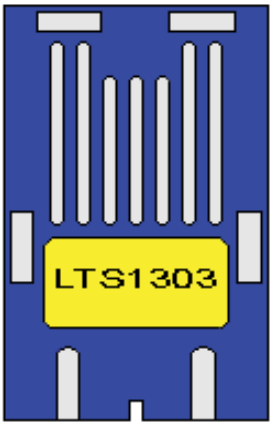
LTS1303 RoHS Compliant 1x9 Transceiver

SONET OC-3 / SDH STM-1 1310 nm 155 Mb/s 40 km



The LTS1303 series of 1x9 155 Mb/s duplex optical transceivers are designed for 40 km reach applications in high speed LAN and SAN SONET OC-3 and SDH STM-1 optical communications equipment where low-cost, low power consumption, extraordinary performance and reliability are essential. They meet the requirements of Telcordia SONET OC-3 / LR-1 and ITU-T G.957 SDH STM-1 / L1.1 and are housed in compact MSA compliant 1x9 plastic packages with integral FC, ST or SC duplex optical receptacles. The DC operating voltage options include 3.3 or 5.0 volts and the temperature options include the commercial, extended or industrial temperature ranges. The laser transmitter incorporates a high-performance 1310 nm DFB optical subassembly, which is compliant with the international safety standard IEC6082-5. The laser driver electronics includes the differential PECL or LVPECL signal interface. The optical receiver incorporates a high-performance InGaAs PIN photo detector and high sensitivity TIA. The quantizer consists of the post amplifier, signal detector and differential PECL or LVPECL signal interface. The Rx_SD receiver monitor function is available with either the TTL / LVTTL or PECL / LVPECL interface. Theses devices may be connected for either AC or DC-coupling. They are Class I laser safety compliant and meet the EEC Directive 2002/95/EC for RoHS compliance.

Applications

- 155 Mb/s SONET/SDH telecom equipment
- Back to Back system interconnects
- Metro / Access Networks
- Switch to switch interfaces
- Hub interconnects
- Bus extenders
- Channel extenders
- Host adapter interconnects
- Mass storage system interconnects
- Telecom switches
- Router interconnects

Features

- SC / FC / ST Duplex optical interface
- 40 km reach
- 155 Mb/s data rate
- +3.3 V or +5 V power supply
- Low DC power consumption
- 1x9 MSA compliant package
- High performance 1310 nm DFB laser
- High sensitivity PIN/TIA optical receiver:
- Single Mode operation
- BER < $1X10^{-10}$ (2^{23} - 1 NRZ PRBS test pattern)
- Telcordia SONET OC-3/ IR-1 compliant
- ITU-T G.957 SDH STM-1/ L-1.1 compliant
- Operating temperature range:
  - Commercial: 0 to 70ºC
  - Extended: -10 to 80ºC
  - Industrial: -40 to 85ºC

HOW TO ORDER

Part Number	PackageT ype (W)		Operating Voltage (X)		Rx_SD Option (Y)		Temperature Option (Z)	
LTS1303 WXYZ	**S**	SC Receptacle	**3**	3.3 V	**T**	TTL/LVTTL	**C**	0 to 70 °C
	F	FC Receptacle	**5**	5.0 V	**P**	PECL/LVPECL	**E**	-10 to 80 °C
	T	ST Receptacle					**H**	-40 to 85 °C

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	T_{stg}	-40	100	ºC	
Operating Temperature	T_{amb}	0	70	ºC	Temp Option “C”
Operating Temperature	T_{amb}	-10	80	ºC	Temp Option “E”
Operating Temperature	T_{amb}	-40	85	ºC	Temp Option “H”
Relative Humidity - Storage	RH_S	0	95	%	
Relative Humidity - Operating	RH_O	0	95	%	
Soldering Temperature	T_{sld}	0	260	ºC	
Soldering Time Duration	t_{sld}	0	10	seconds	
DC Supply Voltage (3.3 Volt Models)	V_{CC}	0	3.6	VDC	
DC Supply Voltage (5.0 Volt Models)	V_{CC}	0	5.45	VDC	

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units	Notes
DC Supply Voltage	V_{CC}	3.14	3.30	3.46	Volts	3.3 Volt Models
		4.75	5.0	5.25	Volts	5.0 Volt Models
Data Input High	V_{IH}-V_{CC}	-1.17		-0.88	V	
Data Input Low	V_{IL}-V_{CC}	-1.81		-1.48	V	

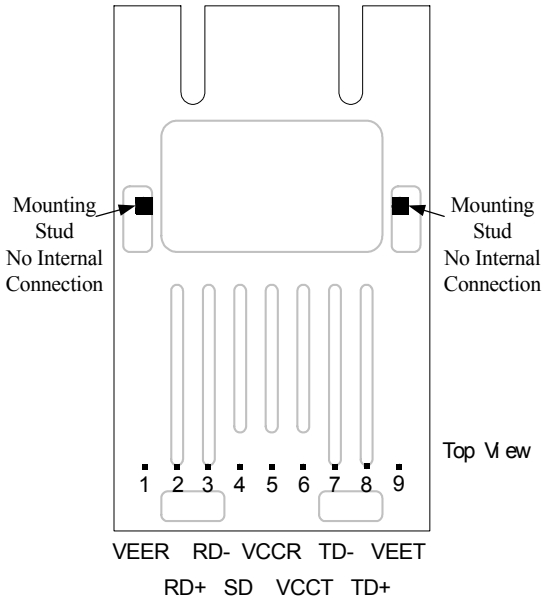
Transmitter Optical and Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Notes
Power Supply Current	Icct	-	55	-	mA	+5 Volt Transceivers
		-	50	-		+3.3 V Transceivers
Differential Input Voltage	Vid	550	-	1750	mV	+5 Volt Transceivers
		350	-	1750		+3.3 Volt Transceivers
Data Input Impedance (Single Ended)	Ri	4.5	-	100	K Ohm	+5 Volt Transceivers
		2.5	-	100		+3.3 Volt Transceivers
Center Wavelength	λ	1270	1310	1350	nm	DFB Laser
Spectral Width (RMS)	Δλ	-	1.5	4	nm	-
Optical Rise Time	t_r	200	-	1100	ps	20% ~ 80%
Optical Fall Time	t_f	250	-	1000	ps	20% ~ 80%
Extinction Ratio	ER	10	-	-	dB	-
Average Optical Output	P_{out}	-3	-	0	dBm	-
Output Optical Eye	ITU-T G.957 compliant (PRBS 2^{23}-1 test pattern @155Mbps)					

Receiver Electro-Optical Characteristics						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Notes**
Receiver Type	PIN / TIA					
Receiver DC Operating Current (Not Including Output Load Current)	I_{CCR}	-	85	-	mA DC	5.0 Volt Models
		-	80	-		3.3 Volt Models
Receiver Optical Sensitivity	Pin	-	-38	-37	dBm	-
Receiver Optical Overload	Pin max	-3	-	-	dBm	-
Center Wavelength	λ	1100	1310	1670	nm	-
Data Output Voltage Swing (Single Ended)	V_{out}	-	800	-	mV pk-pk	-
Rx_DATA+/- Output Load Impedance	R_{OL}	-	50	-	Ohms	To (Vcc-2V)
SD (PECL / LVPECL) Output Load Impedance	R_{SDL}	-	50	-	Ohms	To (Vcc-2V)
Rx_DATA Output Rise Time	t_r	-	1,000	-	ps	20%~80%
Rx_DATA Output Fall Time	t_f	-	1,000	-	ps	20%~80%
Rx_DATA Output Voltage (LOW)	VOH - VCC	-1.84	-	-1.62	V	50 Ohms to (Vcc-2V)
Rx_DATA Output Voltage (HIGH)	VOL - VCC	-1.05	-	-0.88	V	50 Ohms to (Vcc-2V)
Rx_SD Output (LOW)	V_{OL}	-	-	0.8	V	10 k Ohm Pull Up
Rx_SD Output (HIGH)	V_{OL}	2.0	-	-	V	10 k Ohm Pull Up
Signal Detection Range	PSD	-50	-	S-0.5	dBm	AC Optical Signal
Signal Detection Hysteresis	PA-PD	-	3	-	dB	-

APPLICATIONS INFORMATION

1x9 Pin Assignment



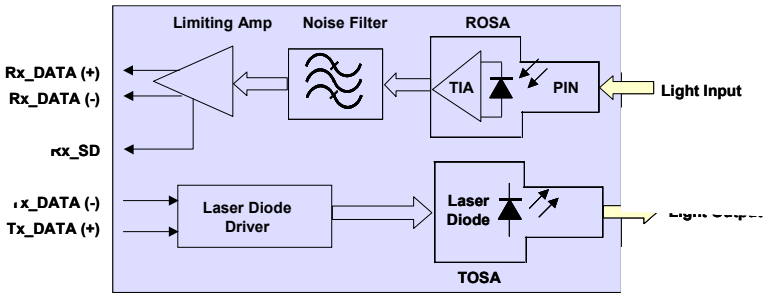
Pin	Symbol	Function
1	VEER	Receiver DC and Signal Ground
2	RD+	Rx_DATA Non-Inverted Differential Signal Output
3	RD-	Rx_DATA Inverted Differential Signal Output
4	SD	Rx_SD, LOW = No Signal, HIGH = Normal Operation
5	VCCR	Rx Positive Supply - Connected to +5.0 or 3.3 VDC
6	VCCT	Tx Positive Supply - Connected to +5.0 or 3.3 VDC
7	TD-	Tx_DATA Inverted Differential Signal Input
8	TD+	Tx_DATA Non-Inverted Differential Signal Input
9	VEET	Transmitter DC and Signal Ground

Operating Notes

- When Rx_SD is LOW, the Rx_DATA Non Inverted output goes LOW
- When Rx_SD is LOW, the Rx_DATA Inverted output goes HIGH
- When the optical input signal is above the receiver detection threshold, the Rx_SD monitor goes HIGH
- When the optical input signal is below the receiver detection threshold, the Rx_SD monitor goes LOW
- The Rx_DATA output and the Tx_DATA input differential I/O ports are either PECL or LVPECL depending upon the part number
- The Rx_SD monitor port interface can be PECL, LVPECL, TTL or LVTTL depending upon the part number.

APPLICATIONS INFORMATION

Transceiver Block Diagram



Transmitter Section

The transmitter incorporates optical and electrical subassemblies. The transmitting optical subassembly (TOSA) incorporates the high-speed laser diode and the optical output receptacle. The high performance MQW laser diode is characterized by its high efficiency and reliability, low threshold current and operating current and long life. The transmitter electrical subassembly incorporates the PECL or LVPECL differential interface and high performance laser driver.

Receiver Section

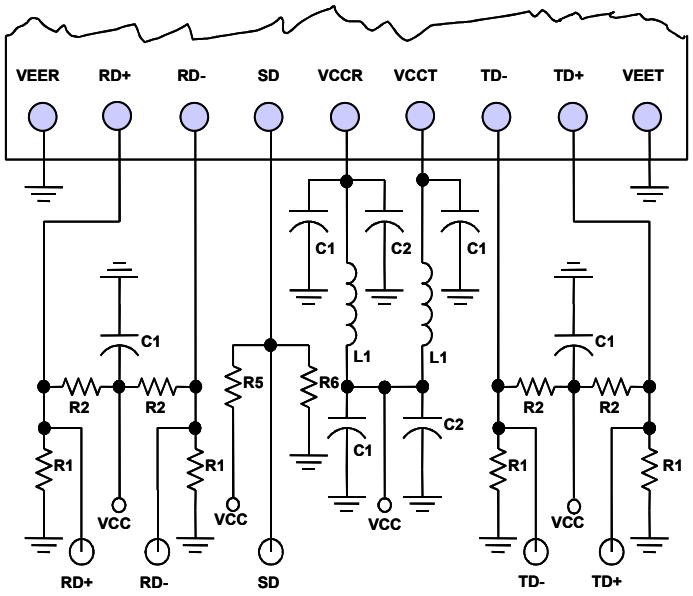
The receiver incorporates optical and electrical subassemblies. The receiver optical subassembly (ROSA) incorporates a planar InGaAs PIN photo detector and the optical input receptacle. The high-reliability photo detector is characterized by its low dark current. The receiver electronics includes an integrated low noise preamplifier and AGC amplifier (TIA), which are mounted in a TO-Metal Can assembly with the photo detector. The output of the TIA drives the band pass filter (BPF) that limits the noise contribution of the received signal and improves the overall sensitivity of the receiver. The filtered BPF signal drives the small signal limiting amplifier. The differential output of the limiting amplifier, which is part number dependent, can drive PECL or LVPECL interface circuits. The receiver monitor function, Rx_SD, can be coupled to TTL, LVTTL, PECL or LVPECL interfaces and is model dependent.

Electrical Interface Circuit Component Values

Interface	R1	R2	R5	R6	C1	C2	L1
5 V / PECL	130 Ω	82 Ω	82 Ω	130 Ω	100 nF	10 µF	1 µHy
3.3 V / LVPECL	82 Ω	130 Ω	130 Ω	82 Ω	100 nF	10 µF	1 µHy
5 V / TTL Rx_SD	130 Ω	82 Ω	10k Ω	Note	100 nF	10 µF	1 µHy
Note: R5 is the TTL pull up resistor, R6 is not used							

Notes

- High-speed circuit design rules and impedance matching are recommended for optimum performance.
- The recommended I/O termination is 50 ohms.
- Although differential signal transmission is preferred, single ended operation may be used.
- The bypass capacitors should be rated for RF service.
- The power supply de-coupling chokes should be rated for RF service and should have low series resistance.



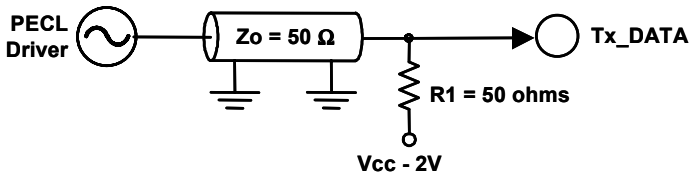
APPLICATIONS INFORMATION

Optional Transmitter Interface Circuits

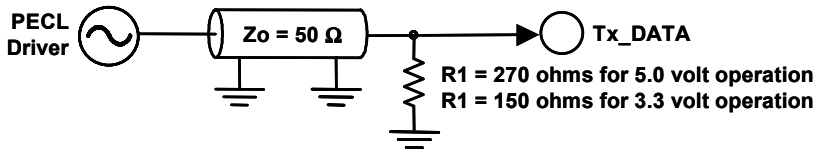
PECL DC Coupling

Two methods of DC Coupling PECL or LVPECL drivers to the Tx_DATA input are presented.

- One terminal is shown. The other terminal should be terminated in the same way. DC Coupling eliminates the DC blocking capacitor.
- Case 1 - the terminating resistor "R1" is connected to (VCC - 2.0) VDC. The value of "R" is 50 ohms.
- Case2 - the terminating resistor is connected to ground. The value of "R1" is 270 ohms for 5.0 volt operation or 150 ohms for 3.3 volt operation.



Case 1 - DC Coupling



Case 2 - DC Coupling

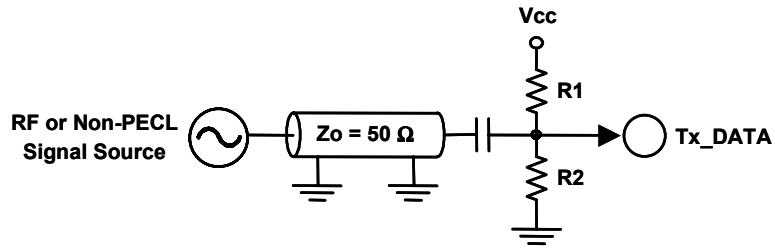
Optional Transmitter Interface Circuits

PECL and NON-PECL AC Coupling

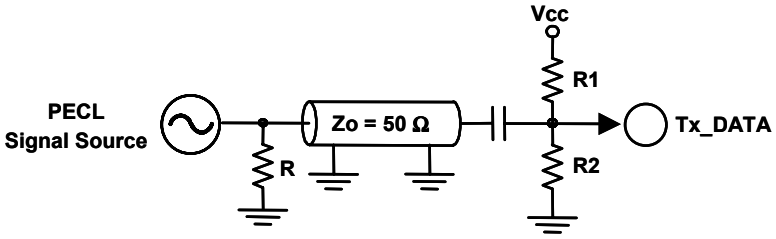
The methods of AC Coupling a PECL or Non-PECL driver source to the Tx_DATA input are presented.

One terminal is shown. The other terminal should be terminated in the same way.

- AC-Coupling a RF or Non-PECL signal source to the 50 ohm load does not require a terminating resistor.
- AC-Coupling a PECL signal source to the 50 load requires a terminating resistor as presented in the table. The value of R is determined by the operating voltage.
- The values of R1 and R2 are dependent upon the operating voltage. The values are presented in the table



AC Coupling for RF or Non-PECL Signal Source



AC Coupling for PECL Signal Source

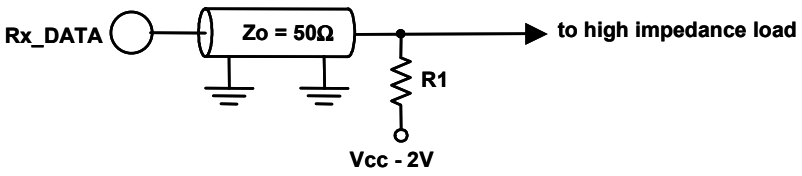
Resistor Values for Tx_DATA AC Coupling			
VCC	**R**	**R1**	**R2**
5.0 V	330 Ω	68 Ω	180 Ω
3.3 V	180 Ω	82 Ω	127 Ω

APPLICATIONS INFORMATION

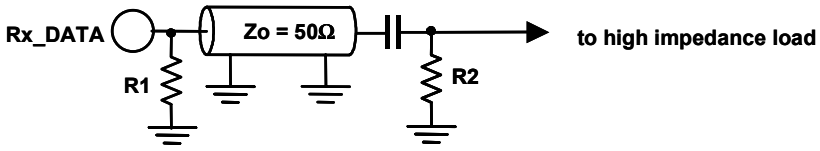
Optional Receiver Interface Circuits
DC or AC Coupling to High Z Loads

The method of DC or AC-Coupling to a high impedance load is presented.

- One terminal is shown. The other terminal should be terminated in the same way.
- DC-Coupling requires connecting R1 to (VCC - 2.0 V). A terminating resistor at the Rx_Data port is not required.
- AC-Coupling requires a terminating resistors at the Rx_DATA port according to the table.



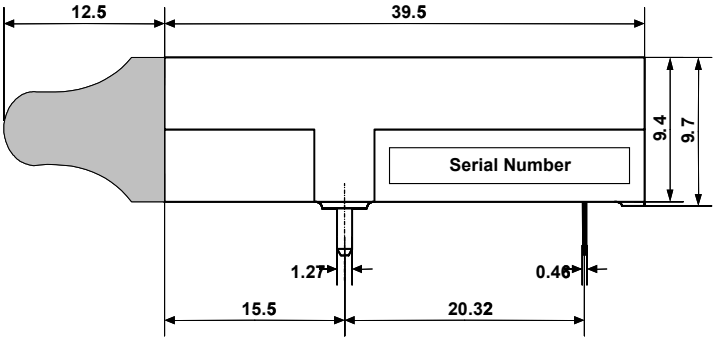
Receiver DC Coupling

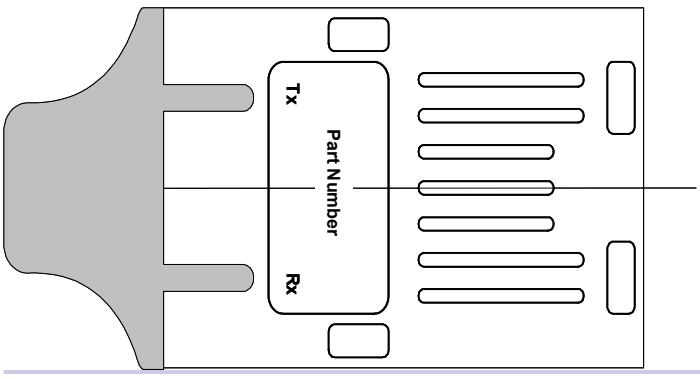


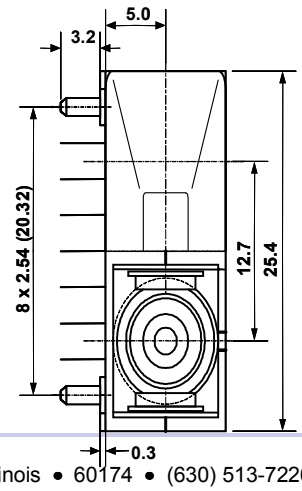
Receiver AC Coupling

Resistor Values for Rx_DATA AC and DC Coupling			
VCC	Coupling	R1	R2
5.0 V	DC	50 Ω	None
3.3 V	DC	50 Ω	None
5.0 V	AC	270 - 330 Ω	560 Ω
3.3 V	AC	150 - 180 Ω	560 Ω

1x9 Duplex Transceiver with SC Duplex Receptacle

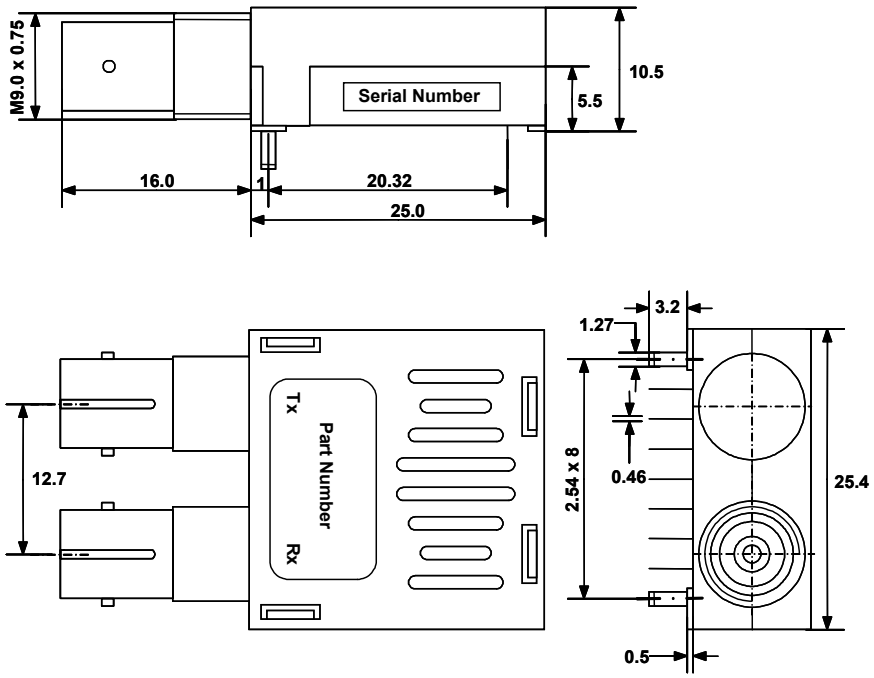






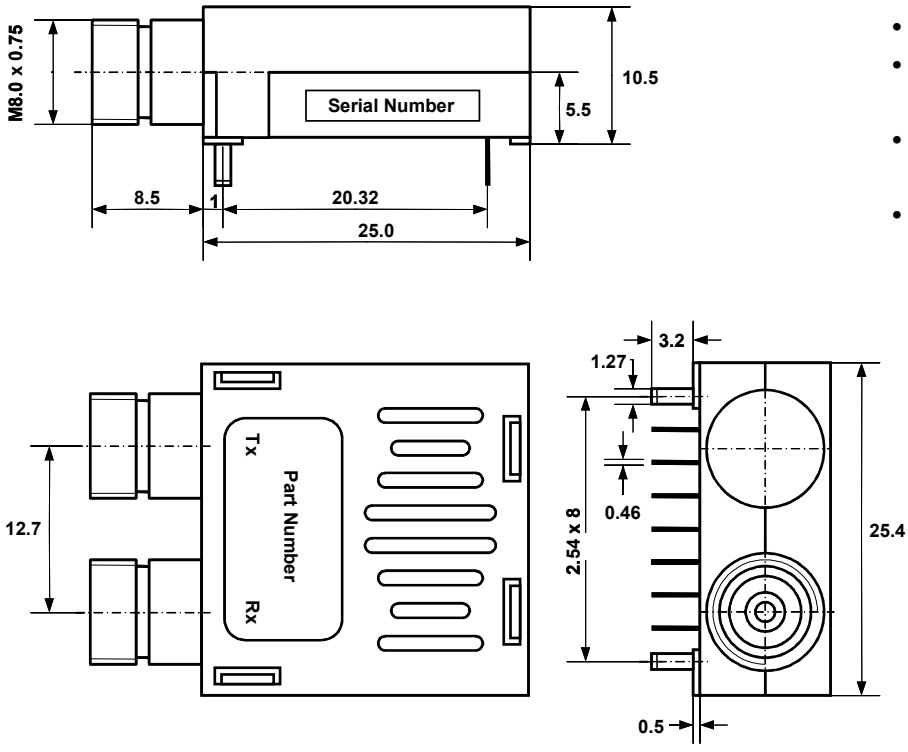
- Dimensions are in millimeters
- The holes for the mounting studs are 1.9 mm diameter
- The holes for the 9 electrical pins are 0.8 mm diameter
- Dimensional tolerances are ± 0.1mm unless otherwise specified

1x9 Duplex Transceiver with ST Duplex Receptacle



- Dimensions are in millimeters
- The holes for the mounting studs are 1.9 mm diameter
- The holes for the 9 electrical pins are 0.8 mm diameter
- Dimensional tolerances are ± 0.1mm unless otherwise specified

1x9 Duplex Transceiver with FC Duplex Receptacle



- Dimensions are in millimeters
- The holes for the mounting studs are 1.9 mm diameter
- The holes for the 9 electrical pins are 0.8 mm diameter
- Dimensional tolerances are ± 0.1mm unless otherwise specified

Regulatory Information

Eye Safety

The transceiver is a Class 1 eye-safe device according to FDA 21CFR1040.10 and IEC 60825-2.

Electromagnetic Interference (EMI), Immunity and Product Safety

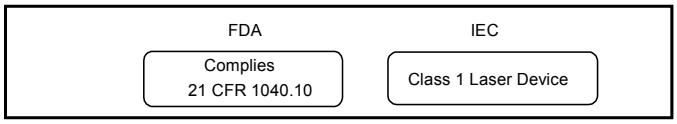
The transceiver is ESD safe (electrical pins) when tested according to MIL-STD-883, Method 3015.7 and ESD safe (optical connector) when tested according to IEC 61000-4-2. The device is immune to strong RF fields when tested in accordance with IEC 610004-3. The device complies with (US) FCC, Part 15, Subpart J; (Europe) CENELEC EN 55022; (Canada) Class B (CISPR22A); and (Japan) VCCI Class 1. The device has been designed to conform to product safety requirements including UL1950, CSA 22.2, and IEC 60950-1, and has been designed to meets the flammability requirements of UL94.

Notice

The factory has made all adjustments to this device prior to shipment. No adjustments or modifications to the device are required or permitted. Any adjustment, modification or tampering of the device voids the product warranty. The US Food and Drug Administration may consider that any adjustment or modification to this device is an act of manufacturing and therefore will require that the device be recertified in accordance with 21 CFR 1040.10 Subpart j.

Laser Radiation Information	
Wavelength	1310 nm
FDA Total Pout: 7 mm aperture at 20 cm distance	< 195 microwatts
IEC Total Pout : 7 mm aperture at 10 cm distance	< 15,600 microwatts
Beam Divergence	17.25º

Required Label



Laser Emission