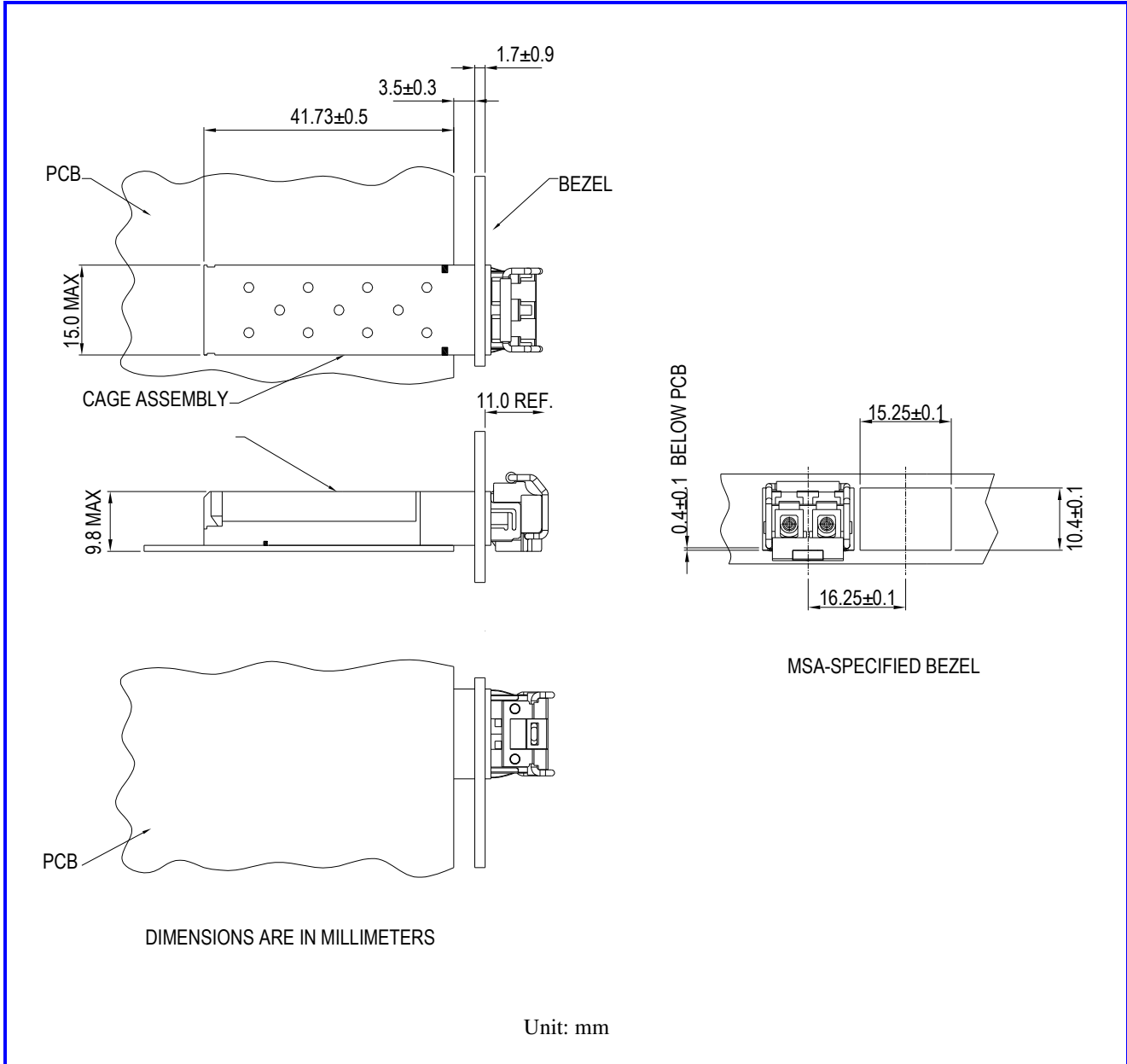
Unit: mm





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Assembly drawing

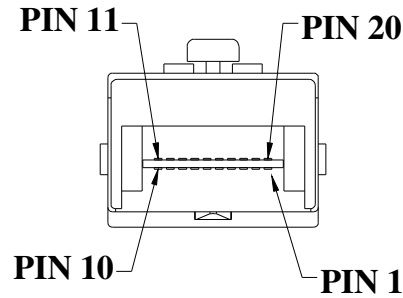




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**Pin Assignment**

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



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**Eye Safety Mark**

The LM2 series multimode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

**Caution**

**All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.**

**Required Mark**

**Class 1 Laser Product  
Complies with  
21 CFR 1040.10 and 1040.11**

Note : All information contained in this document is subject to change without notice.