MDX-19-4-1-X-X Optical Gigabit Ethernet Transceiver

850 nm VCSEL for Multimode Fiber at 1.25 GBaud

ORDERING INFORMATION

MDX- 19 - 4 - 1 - X - X

GROUND CLIP
Blank - Clip Back
F - Clip Forward

SIGNAL DETECT
S – PECL Output
T - TTL Output

WAVELENGTH
1 - 850 nm (multimode)
2 - 1300 nm (single mode) 5 km
2M - 1300 nm (single mode) 10 km
2L - 1300 nm (single mode) 20 km

COMMUNICATIONS PROTOCOL
4 – Gigabit Ethernet, 1.25 GBaud

Features

- Industry Standard 1x9 Footprint
- TTL and PECL Signal Detect Output Options
- Low Profile Fits Mezzanine Card Applications
- Single +5V Power Supply
- Wave Solderable / Aqueous Washable
- Class 1 Laser Safety Compliant
- UL 1950 Approved

PRODUCT OVERVIEW

The MDX-19-4-1 optical transceivers are high performance integrated duplex data links for bi-directional communication over multimode optical fiber. The MDX-19-4-1 module is specifically designed to be used in multimode Gigabit Ethernet applications. At a height of 9.8 mm the MDX-19-4 fits mezzanine card applications. This industry standard 1x9 package with SC duplex fiber optic connector and wave-solderable attaching posts is available in several wavelengths and data rates. The MDX-19-4-1-T optical transceiver with TTL Signal Detect output eliminates the need for a PECL to TTL level shifter in many applications. This results in reduced supply current, component count, and board space.

This optoelectronic transceiver module is a class 1 laser product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J. This component is also class 1 laser compliant according to International Safety Standard IEC-825-1.

SHORT WAVELENGTH LASER

The use of short wavelength VCSELs (Vertical Cavity Surface-Emitting Laser) and high volume production processes has resulted in a low cost, high performance product available in various data transfer rates up to 1.25 GBaud.

LONG WAVELENGTH LASER

The MDX-19-4-2 is provided with single mode optics. The 1300 nm laser provides highly reliable single mode communications which meets or exceeds the Gigabit Ethernet distance requirements.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTES
Storage Temperature	Tstg	-40	85	°C	
Soldering Temperature			260	°C	10 seconds on leads only
Supply Voltage	Vcc		6.0	V	Vcc - ground
Data AC Voltage	Tx+, Tx-		2.6	Vpp	Differential
Data DC Voltage	Tx+, Tx-	-10	10	Vpk	V (Tx+ or Tx-) - ground

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Ambient Operating Temperature	Ta	0		70	°C	
Supply Voltage	Vcc	4.5	5.00	5.5	VDC	
Baud Rate	BRate		1250		MBaud	

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MODULE SPECIFICATIONS - ELECTRICAL — **Ta = 25° C, Vcc = 5.0 V**

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Supply Current	Icc		180	185	mA	Ta = 25°C, Vcc = 5.0 V
	Icc			200	mA	0° C <Ta< 70°C, 4.5 V< Vcc <5.5 V
TRANSMITTER						
ECL Input (Single Ended)		350	720	1250	mVpp	AC coupled inputs
ECL Input (Differential)		700	1440	2500	mVpp	AC coupled inputs
Input Impedance	Zin		50		ohms	Rin > 100 kohms @ DC
RECEIVER						
ECL Output (Single Ended)		300	750	930	mVpp	AC coupled outputs
ECL Output (Differential)		600	1500	1860	mVpp	AC coupled outputs
Total Jitter	TJ			266	psec	
Deterministic Jitter	DJ			170	psec	
PECL Signal Detect Output - Low		3.0		3.4	V	
PECL Signal Detect Output - High		3.8		4.2	V	
PECL Signal Detect Output Load		150	510	10K	ohms	See Pin Description
TTL Signal Detect Output - Low				0.5	V	I_{OL} = -1.6 mA, 1 TTL Unit Load
TTL Signal Detect Output - High		2.4	3.0		V	I_{OH} = 40µA, 1 TTL Unit Load

PERFORMANCE SPECIFICATIONS - OPTICAL 850 nm Laser Multimode — **Ta = 25° C, Vcc = 5.0 V**

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
FIBER LENGTH						
50 µm Core Diameter MMF		500	750		m	BER < 1.0E-12 @ 1.25 GBaud
62.5 µm Core Diameter MMF		275[1]	400		m	BER < 1.0E-12 @ 1.25 GBaud
TRANSMITTER						
Optical Transmit Power	Popt	-9.5		-4	dBm	average @ 850 nm
Optical Center	λ	840	850	860	nm	
Spectral Width	$\Delta\lambda$			.85	nm	RMS
Extinction Ratio	ER	9	10		dB	P1/P0
Relative Intensity Noise	RIN			-117	dB/Hz	
Total Jitter	TJ		150	227	psec	
Deterministic Jitter	DJ			80	psec	
Output Rise, Fall Time	t_R, t_F			0.26	nsec	20 - 80% values, measured unfiltered
Coupled Power Ratio	CPR	9			dB	
RECEIVER						
Optical Input	λ	770		860	nm	
Optical Input Power	Pr	-17	-20	0	dBm	BER < 1.0E-12
Optical Return Loss	ORL	12	30		dB	
Signal Detect - Asserted	Pa			-17	dBm	measured on transition - low to high
Signal Detect - Deasserted	Pd	-29			dBm	measured on transition - high to low
Signal Detect - Hysteresis	Pa - Pd		1.5	5.0	dB	

Note[1] - This is the link length for at least 95% of the installed fiber base.

TERMINATION CIRCUITS

Inputs to the MDX-19 transmitter are AC coupled and internally terminated through 50 ohms to AC ground. These transceivers can operate with PECL or ECL logic levels. The input signal must have at least a 0.4 V peak-to-peak (single ended) signal swing. Output from the receiver section of the module is also AC coupled and is expected to drive into a 50 ohm load. Different termination strategies may be required depending on the particular Serializer/ Deserializer chip set used.

The MDX-19 product family is designed with AC coupled data inputs and outputs to provide the following advantages:

- Close positioning of SERDES with respect to transceiver; allows for shorter line lengths and at gigabit speeds reduces EMI.
- Minimum number of external components.
- Internal termination reduces the potential for unterminated stubs which would otherwise increase jitter and reduce transmission margin.

Subsequently, this affords the customer the ability to optimally locate the SERDES as close to the MDX-19 as possible and save valuable real estate on PCI cards and other small circuit assemblies. At gigabit rates this can provide a significant advantage resulting in better transmission performance and accordingly better signal integrity.

AC coupling allows the Methode MDX-19 to be applied across a wider range of applications without modification. This benefits users in terms of enhanced RF performance, reduced component count, tighter layout and fewer design problems.

Figure 1 illustrates the recommended transmit and receive data line terminations and Figure 2 describes an alternative termination approach. Figure 3 illustrates a Thevenin equivalent 50-ohm termination circuit for the SERDES receiver input data lines, which require a +3 volt PECL termination. Other equivalent circuits can be readily calculated for other bias voltages.

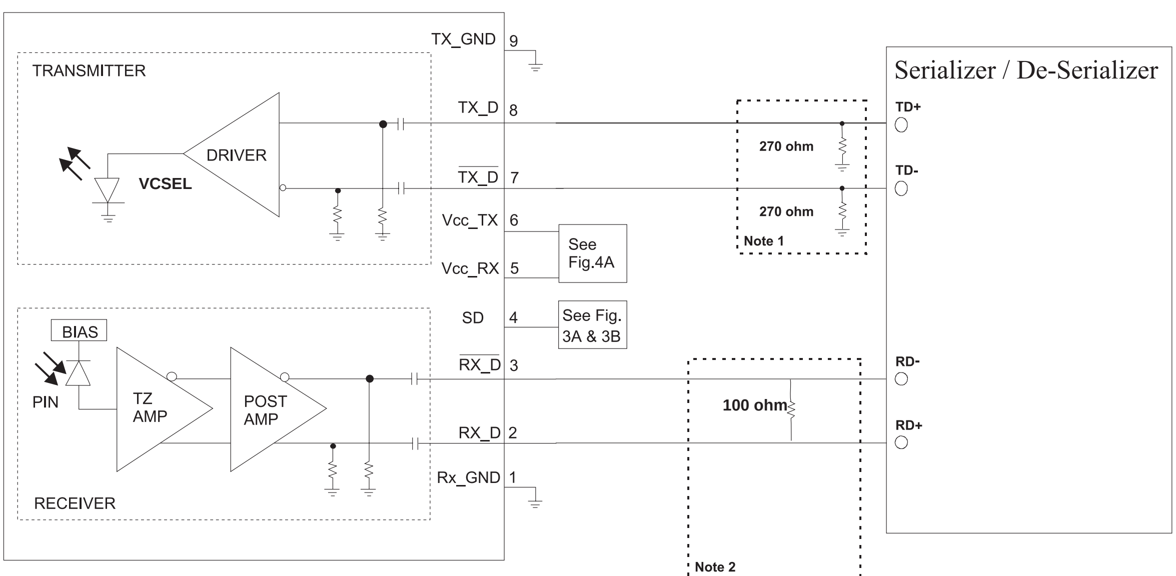

Figure 1. Recommended TRANSMIT and RECEIVE Data Terminations

Notes:

1. Consult the SERDES manufacturer’s applications information for biasing required for Tx outputs. Some serializer outputs are internally biased and may not need external bias resistors.
2. Consult SERDES manufacturer’s data sheet and application data for appropriate receiver input biasing network.

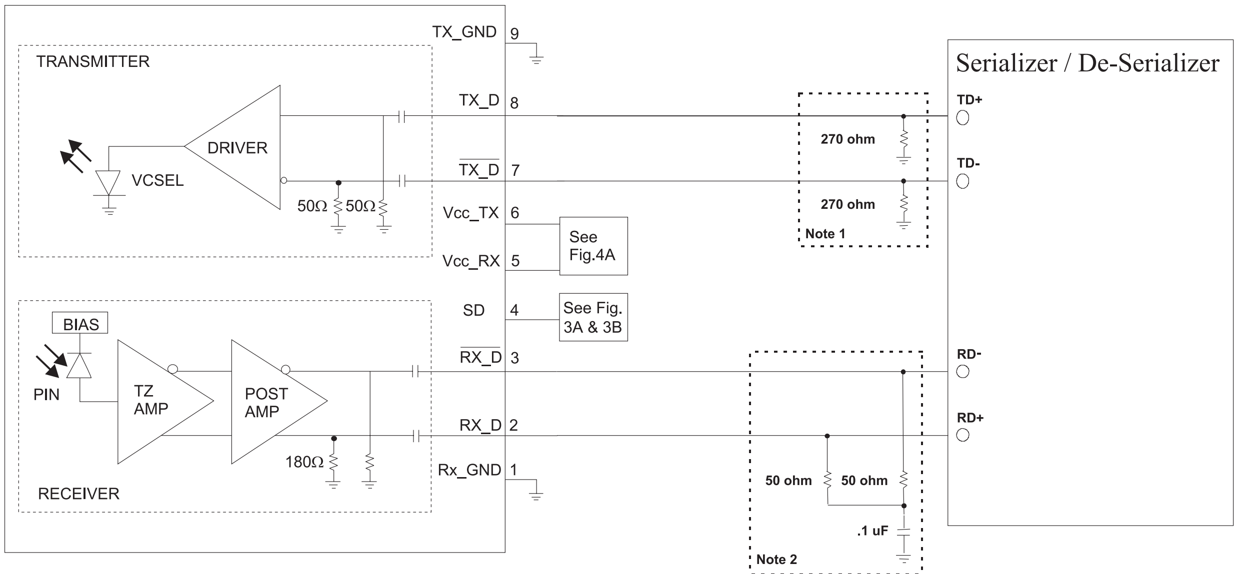

Figure 2. Alternative TRANSMIT and RECEIVE Data Terminations

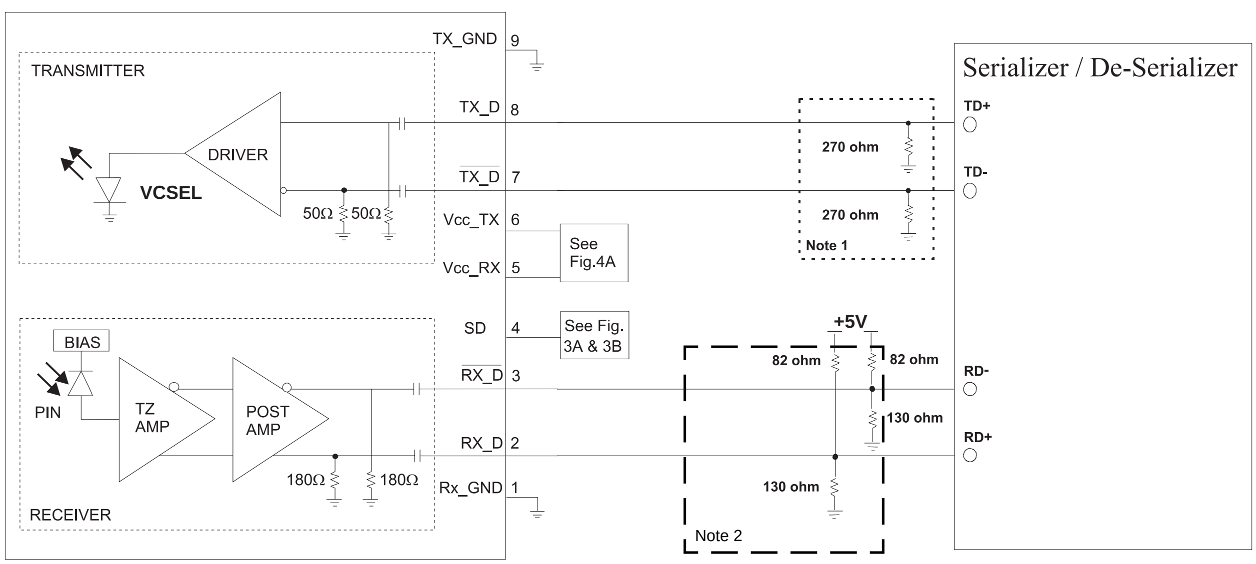

Figure 3. Thevenin Equivalent RECEIVE Data Terminations

Notes:

1. Consult the SERDES manufacturer’s applications information for biasing required for Tx outputs. Some serializer outputs are internally biased and may not need external bias resistors.
2. Consult SERDES manufacturer’s data sheet and application data for appropriate receiver input biasing network.

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SIGNAL DETECT

The SIGNAL DETECT line has two options being a standard TTL output or a PECL output. The TTL option eliminates the need for a PECL to TTL level shifter in most applications. For multi-sourcing, it is recommended to provide a signal trace on the circuit board to bypass the level shifter from input to output. The bypass trace can be routed to a zero ohm resistor to connect the input to the output. The level shifter can be used as an alternate stuffing option to the zero ohm resistor (see Figure 3A) when a TTL Signal Detect output is not offered by the second source.

The PECL output option of the SIGNAL DETECT line may be terminated through a 510 ohm pull down resistor to ground. An alternative termination scheme is to use a 50 ohm resistor to a Vcc-2 volt source or the Thevenin equivalent in order to generate the correct voltage outputs. (See Figure 3B)

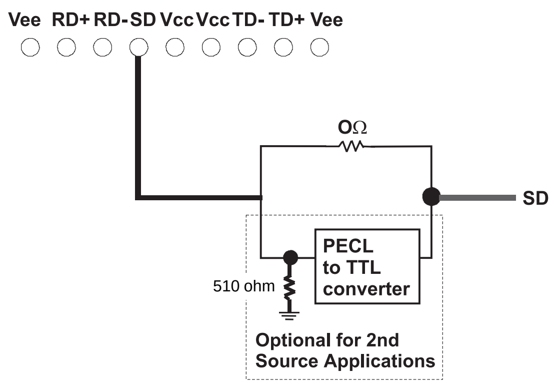

Figure 3A. TTL Signal Detect Option

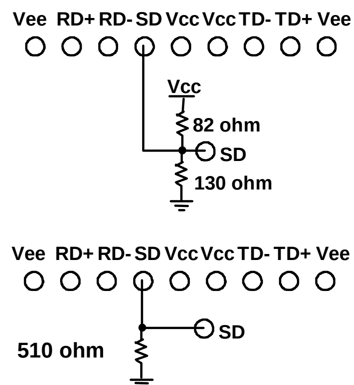

Figure 3B. PECL Signal Detect Option

POWER COUPLING

A suggested layout for power and ground connections is given in figure 4B below. Connections are made via separate voltage and ground planes. The mounting posts are at case ground and should not be connected to circuit ground. The ferrite bead should provide a real impedance of 50 to 100 ohms at 100 to 1000 MHz. Bypass capacitors should be placed as close to the 9-pin connector as possible.

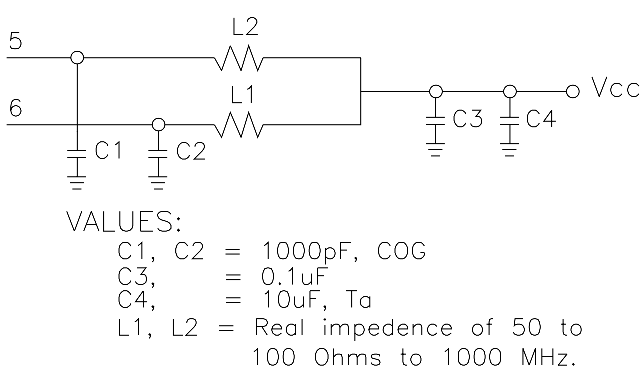

Figure 4A. Suggested Power Coupling

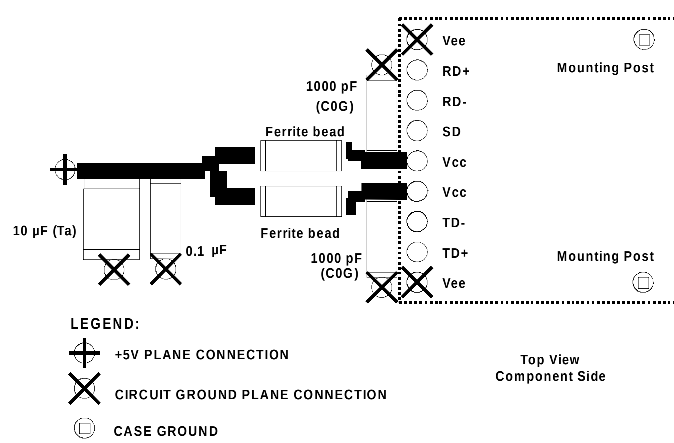

Figure 4B. Suggested Power Coupling

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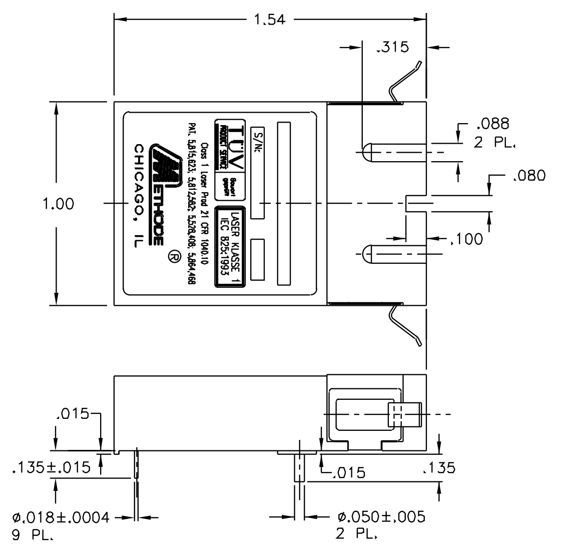
EMI and ESD CONSIDERATIONS

Methode optoelectronic transceivers offer a metalized case and a special chassis grounding clip. As shown in the drawing, this clip connects the module case to chassis ground when installed flush with the panel cutout. The use of a grounding clip provides increased electrostatic protection and helps reduce radiated emissions from the module or the host circuit board through the chassis faceplate. The attaching posts are at case potential and may be connected to chassis ground. They should not be connected to circuit ground.

Methode transceivers employ a .100 inch deep notch in the front of the SC connector latch housing. This makes it possible to use two smaller panel openings instead of a single large cutout for the duplex optical connector. In most applications, the two smaller apertures increase the effectiveness of the panel in containing radiated emissions.

Plastic optical subassemblies are used to further reduce the possibility of radiated emissions by eliminating the metal from the transmitter and receiver diode housings which extend into the connector space. By providing a non-metal receptacle for the optical cable ferrule, the gigabit speed RF electrical signal is now isolated from the connector area thus preventing radiated energy leakage from these surfaces to the outside of the panel.

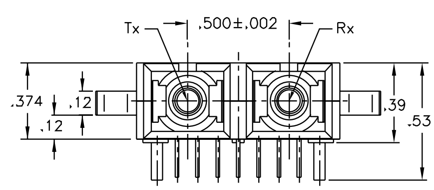
MECHANICAL DIMENSIONS – CLIP FORWARD

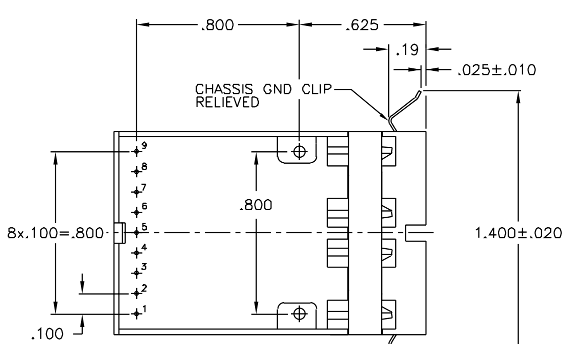


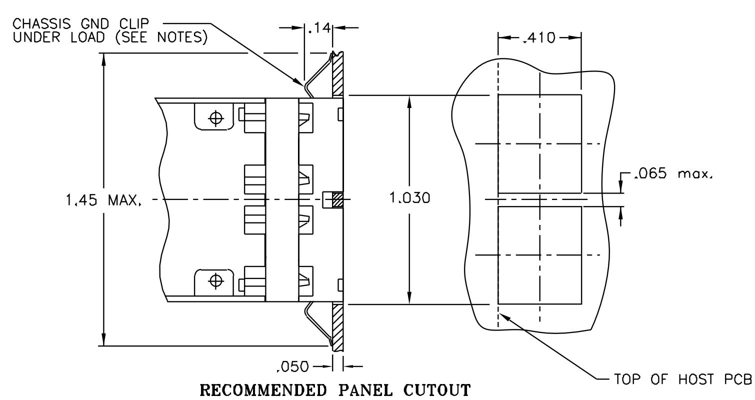
PIN No.	SIGNAL
1	Vee
2	RD+
3	RD−
4	SD
5	Vcc
6	Vcc
7	TD−
8	TD+
9	Vee

NOTES:

1. GND CLIP ENGAGEMENT WITH .050 THK PANEL WILL RESULT IN 0.50±.15 LB FORCE LOAD OF EACH "WING" ON THE PANEL.
2. DISENGAGEMENT BETWEEN GND CLIP AND PANEL LEADS TO GND CLIP "WINGS" .005 SPRINGBACK OFFSET.







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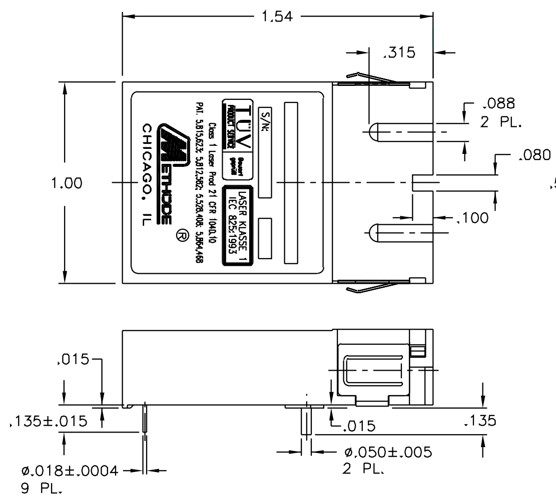
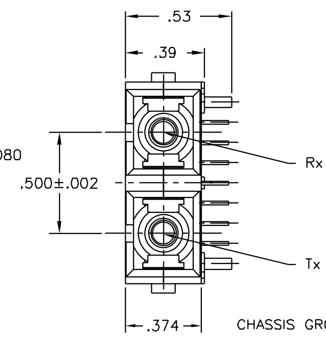
ALTERNATE PANEL CUTOUTS AND EMI

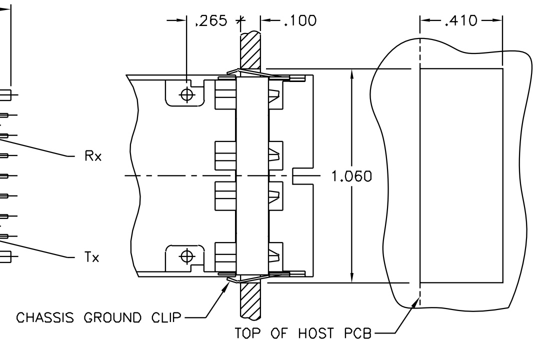
The special chassis grounding clip is available in the clip back configuration shown below. This version of the clip connects the module case to chassis ground when installed through the panel cutout. The grounding clip in this way brushes the edge of the cutout in order to make a proper contact. This method allows the transceiver module to take up less board space. See panel cutout option 1.

The metalized case connected to chassis ground provides electrostatic protection for the module and shields the panel opening from radiated emissions generated inside the system enclosure. The attaching posts are at case potential and may be connected to chassis ground. They should not be connected to circuit ground.

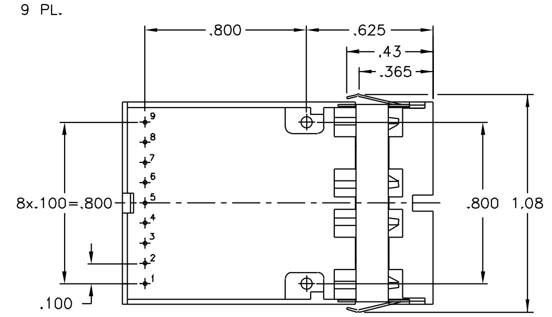
MECHANICAL DIMENSIONS - CLIP BACK



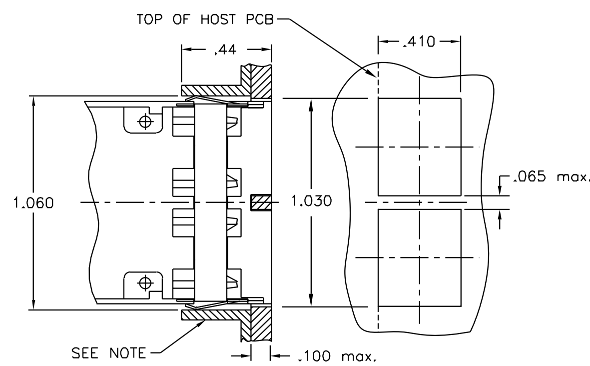




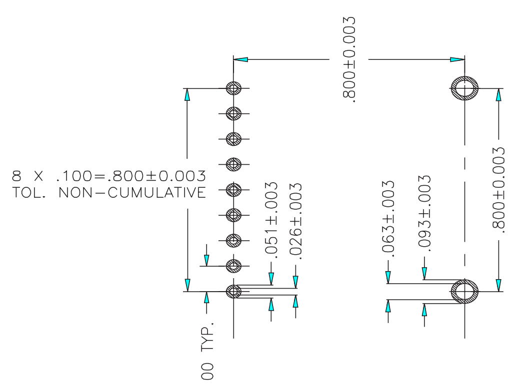
PANEL CUTOUT OPTION 1



PIN No.	SIGNAL
1	Vee
2	RD+
3	RD−
4	SD
5	Vcc
6	Vcc
7	TD−
8	TD+
9	Vee



PANEL CUTOUT OPTION 2



Suggested PCB Land Pattern

MDX-19-4-1-X-X Optical Gigabit Ethernet Transceiver
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PHYSICAL DESCRIPTION

The MDX-19 features a compact design with a standard SC duplex connector for fiber optic connections. The 9-pin inline connector (100 mil spacing) provides the electrical connection for all operation. With a height of 9.8 mm the MDX-19 fits mezzanine card applications. An epoxy encapsulation provides excellent protection from environmental hazards and assists in heat dissipation for all components. Two wave-solderable posts are provided for attaching the package to the circuit board without the need for multiple attachment operations.

ELECTRICAL INTERFACE, PIN DESCRIPTIONS

PIN 1	**RX_GND**	Ground
PIN 2	**RX_D**	Receiver Data Non-inverted Differential Output
PIN 3	**$\overline{\text{RX\_D}}$**	Receiver Data Inverted Differential Output
PIN 4	**SD**	Receiver Signal Detect output. Active high on this line indicates a received optical signal.If the PECL output option is selected then this output must be terminated in the manner described in order to generate the correct voltage outputs.
PIN 5	**Vcc_RX**	+5 volt supply for the Receiver Section
PIN 6	**Vcc_TX**	+5 volt supply for the Transmitter Section
PIN 7	**$\overline{\text{TX\_D}}$**	Transmitter Data Inverted Differential Input
PIN 8	**TX_D**	Transmitter Data Non-inverted Differential Input
PIN 9	**TX_GND**	Ground
Attaching Posts		The attaching posts are at case potential and may be connected to chassis ground. They should not be connected to circuit ground.

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