Prolabs SFP-1G-LX

SFP-1G-LX Long Wavelength Optical Transceiver

Key Features

- Up to 1.25 GBd bi-directional data links
- Compliant with IEEE 802.3z Gigabit Ethernet and 1000BASE-LX
- Compliant with SFP MSA
- Hot-pluggable SFP footprint
- 1310nm Fabry-Perot laser transmitter
- Built-in digital diagnostic functions
- Duplex LC connector
- Up to 10-20km on 9/125um SMF
- Single power supply 3.3V
- RoHS Compliance
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: -5℃ to 85℃.

Applications

- 1.25 GBd Gigabit Ethernet
- 1.063 GBd Fiber Channel

Ordering Information

Part Number	Description
SFP-1G-LX	GE/FC SFP 1310nm LC Connectors 10km on SMF, with DOM function.

Introduction

PROLABS's SFP-1G-LX optical transceivers are based on Gigabit Ethernet IEEE 802.3 standard and Fiber Channel FC-PI Rev.10.0 and provide a reliable interface for the GE/FC application. The Digital diagnostics functions are available via 2-wire serial bus, they comply with the Small Form Factor Pluggable Multi Sourcing Agreement (MSA) and SFF-8472..

Compatible Ordering Information

OEM Manufacturer	Prolabs Ordering SKU	Product Description
ADVA	0061003008-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	0061004009-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Alcatel	1AB376720002-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	3FE25774AA-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	3HE00028AA-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-GIG-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Allied	AT-SPLX10-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Arista	SFP-1G-LX-ARISTA-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Asante	SFP-M1000LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Avaya	AA1419015-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	AA1419049-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Blackbox	LBG200C-SLC-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	LFP413-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Brocade	E1MG-LX-OM-C	1000BASE-LX SFP, 1310nm, 10km over SMF
BTN/IBM	90Y9424-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	BN-CKM-S-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Calix	100-01662-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Checkpoint	CPAC-TR-1LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Ciena	XCVR-010Y31-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Cisco	GLC-LH-SM-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	GLC-LH-SMD-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-GE-L-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Cisco SB	LACGLX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Dell Force10	GP-SFP2-1Y-C	1000BASE-LX SFP, 1310nm, 10km over SMF
D-Link	DEM-310GT-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Enterasys	MGBIC-LC09-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Extreme	10052-C	1000BASE-LX SFP, 1310nm, 10km over SMF
F5 Networks	F5-UPG-SFPLX-R-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Fortinet	FG-TRAN-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Generic	LX-SFP-1G-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	LX-SFP-1G-EXT-C	1000BASE-LX SFP, 1310nm, 10km over SMF
H3C Huawei	SFP-GE-LX-SM1310-A-H3C-C	1000BASE-LX SFP, 1310nm, 10km over SMF
HP 3Com	3CSFP92-C	1000BASE-LX SFP, 1310nm, 10km over SMF
HP Comware	JD119B-C	1000BASE-LX SFP, 1310nm, 10km over SMF
HP ProCurve	J4859C-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Huawei	SFP-1.25G-LX10-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-GE-LX-SM1310-A-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-GE-LX-SM1310-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Juniper	EX-SFP-1GE-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Linksys	MGBLX1-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Maipu	SFP-S2-L24P3-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Marconi	SFP-GE-LXLC-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SU57AE-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Moxa	SFP-1GLXLC-C	1000BASE-LX SFP, 1310nm, 10km over SMF
MRV	SFP-GD-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Netgear	AGM732F-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Netscout	321-0433-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Packetfront	SFP-1000BASE-LX-M-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-1319-7D-PAC-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Palo Alto	PAN-SFP-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Planet	MGB-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF

Compatible Ordering Information

Radware	RAD-SFP-202-6-C	1000BASE-SX SFP, 850nm, 550m over MMF
Redback	RED-SFP-GE-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Riverbed	SFP-001-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SFP-006-LX -C	1000BASE-LX SFP, 1310nm, 10km over SMF
	TRC-1-SFP-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Ruijie	Mini-GBIC-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
SMC	SMC1GSFP-LX-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	SMCBGLLCX1-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Telco	BTI-MGBIC-GLX-DD-LC-C	1000BASE-LX SFP, 1310nm, 10km over SMF
TP-Link	TL-SM311LS-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Transmode	TRX100041-C	1000BASE-LX SFP, 1310nm, 10km over SMF
	TRX100075-C	1000BASE-LX SFP, 1310nm, 10km over SMF
Trendnet	TEG-MGBS10-C	1000BASE-LX SFP, 1310nm, 10km over SMF
ZTE	SFP-GE-S10K-C	1000BASE-LX SFP, 1310nm, 10km over SMF
ZyXEL	SFP-LX-10-D-C	1000BASE-LX SFP, 1310nm, 10km over SMF

Specification

General Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Remarks**
Data Rate	DR	-	1.25	-	GBd	IEEE 802.3.
			1.062			FC-PI-2 Rev 10
Bit Error Rate	BER	-	-	10^{-12}		-
Operating Temperature	T_{OP}	-5	-	85	°C	Case temperature.
Storage Temperature	T_{STO}	-40	-	85	°C	Ambient temperature.
Supply Current	I_S	-	175	300	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.

Optical Characteristics-Transmitter V_{CC}=3V to 3.6V, T_C=-5°C to 85°C						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Remarks**
Output Optical Power	P_{TX}	-9.5	-	-3	GBd	Class 1 Product
Optical Center Wavelength	λ_c	1260	-	1355	nm	-
Optical Modulation Amplitude@1.063GBd	OMA	174	-	-	uW	Equivalent extinction ratio specification for FC
Extinction Ratio@1.25GBd	ER	9	-	-	dB	-
Spectral Width (RMS)	Δλ	-	-	3	nm	-
Optical Rise/Fall Time (20% - 80%)	$T_{RF\ IN}$	-	150	260	ps	-
Relative Intensity Noise	RIN	-	-	-120	dB/Hz	-
Deterministic Jitter Contribution	TX_ΔDJ	-	20	60	ps	-
Total Jitter Contribution	TX_ΔTJ	-	50	120	ps	-

Specification

Optical Characteristics-Receiver V_{CC}=3V to 3.6V, T_C=-5°C to 85°C						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Remarks**
Optical Receiver Power	P_{RX}	-20	-	0	dBm	Average
Optical Center Wavelength	λ_c	1265	-	1600	nm	-
Receiver Sensitivity @ 1.063GBd	$R_{X\ SEN1}$	-	-	-22	dBm	FC-PI-2 Rev.10
Receiver Sensitivity @ 1.25GBd	$R_{X\ SEN2}$	-	-	-22	dBm	IEEE 802.3
Stressed Rx Sens @ 1.25GBd	-	-	-	-14.5	dBm	IEEE 802.3
Optical Return Loss	ORL	12	-	-	dB	-
Receiver Electrical 3dB Upper cutoff frequency	-	-	-	1500	MHz	-
Loss of Signal-Asserted	$P_{LOS\ A}$	-30	-	-	dBm	-
Loss of Signal-Deasserted	P_{LOS_D}	-	-	-22	dBm	-
Loss of Signal-Hysteresis	-	0.5	-	-	dB	-

Electrical Characteristics-Transmitter V_{CC}=3V to 3.6V, T_C=-5°C to 85°C						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Remarks**
Input differential impedance	R_{IN}	-	100	-	Ω	-
Single ended data input swing	$V_{IN\ PP}$	250	-	1200	mV	-
Transmit disable voltage	V_D	V_{CC}-1.3	-	V_{CC}	V	-
Transmit enable voltage	V_{EN}	V_{EE}	-	V_{EE}+0.8	V	-
Transmit disable assert time	-	-	-	10	us	-

Specification

Electrical Characteristics-Receiver V_{CC}=3V to 3.6V, T_C=-5°C to 85°C						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Remarks**
Single ended data output swing	$V_{OUT\ PP}$	300	400	800	mV	-
Data output rise/fall time (20%-80%)	T_R	-	-	300	ps	-
LOS Fault	$V_{LOS\ Fault}$	V_{CC}-0.5	-	$V_{EE\ HOST}$	V	-
LOS Normal	$V_{LOS\ Normal}$	V_{EE}	-	V_{EE}+0.5	V	-
Power Supply Rejection	PSR	100	-	-	mV_{PP}	-
Deterministic Jitter Contribution	RX_ΔDJ	-	-	80	ps	-
Total Jitter Contribution	RX_ΔTJ	-	-	122.4	ps	-

Digital Diagnostic Functions
SFP-1G-LX supports the 2-wire serial communication protocol as defined in SFP MSA. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital Diagnostics for SFP-1G-LX 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.

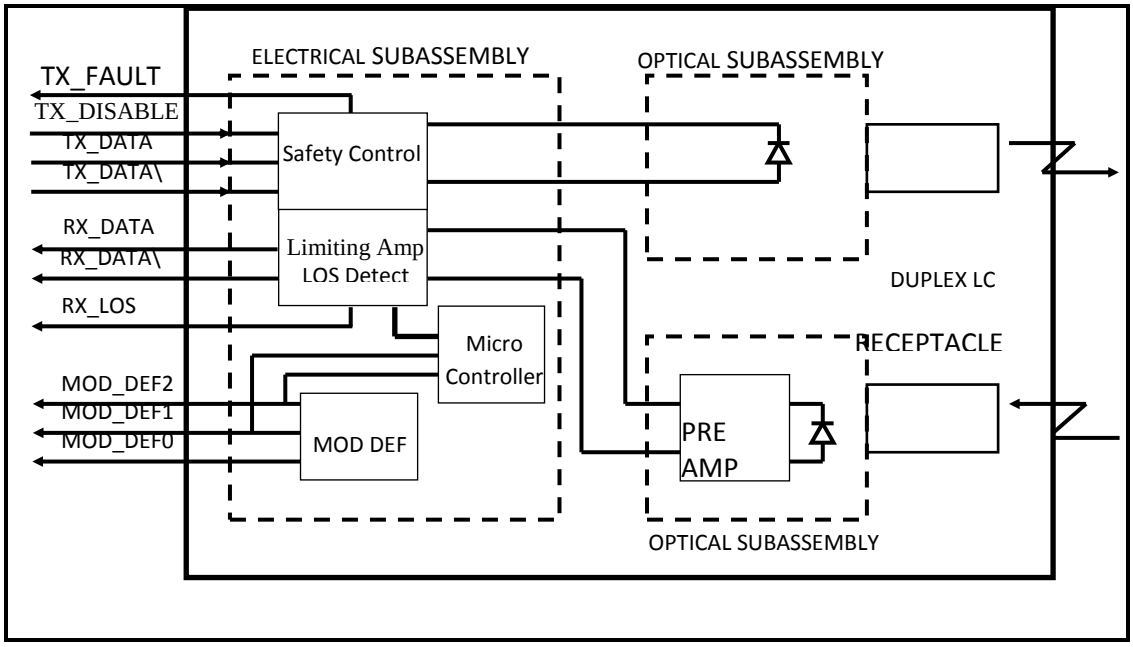
Transceiver TX bias current, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2 µA, yielding a total range of 0 to 131mA. Accuracy is better than ±10% over specified operating temperature and voltage.

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.

Specification

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. The laser is packaged in an eye safe optical subassembly (OSA) which 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 Trans impedance amplifier, with internal 100Ω differential termination.

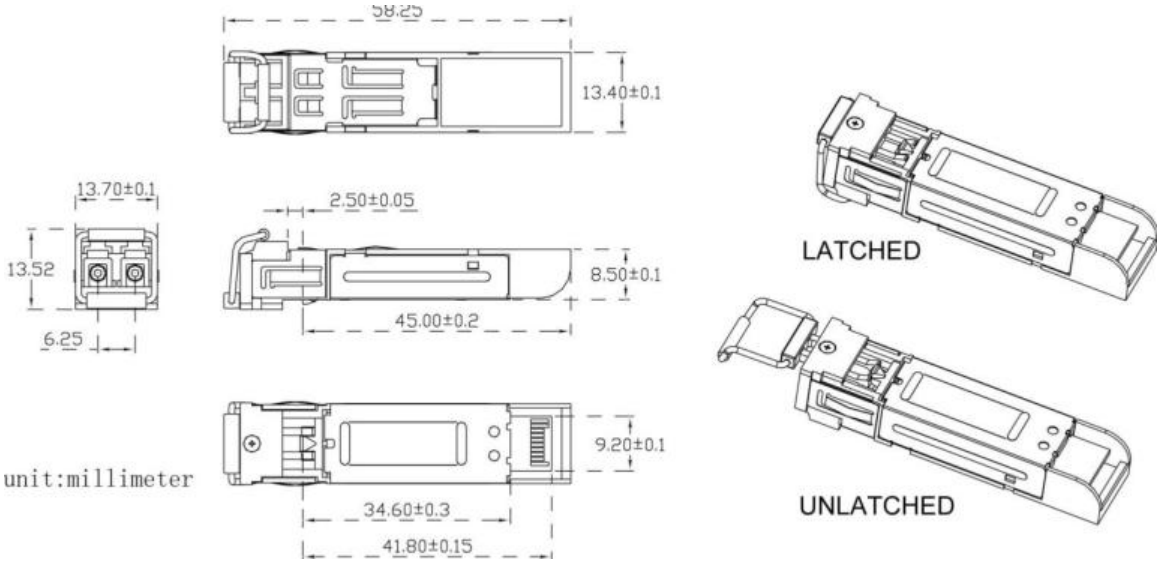
Receive Loss (RX_LOS)

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 statuses to the customer.

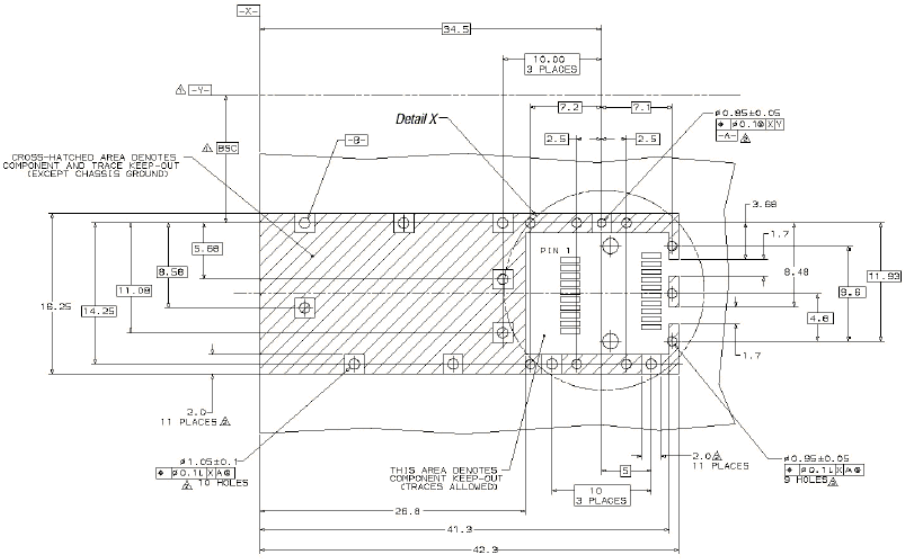
Dimensions



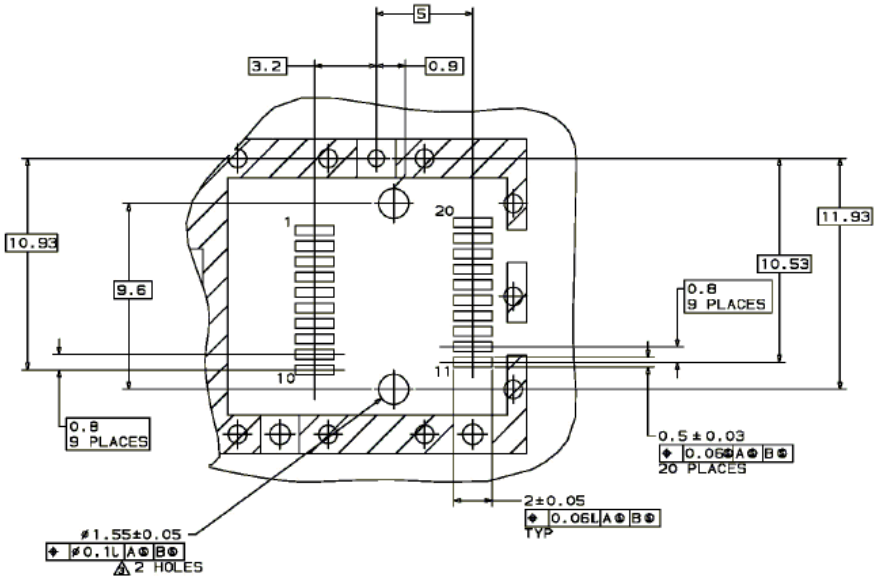
ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED

UNIT: mm

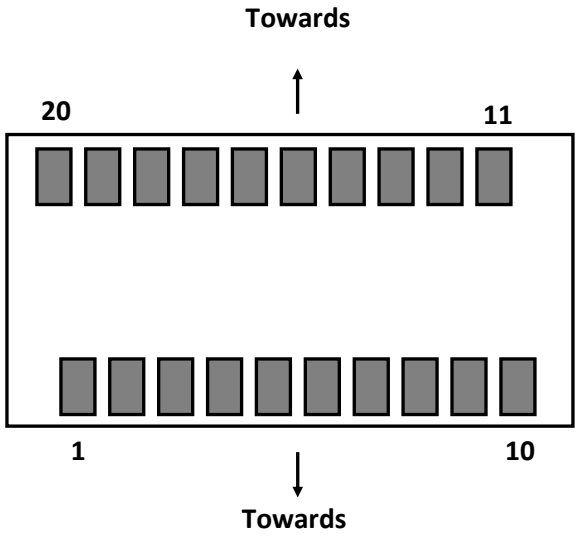
PCB Layout Recommendations

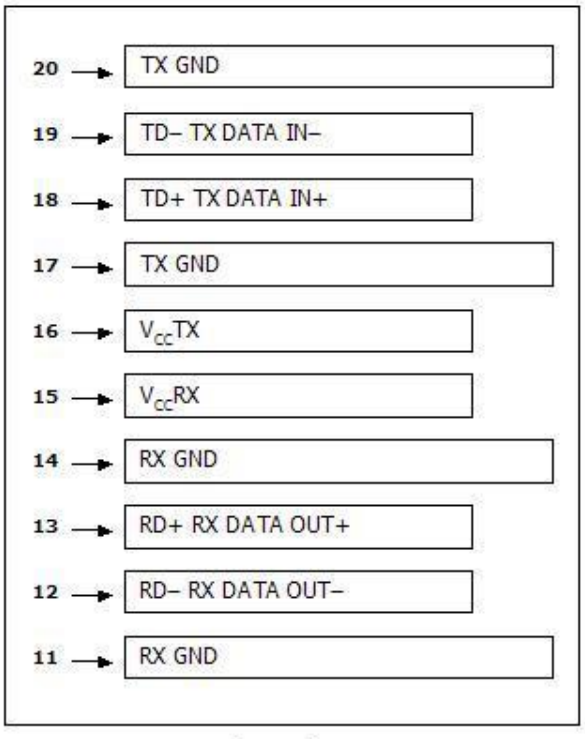


△Datum and Basic Dimension Established by Customer
△Pads and Vias are Chassis Ground, 11 Places
△Through Holes are Unplated

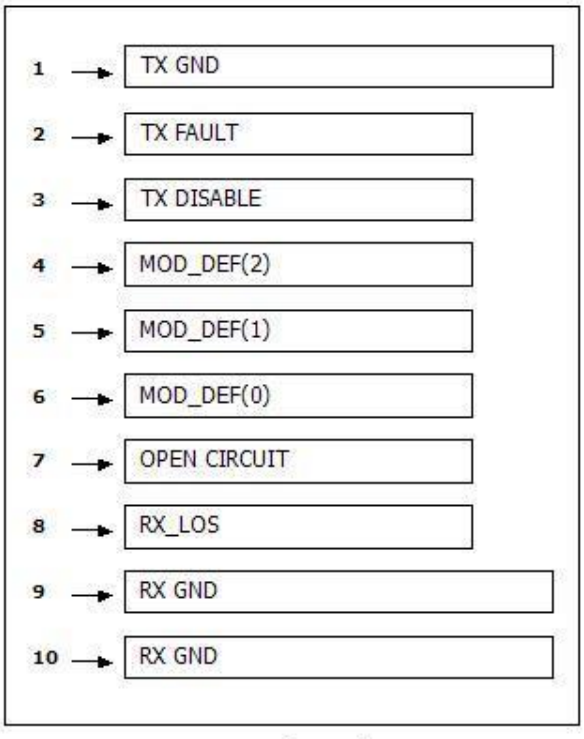


Electrical Pad Layout





Top of Board



Bottom of Board

Pin Assignments

Pin Assignments			
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. Not supported	-
3	T_{DIS}	Transmitter Disable. Laser output disable on high or open	Disabled: T_{DIS}>2V or open
			Enabled: T_{DIS}<0.8V
4	MOD_DEF (2)	Module Definition 2. 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	MOD_DEF (1)	Module Definition 1. Clock line for serial ID	
6	MOD_DEF (0)	Module Definition 0. Grounded within the module	
7	Rate Select	No connection required	-
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	LOS is open collector output
9	V_{EER}	Receiver ground (common with transmitter ground)	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 802.3. IEEE Standard Department, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
3. Fiber Channel Draft Physical Interface Specification (FC-PI-2 Rev.10).
4. Fiber Channel Physical and Signaling Interface (FC-PH/PH2/PH3).