



LTD1382 1310 nm SFP Optical Transceiver 1250 Mb/s Gigabit Ethernet 10 km

The LTD1382 SFP Gigabit Ethernet LC duplex transceiver is intended for 10 km reach service in 1250 Mb/s 1310 nm single mode high-speed LAN and SAN data communications equipment where low-cost, extraordinary performance and reliability are essential. It meets the requirements of IEEE802.3z 1000 BASE-LX, consumes low power, operates from a 3.3 volt DC power supply and is offered in the commercial, extended and industrial temperature ranges. The industry standard 2x10 small form pluggable (SFP) package is fabricated with a rugged die cast metal housing and cage assembly. An optional plastic housing is also offered. The low jitter and low bit error rate optical assembly features a 1310 nm F-P laser transmitter and PIN/TIA receiver. It incorporates the SFP MSA LVTTTL Loss of Signal (Rx_LOS), Tx Fault (Tx_FAULT) and Tx Disable (Tx_DIS) monitor and control functions. Internal device parameters can be accessed via the I²C 2-wire serial ID interface (MOD_DEF 0-1-2). The differential AC coupled Tx and Rx data interfaces (50 ohms to ground, 100 ohms line to line) are LVPECL compatible. The device is Class I laser safety compliant.



LTD1382 - METAL HOUSING

Applications

- | | | |
|---------------------------------------|------------------------|-----------------------------------|
| 1250 Mb/s Gigabit Ethernet Data Links | Router Interconnects | Host Adapters |
| Channel Extenders | Data Storage Networks: | Switch-to-Switch Interfaces |
| Bus Extenders | • LAN | Mass Storage System Interconnects |
| High Speed I/O File Servers | • SAN | Hub Interconnects |
| Telecom Switches | • RSAN | Distributed Multi Processing |

Features

- LC Duplex Optical Interface
- 10 km Reach
- 1250 Mb/s Data Rate
- +3.3 V Power Supply
- Low DC Power Consumption
- 2x10 SFP MSA compliant packages
 - Metal
 - Plastic
- Bail or Pull Latch Option
- Hot Swappable
- High Performance 1310 nm F-P Laser
- High Sensitivity PIN/TIA Optical Receiver:
- Single Mode Operation
- BER < 1X10⁻¹² (2⁷ - 1 NRZ PRBS)
- IEEE 802.3z 1000 BASE-LX Compliant
- Operating Temperature Range Options:
 - Commercial: 0 to +70°C
 - Extended: -10 to +85°C
 - Industrial: -40 to +85°C
- Monitor and Control Functions
 - Loss of Signal (Rx_LOS), LVTTTL
 - Tx Disable (Tx_DIS), LVTTTL
 - Tx Fault (Tx_FAULT), LVTTTL
 - 2-Wire I²C Data Bus, LVTTTL
- RX_DATA
 - LVPECL differential data interface
 - Internally AC-coupled
- Tx_DATA
 - LVPECL differential data interface
 - Internally AC-coupled and terminated
- 100 Ohms Differential (Line to Line)
- 50 Ohms Single Ended (Line to Ground)

HOW TO ORDER - METAL HOUSING

Ligent Part Number	Lambda	Reach	Mode	Laser	Optical Output	Latch	Case Operating Temperature Range
LTD1382 BC	1310 nm	10 km	Single Mode	F-P	-9.5 to -3 dBm	Bail = B	C = 0°C to 70°C
LTD1382 BH	1310 nm	10 km	Single Mode	F-P	-9.5 to -3 dBm	Bail = B	H = -40°C to +85°C
LTD1382 PC	1310 nm	10 km	Single Mode	F-P	-9.5 to -3 dBm	Pull = P	C = 0°C to 70°C
LTD1382 PH	1310 nm	10 km	Single Mode	F-P	-9.5 to -3 dBm	Pull = P	H = -40°C to +85°C

HOW TO ORDER - PLASTIC HOUSING

LTD1382 NE	1310 nm	10 km	Single Mode	F-P	-12 to -5 dBm	Button = N	E = -10°C to +85°C
LTD1382 NC	1310 nm	10 km	Single Mode	F-P	-12 to -3 dBm	Button = N	C = 0°C to 70°C



Absolute Maximum Ratings (EXCEEDING THESE RATINGS MAY CAUSE IRREVERSIBLE DAMAGE TO THE DEVICE)

Parameter	Symbol	Min	Max	Units
Storage Temperature	T _{stg}	-40	+85	°C
Relative Humidity - Storage	RH _S	0	95	%
Relative Humidity - Operating	RH _O	0	85	%
DC Supply Voltage	V _{CC}	0	3.6	V
Soldering Temperature	T _{slid}	0	260	°C
Soldering Time Duration	t _{slid}	0	10	seconds
Tx DATA	V _{in}	0	V _{CC} + 0.5	V

Optical and Electrical Signal Absolute Maximum Ratings

Signal / Data Input Voltage (Tx_DATA)	V _{IN PK-PK}	-	2.4	V
8472 Clock Signal (Standard Mode)	I _{CLOCK}	100	-	kHz
8472 Clock Signal (Fast Mode)	I _{CLOCK}	-	400	kHz
Rx Optical Input Power	P _{IN-MAX}	-	3	dBm

Logic State Absolute Maximum Ratings

Tx_DISABLE Logic HIGH State	Tx_DIS	-	V _{CC} +0.5	V
Tx_FAULT Logic HIGH State	Tx_FAULT	-	V _{CC} +0.5	V
Rx_LOS Logic HIGH State	Rx_LOS	-	V _{CC} +0.5	V
8472 MOD-DEF2	MOD_DEF2	-	V _{CC} +0.5	V

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units	Notes
Ambient Operating Temperature	T _{amb}	0	25	+70	°C	Temperature Range = C
		-10	25	+85	°C	Temperature Range = E
		-40	25	+85	°C	Temperature Range = H
DC Supply Voltage	V _{CC}	3.14	3.30	3.46	Volts	
Module Supply Current	I _{IN}	-	150	200	mA	
Power Dissipation	P _D	-	500	700	mW	



LTD1382 1310 nm SFP Optical Transceiver

1250 Mb/s Gigabit Ethernet 10 km

Transmitter Logic						
Parameter	Function	Logic State	Logic Type	Min	Max	Units
Tx_DIS and Tx_FAULT	DISABLE	HIGH	LVTTL	2.4	V _{CC} +0.3	V
Tx_DIS and Tx_FAULT	ENABLE	LOW	LVTTL	0	0.8	V
Tx_DIS	Assert Time	-	LVTTL	-	10	μs
Receiver Logic						
Parameter	Function	Logic State	Logic Type	Min	Max	Units
Rx_LOS	LOSS OF SIGNAL	HIGH	LVTTL	2.4	V _{CC} +0.3	V
Rx_LOS	NORMAL	LOW	LVTTL	0	0.8	V
I ² C Serial ID Logic						
Parameter	Function	Logic State	Logic Type	Min	Max	Units
MOD_DEF 0	Digital Ground	Ground	N/A	0	0	V
MOD_DEF 1	Clock Signal	HIGH	LVTTL	2.4	V _{CC} +0.3	V
		LOW	LVTTL	0	0.8	V
MOD_DEF 2	Serial Data	HIGH	LVTTL	2.4	V _{CC} +0.3	V
		LOW	LVTTL	0	0.8	V

Transmitter Electro-Optical Characteristics						
Parameter	Symbol	LTD1382			Units	Notes
		Min	Typ	Max		
Laser Type		1310 nm F-P				
Optical Output Power (Metal Housing)	P _o	-9.5	0	-3	dBm	Average Optical Output
Optical Output Power (Plastic Housing)	P _o	-12	0	-5	dBm	Average Optical Output
Center Wavelength	λ	1270	1310	1355	nm	
RMS Spectral Line Width	Δλ	-	-	4	nm	
Extinction Ratio	ER	9	-	-	dB	
Optical Rise and Fall Time	t _r , t _f	-	150	260	ps	20% - 80%
Relative Intensity Noise	RIN	-	-	-120	dB/Hz	
Deterministic Jitter	DJ	-	-	0.2	UI	
RMS Jitter	J _{RMS}	-	0.03	-	UI	
Output Eye		IEEE 802.3z 1000 BASE-LX Compliant				
Tx Differential Input Impedance	Z _{in}	-	100	-	Ohms	
Tx Differential Input Voltage	V _{IN}	300	-	2400	mV p-p	LVPECL Tx DATA (Note 1)

Note 1: Internally AC coupled and terminated

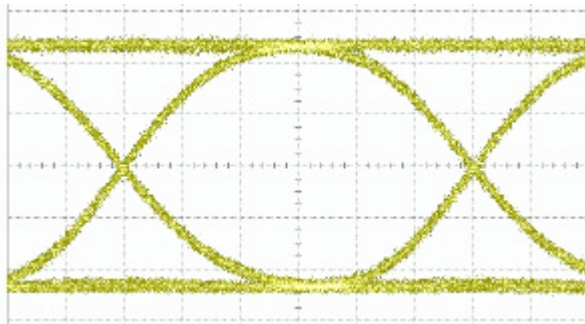


Receiver Electro-Optical Characteristics						
Parameter	Symbol	LTD1382			Units	Notes
		Min	Typ	Max		
Receiver Type		PIN / TIA				
Receiver Optical Sensitivity (Metal Housing)	P_{IN}	-	-	-19	dBm	Average Received Power (Note 1)
Receiver Optical Sensitivity (Plastic Housing)	P_{IN}	-	-23	-22	dBm	Average Received Power (Note 1)
Receiver Optical Overload	$P_{IN MAX}$	-	-	-3	dBm	
Center Wavelength	λ	1270	1310	1355	nm	
Optical Return Loss	RL	12	-	-	dB	
Rx Upper 3 dB Cutoff Frequency	f_c	-	-	1500	MHz	
Signal Loss - Assert	P_{SLA}	-29	-	-21.5	dBm	
Signal Loss - Deassert	P_{SLD}	-28.5	-	-21	dBm	
Signal Loss - Hysteresis	P_H	0.5	2	5	dB	
Data Output Rise / Fall Time	t_r / t_f		150	-	ps	20 - 80 %
Rx Differential Load Impedance	Z_{LOAD}	-	100	-	Ohms	
Rx Differential Output Voltage	V_{OUT}	400	-	1200	mV p-p	LVPECL Rx DATA (Note 2)

Note 1: Average received power where the BER = 10^{-12} , measured with a 2^7-1 NRZ test pattern

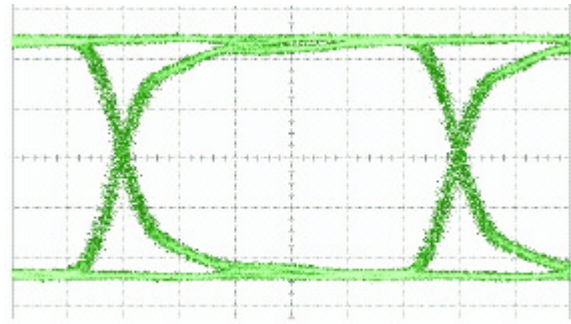
Note 2: Internally AC coupled and terminated

EYE DIAGRAM



Transmitter Test Conditions

- Optical Output Power = **-5 dBm**
- Test Pattern = 2^7-1 NRZ PRBS

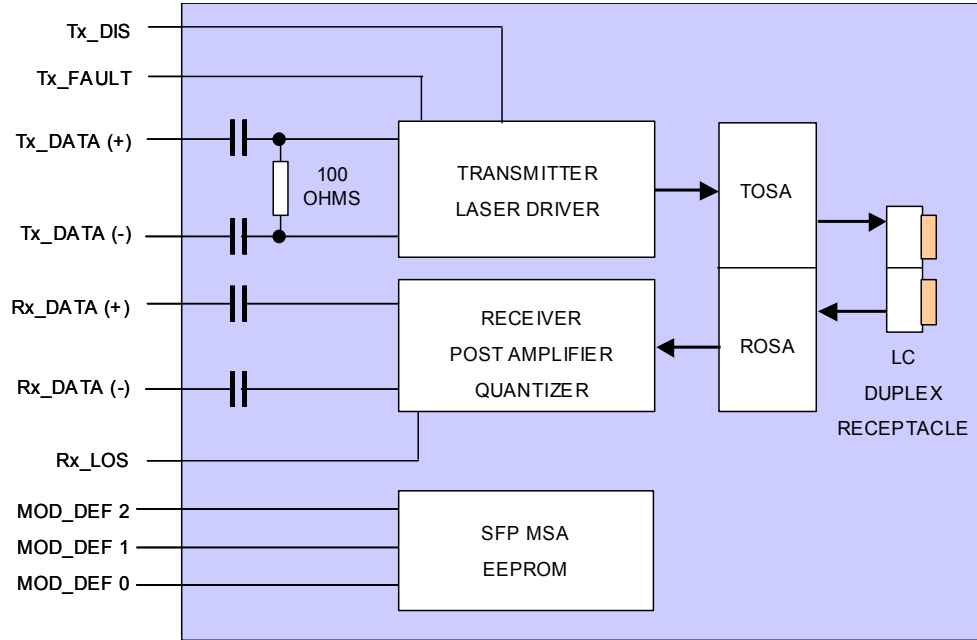


Receiver Test Conditions

- Optical Input Power = **-17 dBm**
- Test Pattern = 2^7-1 NRZ PRBS



TRANSCEIVER BLOCK DIAGRAM



Transmitter Section

The transmitter section consists of a high reliability 1310 nm FP laser diode (LD) with back facet monitor photo detector (PD) in an eye safe optical sub-assembly (TOSA), which is mated to the Tx port of the fiber optic LC duplex receptacle. A driver IC converts LVPECL differential input data signals into an analog current source that drives the LD. The transmitter is provided with the Tx_Disable and Tx_FAULT control and monitoring functions. Access to the internal SFP MSA device characteristics are enabled via the 2-wire I²C data bus.

Receiver Section

The receiver section consists of a high-speed InGaAs PIN photodiode and transimpedance preamplifier mounted in an optical subassembly (ROSA), which is mated to the Rx port of the fiber optic LC duplex receptacle. The output of the PD drives the post-amplification, quantizing, and optical signal detection circuits. The receiver is equipped with the Rx_LOS (Loss of Signal) monitoring function.

Transceiver Monitor and Control Functions

Rx Signal Loss (Rx_LOS) Description

The Rx_LOS (Loss of Signal) is an open collector LVTTTL monitor port. It switches state based on the received optical input signal level that passes through the photo detector (PD), post amplifier and quantizer.

If the received signal is above the Rx threshold, then Rx_LOS is set LOW indicating normal operation. If the received signal is below the Rx threshold, then Rx_LOS is set HIGH indicating a possible broken fiber, unplugged connector or low Tx signal from the host. The Rx_LOS pin requires an external 4.7K to 10 K Ohm pull-up resistor.

Tx Disable (Tx_DIS) Description

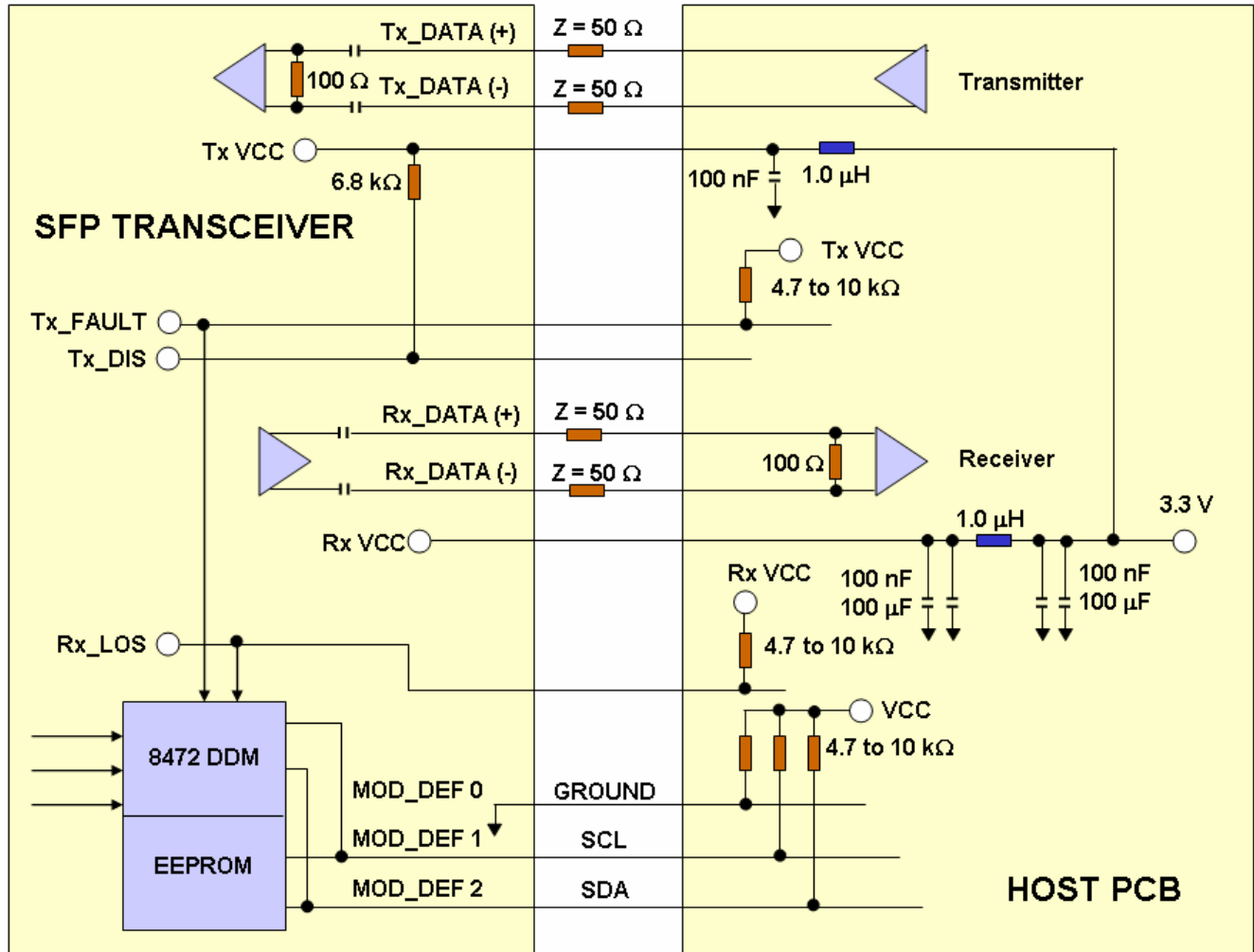
The Tx_DIS (Transmit Disable) is an open collector LVTTTL control port that is controlled by a logic signal on the host (system) printed circuit board. If the system is ready to send data then the Tx_DIS line is set LOW to enable the laser driver and the laser transmitter. If the system is not ready to send data, then the Tx_DIS line is set HIGH to disable the transmitter.

Tx Fault (Tx_FAULT) Description

The Tx_FAULT (Transmit Fault) is an open collector LVTTTL monitor port. It switches states based on the condition of the laser driver and the laser including the end of life condition of the laser. If the parameters of the laser driver and laser are within specifications then the Tx_FAULT is set LOW indicating normal transceiver operation. If a fault occurs, including excess optical output power then Tx_FAULT is set HIGH which disables the transmitter. The Tx_FAULT can be reset to normal operation by toggling Tx_DIS or switching the power supply. The Tx_FAULT pin requires an external 4.7K to 10K Ohm pull-up resistor.

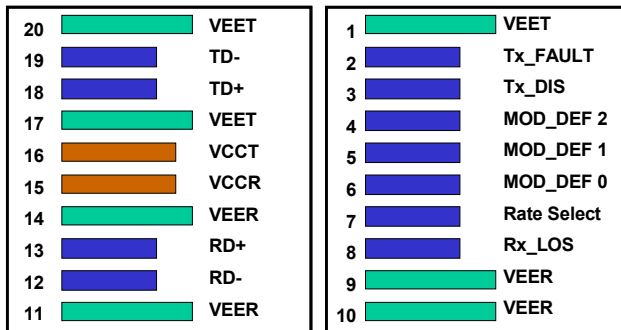


ELECTRICAL INTERFACE

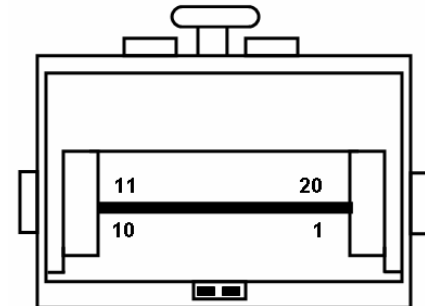




PIN ASSIGNMENT



Transceiver Electrical Pad Layout
Top View **Bottom View**



Transceiver Pin Locations

SFP Pin Assignment

Pin	Symbol	Logic Type	Description	Notes
1	V _{EET}	N/A	Transmitter Ground	
2	Tx_FAULT	LVTTTL	Transmitter Fault, LOW = Normal Operation, HIGH = Fault Indication	Note 1
3	Tx_DIS	LVTTTL	Transmit Disable, LOW = Normal Operation, HIGH = Disables Module	Note 1
4	MOD_DEF 2	LVTTTL	Module Definition 2 - Two-Wire Interface - Serial Data	Note 1
5	MOD_DEF 1	LVTTTL	Module Definition 1 - Two-Wire Interface - Clock Signal	Note 1
6	MOD_DEF 0	LVTTTL	Module Definition 0 - Two-Wire Interface Digital Ground	
7	Rate Select	N/A	Not Connected	
8	Rx_LOS	LVTTTL	Receiver Loss of Signal, LOW = Normal Operation, HIGH = Loss of Signal	Note 1
9	V _{EER}	N/A	Receiver Ground	
10	V _{EER}	N/A	Receiver Ground	
11	V _{EER}	N/A	Receiver Ground	
12	RD-	LVPECL	Rx_Data Output (Inverted)	Note 2
13	RD+	LCPECL	Rx_Data Output (Non Inverted)	Note 2
14	V _{EER}	N/A	Receiver Ground	
15	V _{CCR}	N/A	Receiver DC Power	3.3 V +/- 5%
16	V _{CCT}	N/A	Transmitter DC Power	3.3 V +/- 5%
17	V _{EET}	N/A	Transmitter Ground	
18	TD+	LVPECL	Tx_Data Input (Non Inverted)	Note 3
19	TD-	LVPECL	Tx_Data Input (Inverted)	Note 3
20	V _{EET}	N/A	Transmitter Ground	

Notes

1	The uncommitted Tx_Fault, Rx_LOS, MOD_DEF 1 and MOD_DEF 2 LVTTTL monitor and control pins each require a pull up resistor of 4.7K to 10K Ohms.
2	The 100 Ohm differential Rx Data output is internally AC coupled and must be terminated with 100 Ohms at the differential user interface.
3	The 100 Ohm differential Tx Data input is internally AC coupled and terminated.



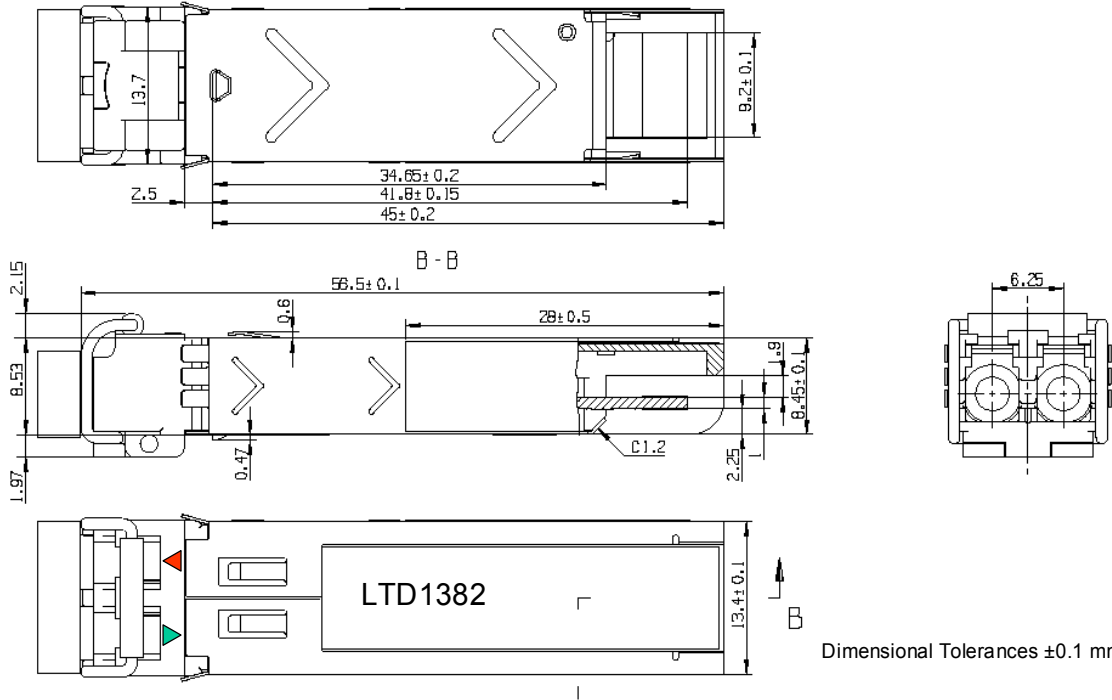
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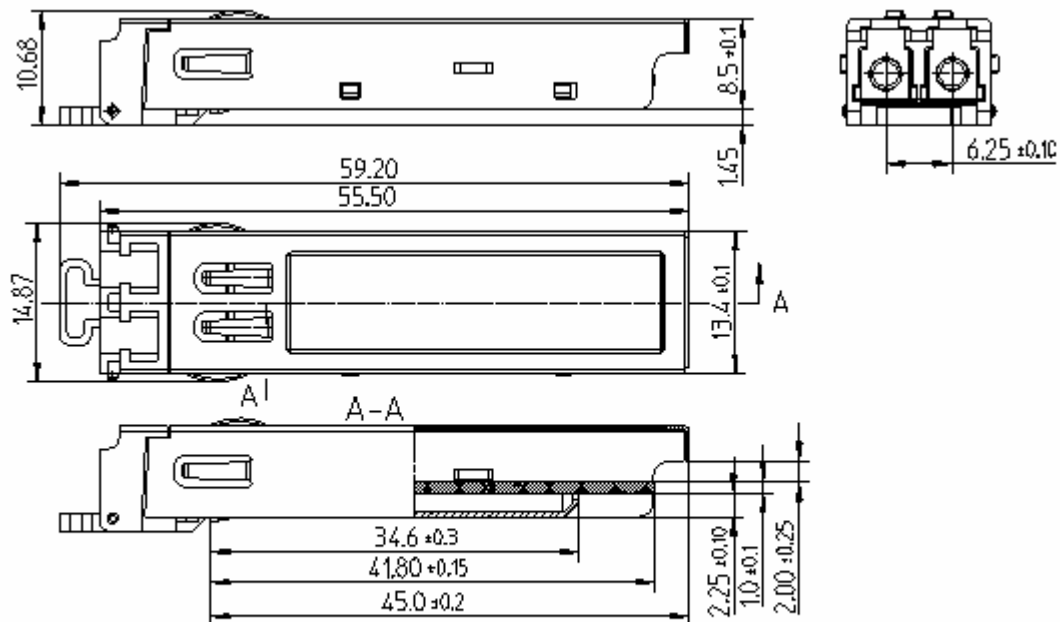
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MECHANICAL DIMENSIONS - METAL HOUSING / BAIL LATCH



MECHANICAL DIMENSIONS - METAL HOUSING / PULL LATCH

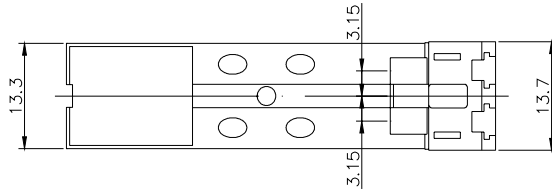


Dimensions are in millimeters
Dimension tolerance is ± 0.1mm unless otherwise specified

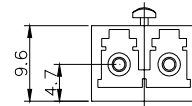
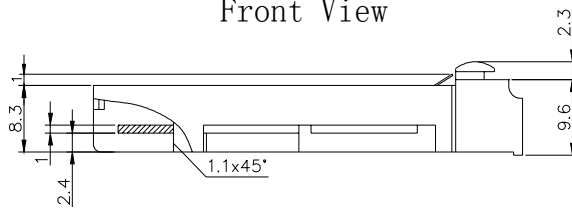


MECHANICAL DIMENSIONS - PLASTIC HOUSING / BUTTON LATCH

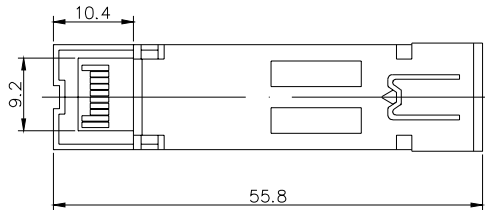
Top View



Front View



Side View



Bottom View



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

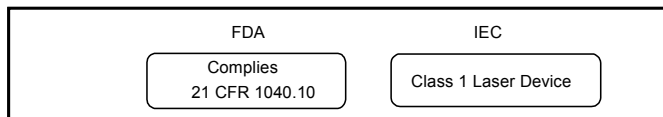
The transceiver is ESD safe (electrical pins) when tested according to MIL-STD-883, Method 3015.7 and ESD safe (optical connector) when tested according to IEC 61000-4-2. The device is immune to strong RF fields when tested in accordance with IEC 610004-3. The device complies with (US) FCC, Part 15, 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	17.25°

Required Label



Laser Emission

