



Fixed Fiber Optic Attenuators



Attenuators reduce the power (signal strength) in a fiber optic cable at values ranging from 3dB ~ 20dB. PRO's fixed fiber optic attenuators are compact, adapter-style components that are useful in a variety of singlemode fiber applications, including fiber amplifiers, DWDM and with telecom equipment. All PRO attenuators are constructed with durable Zirconia ferrules and built to extremely high tolerances.

Fixed attenuators are available for SC/UPC, FC/UPC, LC/UPC, ST/UPC, FC/APC and SC/APC applications. Variable Attenuators are also available.

Ordering Information

AT-MF-CACA01	AT-MF-CACA01 In-Line Attenuator (Male / Female) SC/APC 1 dB
AT-MF-CACA02	AT-MF-CACA02 In-Line Attenuator (Male / Female) SC/APC 2 dB
AT-MF-CACA03	AT-MF-CACA03 In-Line Attenuator (Male / Female) SC/APC 3 dB
AT-MF-CACA04	AT-MF-CACA04 In-Line Attenuator (Male / Female) SC/APC 4 dB
AT-MF-CACA05	AT-MF-CACA05 In-Line Attenuator (Male / Female) SC/APC 5 dB
AT-MF-CACA06	AT-MF-CACA06 In-Line Attenuator (Male / Female) SC/APC 6 dB
AT-MF-CACA07	AT-MF-CACA07 In-Line Attenuator (Male / Female) SC/APC 7 dB
AT-MF-CACA08	AT-MF-CACA08 In-Line Attenuator (Male / Female) SC/APC 8 dB
AT-MF-CACA09	AT-MF-CACA09 In-Line Attenuator (Male / Female) SC/APC 9 dB
AT-MF-CACA10	AT-MF-CACA10 In-Line Attenuator (Male / Female) SC/APC 10 dB
AT-MF-CACA11	AT-MF-CACA11 In-Line Attenuator (Male / Female) SC/APC 11 dB
AT-MF-CACA12	AT-MF-CACA12 In-Line Attenuator (Male / Female) SC/APC 12 dB
AT-MF-CACA13	AT-MF-CACA13 In-Line Attenuator (Male / Female) SC/APC 13 dB
AT-MF-CACA14	AT-MF-CACA14 In-Line Attenuator (Male / Female) SC/APC 14 dB
AT-MF-CACA15	AT-MF-CACA15 In-Line Attenuator (Male / Female) SC/APC 15 dB
AT-MF-CACA16	AT-MF-CACA16 In-Line Attenuator (Male / Female) SC/APC 16 dB
AT-MF-CACA17	AT-MF-CACA17 In-Line Attenuator (Male / Female) SC/APC 17 dB
AT-MF-CACA18	AT-MF-CACA18 In-Line Attenuator (Male / Female) SC/APC 18 dB
AT-MF-CACA19	AT-MF-CACA19 In-Line Attenuator (Male / Female) SC/APC 19 dB
AT-MF-CACA20	AT-MF-CACA20 In-Line Attenuator (Male / Female) SC/APC 20 dB

AT-MF-CUCU01	AT-MF-CUCU01 In-Line Attenuator (Male / Female) SC/UPC 1 dB
AT-MF-CUCU02	AT-MF-CUCU02 In-Line Attenuator (Male / Female) SC/UPC 2 dB
AT-MF-CUCU03	AT-MF-CUCU03 In-Line Attenuator (Male / Female) SC/UPC 3 dB
AT-MF-CUCU04	AT-MF-CUCU04 In-Line Attenuator (Male / Female) SC/UPC 4 dB
AT-MF-CUCU05	AT-MF-CUCU05 In-Line Attenuator (Male / Female) SC/UPC 5 dB
AT-MF-CUCU06	AT-MF-CUCU06 In-Line Attenuator (Male / Female) SC/UPC 6 dB
AT-MF-CUCU07	AT-MF-CUCU07 In-Line Attenuator (Male / Female) SC/UPC 7 dB
AT-MF-CUCU08	AT-MF-CUCU08 In-Line Attenuator (Male / Female) SC/UPC 8 dB
AT-MF-CUCU09	AT-MF-CUCU09 In-Line Attenuator (Male / Female) SC/UPC 9 dB
AT-MF-CUCU10	AT-MF-CUCU10 In-Line Attenuator (Male / Female) SC/UPC 10 dB
AT-MF-CUCU11	AT-MF-CUCU11 In-Line Attenuator (Male / Female) SC/UPC 11 dB
AT-MF-CUCU12	AT-MF-CUCU12 In-Line Attenuator (Male / Female) SC/UPC 12 dB
AT-MF-CUCU15	AT-MF-CUCU15 In-Line Attenuator (Male / Female) SC/UPC 15 dB
AT-MF-LULU01	AT-MF-LULU01 In-Line Attenuator (Male / Female) LC/UPC 1 dB
AT-MF-LULU02	AT-MF-LULU02 In-Line Attenuator (Male / Female) LC/UPC 2 dB
AT-MF-LULU03	AT-MF-LULU03 In-Line Attenuator (Male / Female) LC/UPC 3 dB
AT-MF-LULU04	AT-MF-LULU04 In-Line Attenuator (Male / Female) LC/UPC 4 dB
AT-MF-LULU05	AT-MF-LULU05 In-Line Attenuator (Male / Female) LC/UPC 5 dB
AT-MF-LULU10	AT-MF-LULU10 In-Line Attenuator (Male / Female) LC/UPC 10 dB



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Optical Characteristics - Transmitter

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	λ	1260		1355	nm	
Output Optical Power	P_{TX}	-8.2		0.5	dBm	Average
Extinction Ratio @ 1.25GBd	ER	3	5.5		dB	
Optical Modulation Amp	OMA	-5.2				Per IEEE 802.3ae
Spectral Width (RMS)	$\Delta\lambda$			0.6	nm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Dispersion Penalty	TDP			3.2	dB	
Launch Power of OFF Transmitter	P_{OUT_OFF}			-30	dB	Average

Transmitter Jitter

According to IEEE 802.3ae requirement

Optical Characteristics Receiver

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	λ_C	1260		1600	nm	
Optical Input Power	P_{IN}	-14.4		0.5	dBm	Average
Receiver Sensitivity in OMA @ 10.3 GBd	P_{SENS1}			-12.6	dBm	Worst ER: BER<10 ⁻¹² 2 ³¹ -1 PRBS
Stressed Receiver Sensitivity in OMA @ 10.3 GBd	P_{SENS2}			-10.3		IEEE 802.3ae
Receiver Reflectance	TR_{RX}			-12	dB	
LOS Assert	LOS_A	-25			dBm	
LOS De-Assert	LOS_D			-16	dBm	
LOS Hysteresis		0.5			dB	

Electrical Characteristics - Transmitter

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

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Differential data output swing	V_{OUT_PP}	600	650	800	mV	
Data output rise time	T_R			40	ps	20%-80%
Data output fall time	T_F			40	ps	20%-80%
LOS Fault	V_{LOS_F}	$V_{CC} - 0.5$		V_{CC_HOST}	V	
LOS Normal	V_{LOS_N}	GND		GND + 0.5	V	



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Digital Diagnostic Functions

The SFP 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 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.

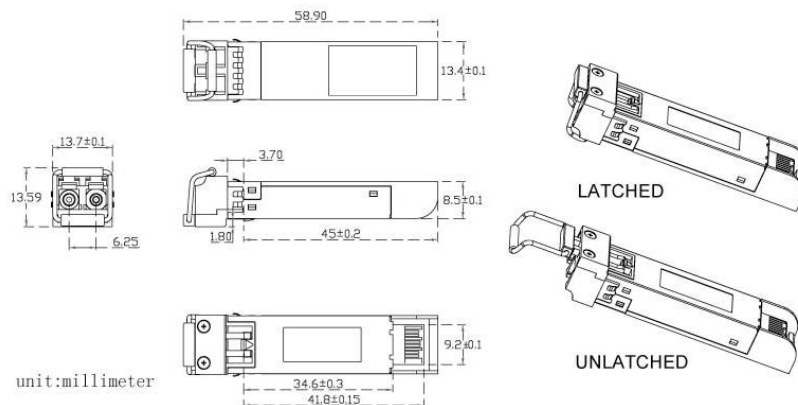
Transceiver Supply Power- Internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100 μ Volt, yielding a total range of 0 to +6.55 Volts.

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 μ A, yielding a total range of 0 to 131mA. Accuracy is better than $\pm 10\%$ 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 μ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ± 3 dB 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 μ W. Accuracy is better than ± 3 dB over specified temperature and voltage.

Parameter	Symbol	Accuracy	Units	Report Range	Unit	Remarks
Temperature	T _{MON}	± 3	°C	-10 - +85	°C	
Voltage	V _{MON}	± 0.1	V	2.9 - 3.7	V	
Bias Current	T _F	± 10	%	1 - 15	mA	
TxPower	V _{LOS_F}	± 3	dB	-10 - 0	dBm	
Rx Power	V _{LOS_N}	± 3	dB	-20 - 0	dBm	

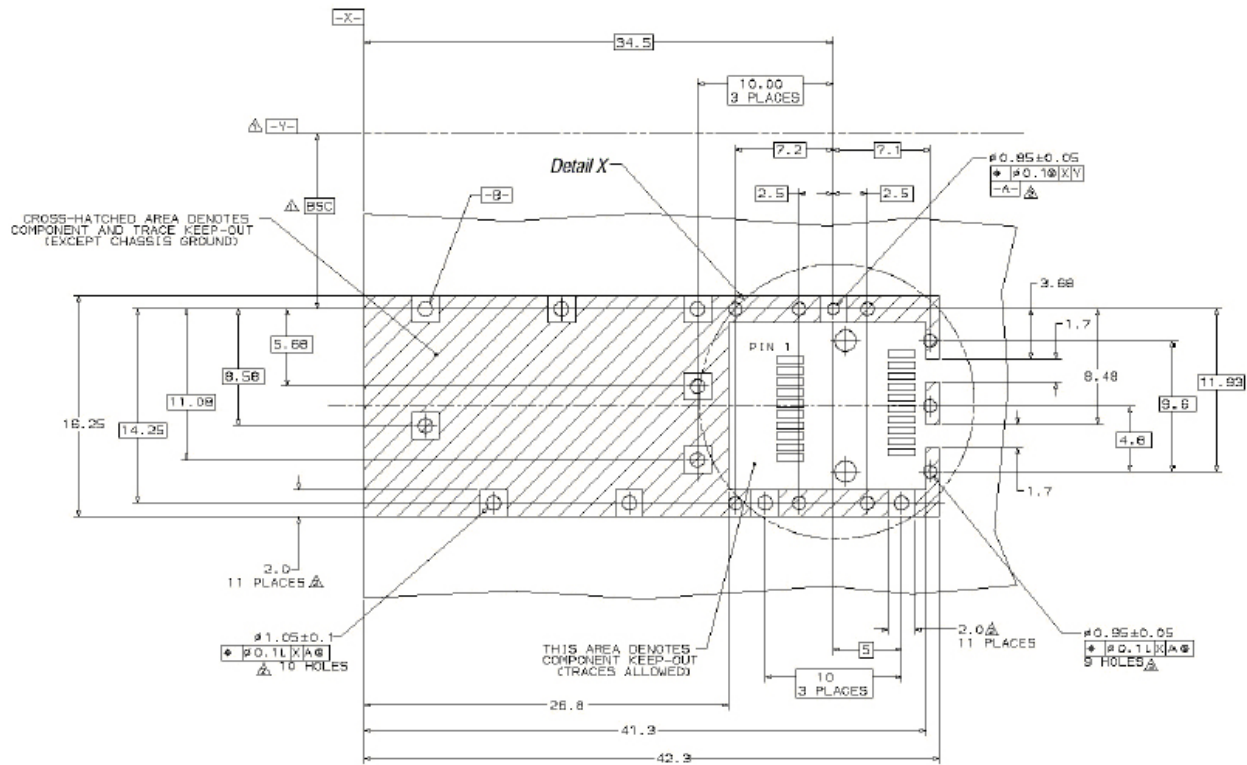




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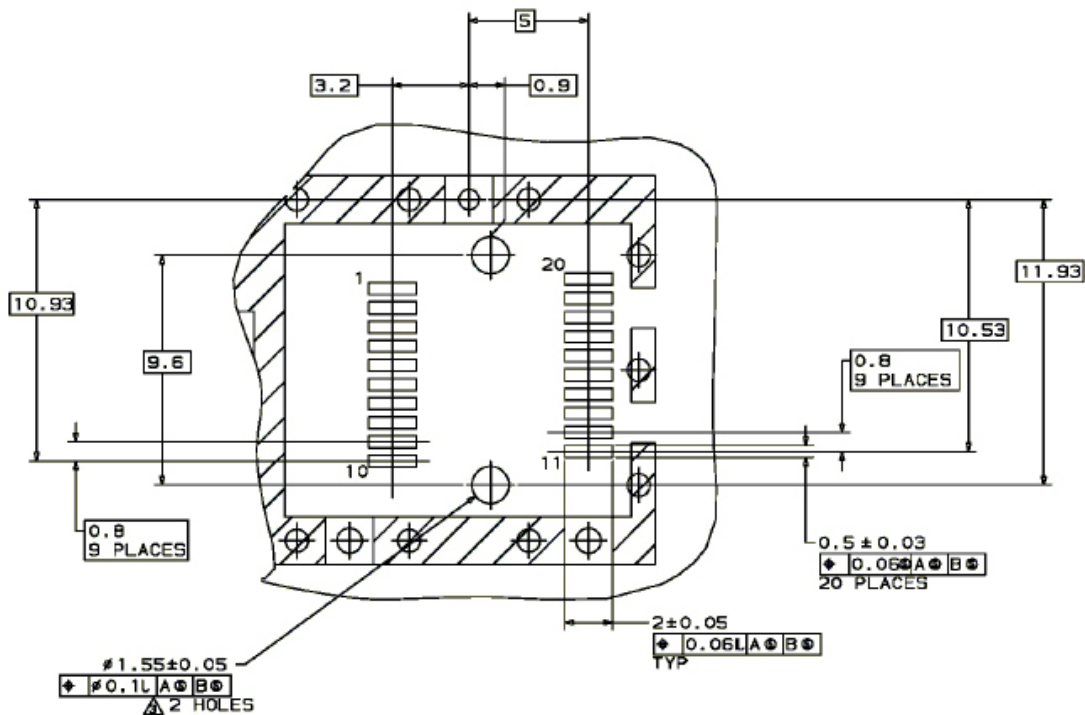
PCB Layout Recommendation



△ Datum and Basic Dimension Established by Customer

△ Pads and Vias are Chassis Ground, 11 Places

△ Through Holes are Unplated

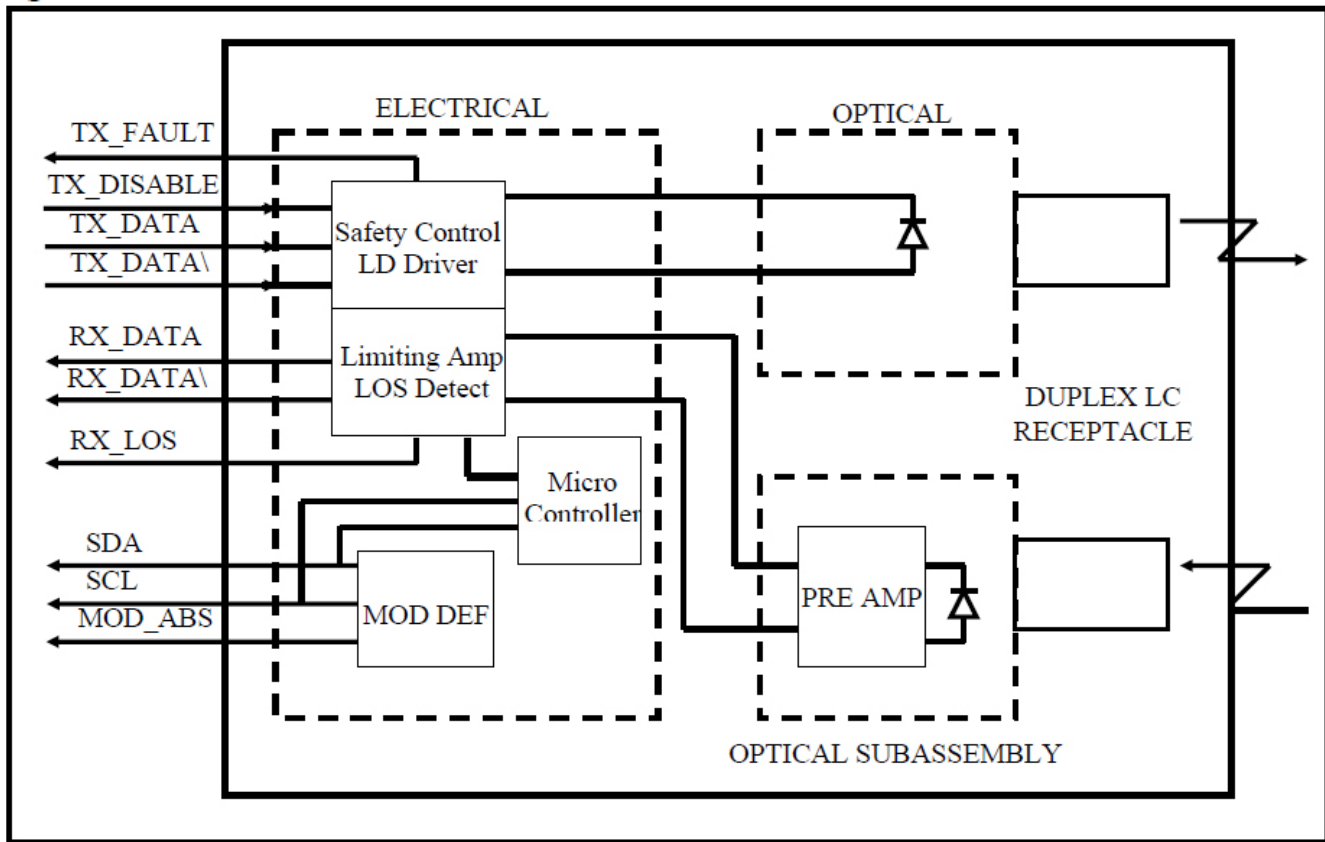




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Block Diagram of Transceiver



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. 1310 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.

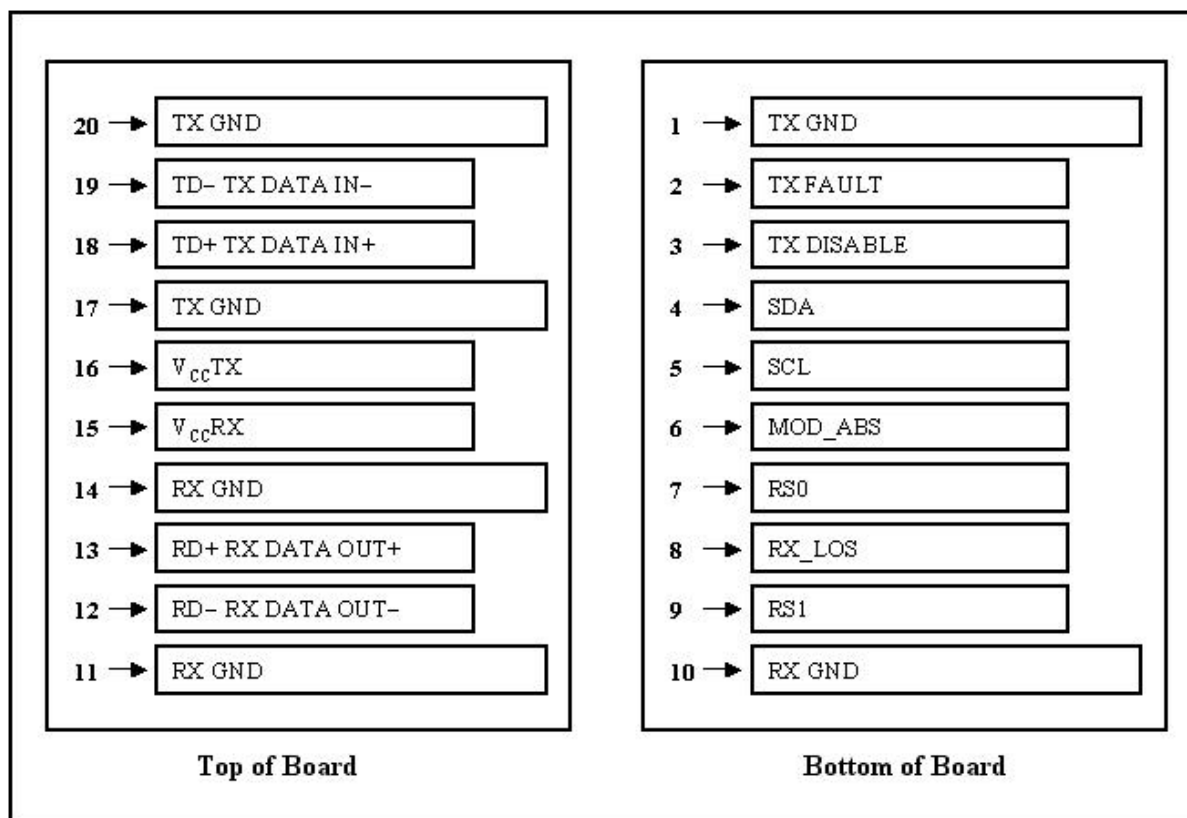
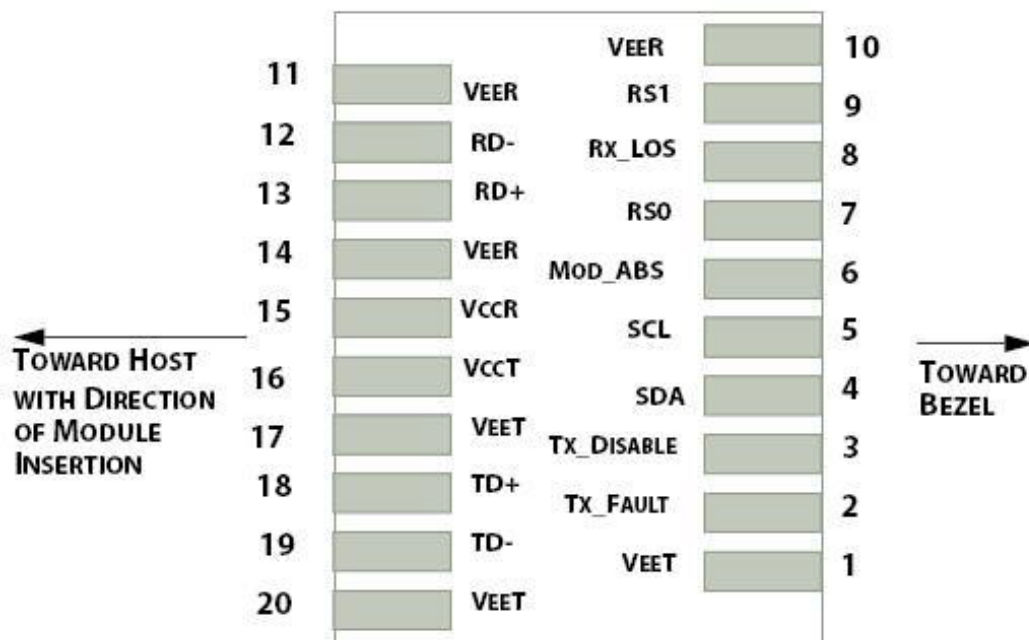
Controller Section- The micro controller unit monitors the operation information of LD driver and Limiting Amplifier and report these status to the customer.



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Electrical Pad Layout





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Pin Assignment - Pin 1 to Pin 35:

PIN #	Symbol	Description	Remarks
1	VEET	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
2	TFAULT	Transmitter Fault	
3	TDIS	Transmitter Disable. Laser output disable on high or open	Disabled: TDIS>2V or open Enabled: TDIS<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. Ground 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	+3.3V Power Supply	
10	VEER	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground
11	VEER	Receiver ground (common with transmitter ground)	
12	RD-	Receiver Inverted DATA out. AC coupled	
13	RD+	Receiver Non-inverted DATA out. AC coupled	
14	VEER	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground
15	VCCR	Receiver power supply	
16	VCCT	Transmitter power supply	Same as Pin# 1
17	VEET	Transmitter ground (common with receiver ground)	Circuit ground is connected to chassis ground
18	TD+	Transmitter Non-inverted DATA out. AC coupled	
19	TD-	Transmitter Inverted DATA out. AC coupled	
20	VEET	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.