PROLABS – SFP-10G-ZR-XX.XX-C

10 Gigabit DWDM 80km SFP+ Transceiver

SFP-10G-ZR-XX.XX-C Overview

PROLABS's SFP-10G-ZR-XX.XX-C DWDM SFP+ optical transceivers are based on 10G Ethernet and SFF 8431 standard, and provide a quick and reliable interface for the 10G DWDM application. The Digital diagnostics functions are available via 2-wire serial bus specified in the SFF 8472.

Product Features

- Up to 10.7 GBd bi-directional data links
- Compliant with 10GBASE-ZR
- Compliant with 10GFC
- Compliant with SFF8431
- Hot-pluggable SFP+ footprint
- Temperature-stabilized EML laser
- 100GHz ITU Grid, C Band
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 80km on SMF
- Single power supply 3.3V
- RoHS Compliance
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0℃ to 70℃.

Applications

- DWDM 10G Ethernet
- DWDM 10G Fiber Channel

Ordering Information

Part Number	***Description***
SFP-10G-ZR-XX.XX-C	10GBASE-DWDM SFP+, DWDM C-Band (ITU 100GHz Grid), 80km over SMF, DOM Support.

Product Selection

Product number	Description	ITU channel
SFP-10G-ZR-30.33-C	10GBASE-DWDM 80km,1530.33 nm SFP+ (100-GHz ITU grid)	59
SFP-10G-ZR-31.12-C	10GBASE-DWDM 80km,1531.12 nm SFP+ (100-GHz ITU grid)	58
SFP-10G-ZR-31.90-C	10GBASE-DWDM 80km,1531.90 nm SFP+ (100-GHz ITU grid)	57
SFP-10G-ZR-32.68-C	10GBASE-DWDM 80km,1532.68 nm SFP+ (100-GHz ITU grid)	56
SFP-10G-ZR-33.47-C	10GBASE-DWDM 80km,1533.47 nm SFP+ (100-GHz ITU grid)	55
SFP-10G-ZR-34.25-C	10GBASE-DWDM 80km,1534.25 nm SFP+ (100-GHz ITU grid)	54
SFP-10G-ZR-35.04-C	10GBASE-DWDM 80km,1535.04 nm SFP+ (100-GHz ITU grid)	53
SFP-10G-ZR-35.82-C	10GBASE-DWDM 80km,1535.82 nm SFP+ (100-GHz ITU grid)	52
SFP-10G-ZR-36.61-C	10GBASE-DWDM 80km,1536.61 nm SFP+ (100-GHz ITU grid)	51
SFP-10G-ZR-37.40-C	10GBASE-DWDM 80km,1537.40 nm SFP+ (100-GHz ITU grid)	50
SFP-10G-ZR-38.19-C	10GBASE-DWDM 80km,1538.19 nm SFP+ (100-GHz ITU grid)	49
SFP-10G-ZR-38.98-C	10GBASE-DWDM 80km,1538.98 nm SFP+ (100-GHz ITU grid)	48
SFP-10G-ZR-39.77-C	10GBASE-DWDM 80km,1539.77 nm SFP+ (100-GHz ITU grid)	47
SFP-10G-ZR-40.56-C	10GBASE-DWDM 80km,1540.56 nm SFP+ (100-GHz ITU grid)	46
SFP-10G-ZR-41.35-C	10GBASE-DWDM 80km,1541.35 nm SFP+ (100-GHz ITU grid)	45
SFP-10G-ZR-42.14-C	10GBASE-DWDM 80km,1542.14 nm SFP+ (100-GHz ITU grid)	44
SFP-10G-ZR-42.94-C	10GBASE-DWDM 80km,1542.94 nm SFP+ (100-GHz ITU grid)	43
SFP-10G-ZR-43.73-C	10GBASE-DWDM 80km,1543.73 nm SFP+ (100-GHz ITU grid)	42
SFP-10G-ZR-44.53-C	10GBASE-DWDM 80km,1544.53 nm SFP+ (100-GHz ITU grid)	41
SFP-10G-ZR-45.32-C	10GBASE-DWDM 80km,1545.32 nm SFP+ (100-GHz ITU grid)	40
SFP-10G-ZR-46.12-C	10GBASE-DWDM 80km,1546.12 nm SFP+ (100-GHz ITU grid)	39
SFP-10G-ZR-46.92-C	10GBASE-DWDM 80km,1546.92 nm SFP+ (100-GHz ITU grid)	38
SFP-10G-ZR-47.72-C	10GBASE-DWDM 80km,1547.72 nm SFP+ (100-GHz ITU grid)	37
SFP-10G-ZR-48.51-C	10GBASE-DWDM 80km,1548.51 nm SFP+ (100-GHz ITU grid)	36
SFP-10G-ZR-49.32-C	10GBASE-DWDM 80km,1549.32 nm SFP+ (100-GHz ITU grid)	35
SFP-10G-ZR-50.12-C	10GBASE-DWDM 80km,1550.12 nm SFP+ (100-GHz ITU grid)	34
SFP-10G-ZR-50.92-C	10GBASE-DWDM 80km,1550.92 nm SFP+ (100-GHz ITU grid)	33
SFP-10G-ZR-51.72-C	10GBASE-DWDM 80km,1551.72 nm SFP+ (100-GHz ITU grid)	32
SFP-10G-ZR-52.52-C	10GBASE-DWDM 80km,1552.52 nm SFP+ (100-GHz ITU grid)	31
SFP-10G-ZR-53.33-C	10GBASE-DWDM 80km,1553.33 nm SFP+ (100-GHz ITU grid)	30
SFP-10G-ZR-54.13-C	10GBASE-DWDM 80km,1554.13 nm SFP+ (100-GHz ITU grid)	29
SFP-10G-ZR-54.94-C	10GBASE-DWDM 80km,1554.94 nm SFP+ (100-GHz ITU grid)	28
SFP-10G-ZR-55.75-C	10GBASE-DWDM 80km,1555.75 nm SFP+ (100-GHz ITU grid)	27
SFP-10G-ZR-56.55-C	10GBASE-DWDM 80km,1556.55 nm SFP+ (100-GHz ITU grid)	26
SFP-10G-ZR-57.36-C	10GBASE-DWDM 80km,1557.36 nm SFP+ (100-GHz ITU grid)	25
SFP-10G-ZR-58.17-C	10GBASE-DWDM 80km,1558.17 nm SFP+ (100-GHz ITU grid)	24
SFP-10G-ZR-58.98-C	10GBASE-DWDM 80km,1558.98 nm SFP+ (100-GHz ITU grid)	23
SFP-10G-ZR-59.79-C	10GBASE-DWDM 80km,1559.79 nm SFP+ (100-GHz ITU grid)	22
SFP-10G-ZR-60.61-C	10GBASE-DWDM 80km,1560.61 nm SFP+ (100-GHz ITU grid)	21

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	*DR*		10.3125		GBd	IEEE 802.3ae
Bit Error Rate	*BER*			10^{-12}		
Operating Temperature	T_{OP}	0		70	℃	Case temperature
Storage Temperature	T_{STO}	– 40		85	℃	Ambient temperature
Supply Current	I_S		450	500	mA	For electrical power interface
Input Voltage	V_{CC}	3	3.3	3.6	V	
Maximum Voltage	V_{MAX}	– 0.5		4	V	For electrical power interface

Link Distances

Parameter	Fiber Type	Distance Range (Km)
10.3125 GBd	9/125um SMF	80

Optical Characteristics – Transmitter

V_{CC}=3V to 3.6V, T_C=0℃ to 70℃

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Power	P_{OUT}	0		4	dBm	Average
Optical Wavelength	λ	X-100	X	X+100	pm	Note 1
Extinction Ratio	*ER*	9			dB	
Spectral Width (– 20 dB)	$\Delta\lambda$			0.6	nm	
Side Mode Suppression Ratio	*SMSR*	30			dB	
Relative Intensity Noise	*RIN*			– 128	dB/Hz	
Transmitter Dispersion Penalty	*TDP*			3.2	dB	
Transmitter Jitter	According to IEEE 802.3ae requirement					
Launch Power of OFF Transmitter	P_{OUT_OFF}			– 30	dBm	Average

Note

1、X = specified ITU Grid wavelength

Optical Characteristics – Receiver

V_{CC}=3V to 3.6V, T_C=0℃ to 70℃

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	λ_C	1260		1565	nm	
Optical Input Power	P_{IN}	-24		-7	dBm	Average, Informative
Receiver Sensitivity@ 10.3GBd	R_{X_SEN1}			– 24	dBm	Measured with worst ER: BER<10^{-12} 2^{31}-1 PRBS
Receiver Reflectance	TR_{RX}			– 27	dB	
LOS Assert	LOS_A	– 30			dBm	
LOS De-Assert	LOS_D			– 25	dBm	
LOS Hysteresis		0.5			dB	

Electrical Characteristics – Transmitter

V_{CC}=3V to 3.6V, T_C=0℃ to 70℃

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R_{IN}		100		Ω	Non condensing
Single ended data input swing	V_{IN_PP}	250		800	mV	
Transmit disable voltage	V_D	2		V_{CC}	V	
Transmit enable voltage	V_{EN}	V_{EE}		V_{EE}+0.8	V	

Electrical Characteristics – Receiver

V_{CC}=3V to 3.6V, T_C=0℃ to 70℃

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	V_{OUT_PP}	150	300	425	mV	
Data output rise time (20%-80%)	T_R		30		ps	
Data output fall time (20%-80%)	T_F		30		ps	
LOS Fault	V_{LOS_Fault}	2		V_{CC_HOST}	V	
LOS Normal	V_{LOS_normal}	V_{EE}		V_{EE}+0.5	V	

Digital Diagnostic Functions

SFP-10G-ZR-XX.XX-C support the 2-wire serial communication protocol as defined in the SFF 8472. Digital diagnostic information are accessible over the 2-wire interface at the address 0xA2. Digital Diagnostics for SFP-10G-ZR are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver.

Transceiver Temperature, internally measured, represented as a 16 bit signed twos complement value in increments of 1/256 degrees Celsius, Temperature accuracy is better than ±3 degrees Celsius over specified operating temperature and voltage.

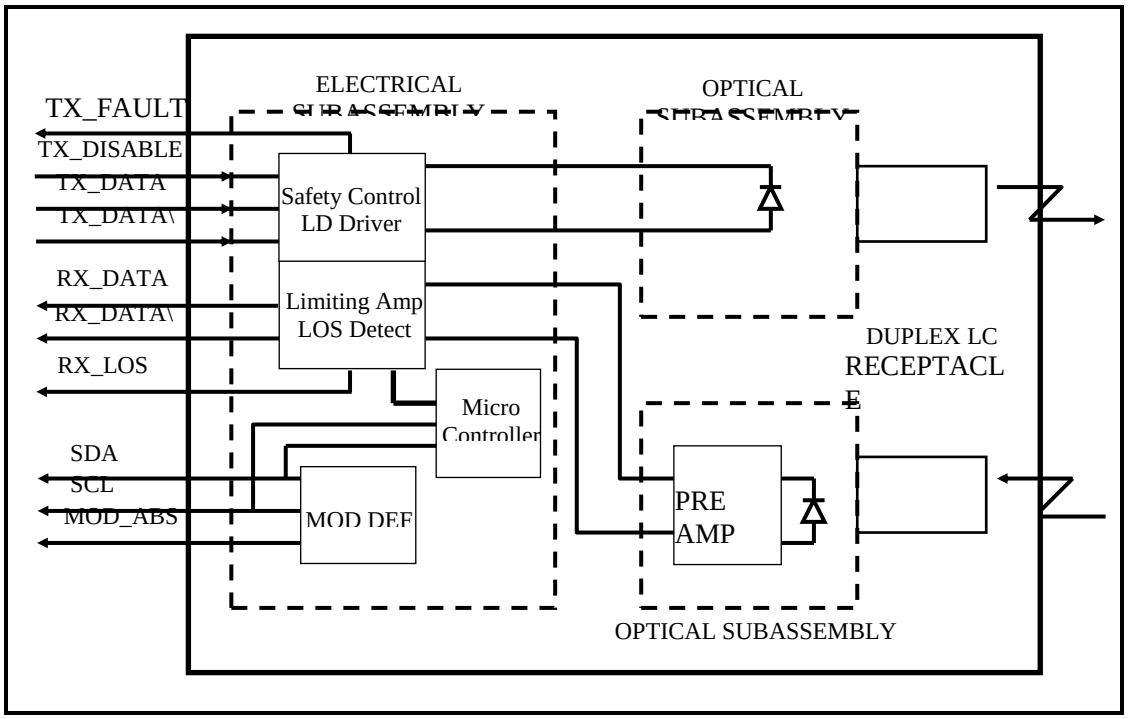
Transceiver Supply Power, internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100 µVolt, yielding a total range of 0 to +6.55 Volts.

Transceiver TX bias current, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2 µA, yielding a total range of 0 to 131mA. Accuracy is better than ±10% over specified operating temperature and voltage.

Transceiver TX output power, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit value (0 – 65535) with LSB equal to 0.1 µW. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ±3dB over specified temperature and voltage. Data is not valid when the transmitter is disabled.

Transceiver RX received optical power, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit 35 value (0 – 65535) with LSB equal to 0.1 µW. Accuracy is better than ±3dB over specified temperature and voltage.

Block Diagram of Transceiver



Transmitter Section
The Laser driver accept differential input data and provide bias and modulation currents for driving a laser. An automatic power-control (APC) feedback loop is incorporated to maintain a constant average optical power. DWDM DFB in an eye safe optical subassembly (OSA) mates to the fiber cable.

TX_DISABLE
The TX_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on within 1ms when TX_DISABLE is low (TTL logic "0").

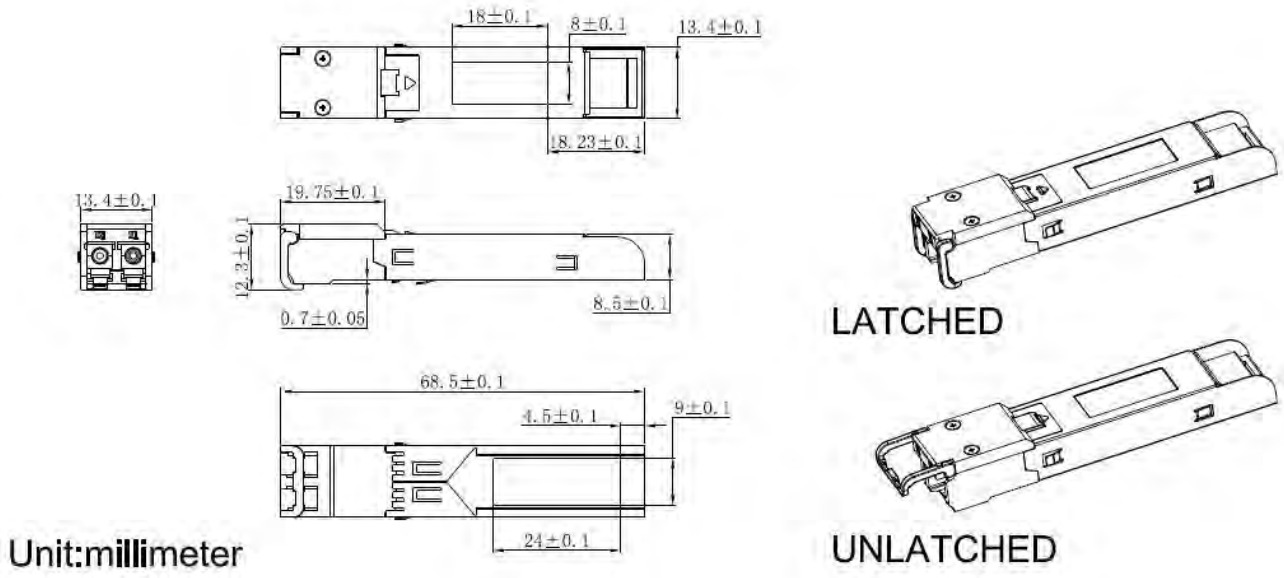
TX_FAULT
When the TX_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

Receiver Section
The receiver utilizes a PIN detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a Limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting Amplifier is AC-coupled to the transimpedance amplifier, with internal 100Ω differential termination.

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.

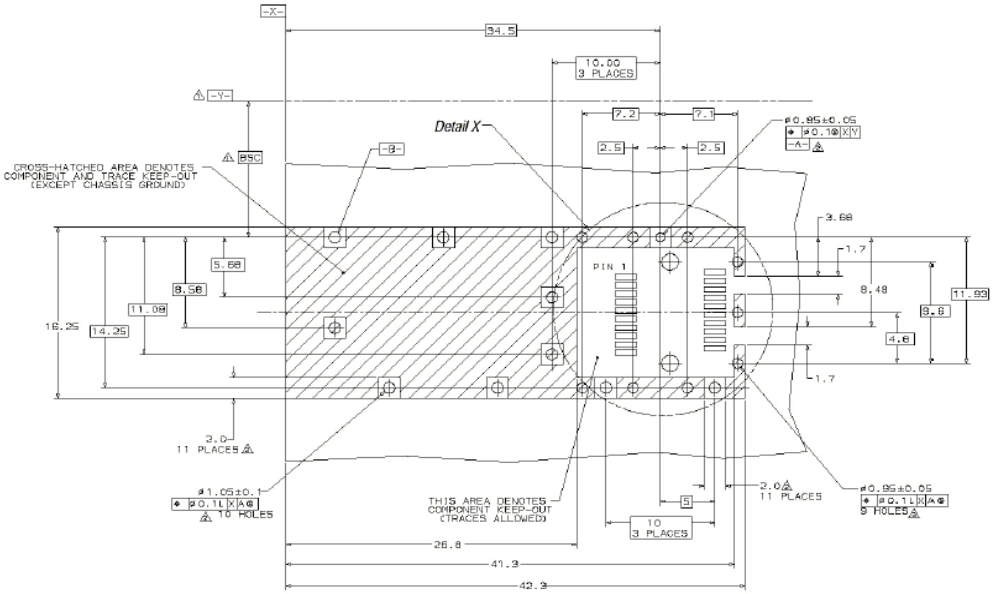
Controller Section
The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

Dimensions



ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

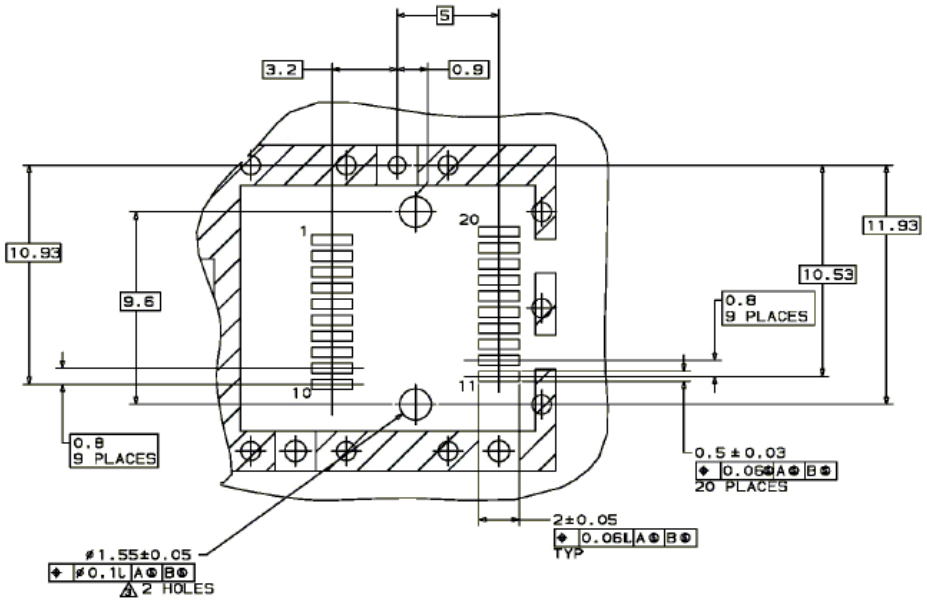
PCB Layout Recommendation



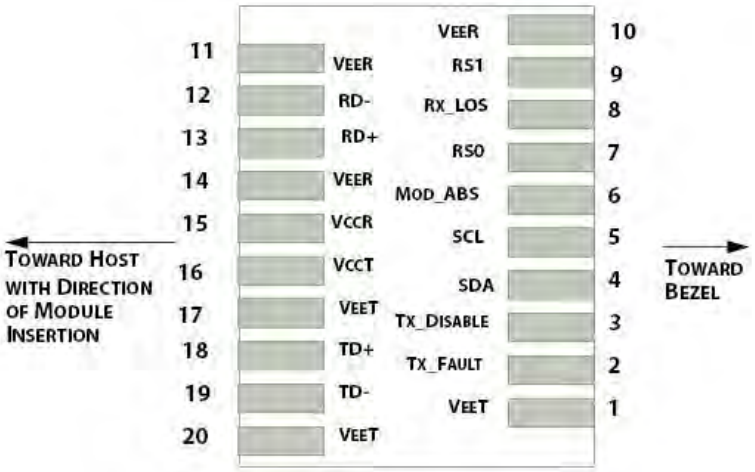
1 Datum and Basic Dimension Established by Customer

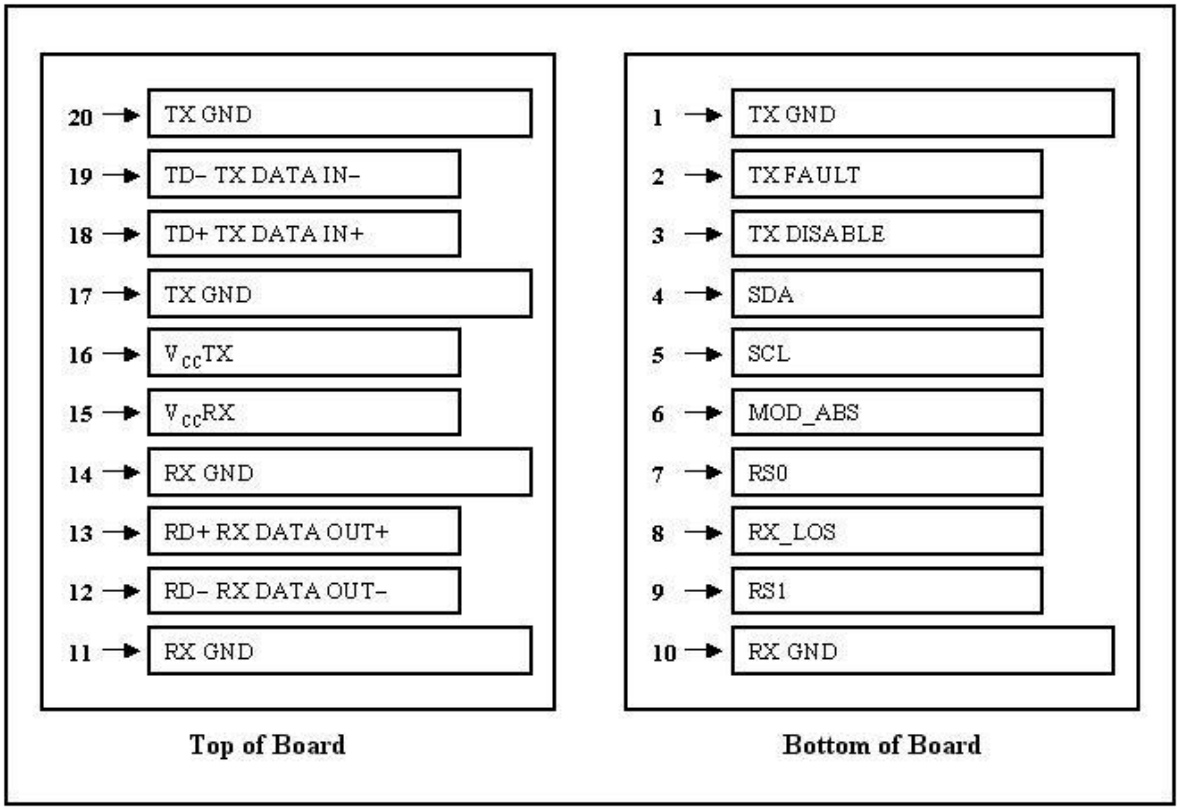
2 Pads and Vias are Chassis Ground, 11 Places

3 Through Holes are Unplated



Electrical Pad Layout





Pin Assignment

PIN #	Symbol	Description	Remarks
1	V_{EET}	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
2	T_{FAULT}	Transmitter Fault.	
3	T_{DIS}	Transmitter Disable. Laser output disable on high or open	Disabled: T_{DIS}>2V or open Enabled: T_{DIS}<0.8V
4	SDA	Data line for serial ID	Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V
5	SCL	Clock line for serial ID	
6	MOD_ABS	Module Absent. Grounded within the module	
7	RS0	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	LOS is open collector output
9	RS1	No connection required	Circuit ground is isolated from chassis ground
10	V_{EER}	Receiver ground (common with transmitter ground)	
11	V_{EER}	Receiver ground (common with transmitter ground)	
12	RD–	Receiver Inverted DATA out. AC coupled	
13	RD+	Receiver Non-inverted DATA out. AC coupled	
14	V_{EER}	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground
15	V_{CCR}	Receiver power supply	
16	V_{CCT}	Transmitter power supply	
17	V_{EET}	Transmitter ground (common with receiver ground)	Circuit ground is connected to chassis ground
18	TD+	Transmitter Non-Inverted DATA in. AC coupled	
19	TD–	Transmitter Inverted DATA in. AC coupled	
20	V_{EET}	Transmitter ground (common with receiver ground)	Circuit ground is connected to chassis ground

References

1. IEEE standard 802.3ae. IEEE Standard Department, 2005.
2. Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module "SFP+" – SFF-8431
3. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.