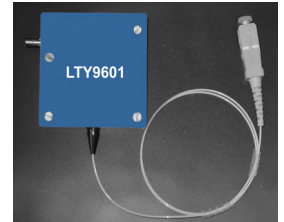




LTY9610 and LTY9613

B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM

The LTY96XX series of triplexers are low-cost 155 / 622 Mb/s B-PON bidirectional transceivers designed to meet the ITU-T G.983.3 27/28 dB distribution requirements (video overlay) for Class B point to multi point service in advanced “triple play” Optical Network Termination (ONT) or Optical Network Unit (ONU) equipment. They incorporate a 1310 nm F-P burst mode upstream laser transmitter, a 1490 nm continuous mode downstream digital receiver and a 1550 nm video receiver for reception of CATV signals in the 47 to 870 MHz band. They are packaged in the industry standard 20-Pin Single-In-Line 50.8 x 50.8 x 13.7 mm metal housing with SC/APC fiber pigtail and 75-Ohm SMB connector. They are designed to operate over the industrial temperature range of -40°C to +85°C. The LTY9610 receiver incorporates the LVTTTL Rx_SD monitor function whereas the LTY9613 incorporates the LVTTTL Rx_LOS Loss of Signal monitor function. The 2-wire LVTTTL I²C data bus enables access to the 8472 internally calibrated alarm and warning functions.

**Optical Features**

- Single Fiber Triplexer
- 1310 nm 155 Mb/s F-P Burst Mode Tx
- < -45 dBm Tx “Off State” Optical Power
- 1490 nm 622 Mb/s PIN/TIA CW Mode Rx
- 1550 nm Linear CATV Video Receiver
- 47 dB Cross Talk Isolation
- SC/APC Fiber Pigtail

RF / Electrical Features

- 3.3 V Burst Mode Transmitter
- 3.3 V Digital Receiver

- 12.0 V Video Receiver
- 2.2 W Typical Power Consumption
- Differential LVPECL Rx Signal Interface
- Differential LVPECL Tx Signal Interface
- 47 to 870 MHz RF BW
- +14 dBmV RF Output with Tilt
- 75-Ohm Single-Ended RF Output

Diagnostic Features

- LVTTTL Rx_SD LTY9610
- LVTTTL Rx_LOS LTY9613
- LVTTTL Tx_BEN

- < 10 ns Burst Mode Tx Response Time
- LVTTTL 8472 I²C DDM Interface

Mechanical Features

- 20-Pin SIL Package
- 50.8 x 50.8 x 13.7 mm Package Outline
- 75-Ohm SMB RF Output Jack

Environmental Features

- -40°C to +100°C Storage Temperature
- -40°C to +85°C Operating Temperature

Applications

- Passive optical network (PON)
- Full Service Access Networks
- Fiber-to-the-Home (FTTH)
- Fiber-to-the-Business (FTTB)
- B-PON Upstream Transceiver

Applied Standards

- FSAN B-PON, Class B
- ITU-T G.983.3

PRODUCT SUMMARY

Part Number	Description	Tx	Rx	Rx Monitor	RF Output
LTY9610	B-PON ONU Triplexer, G.983.3 Compliant, Class B	155 Mb/s	622 Mb/s	LVTTTL Rx_SD	75-Ohm SMB JACK
LTY9613	B-PON ONU Triplexer, G.983.3 Compliant, Class B	155 Mb/s	622 Mb/s	LVTTTL Rx_LOS	75-Ohm SMB JACK



LTY9610 and LTY9613

B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Units
Storage Temp	Tstg	-40	+100	°C
Case Operating Temperature	Tcase	-40	+85	°C
Soldering Temperature	Tsld	-	260	°C
Soldering Time	Ts	-	10	s

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Case Operating Temperature	Tcase	-40	-	+85	°C	
DC Power Supply Voltage	V _{CC}	3.135	3.3	3.465	VDC	
Video Power Supply	V _{DD1}	10.8	12.0	13.2	VDC	
Tx Upstream Bit Rate	-	-	155.52	-	Mb/s	
Rx Downstream Bit Rate	-	-	622.08	-	Mb/s	
Video Bandwidth	BW	47	-	870	MHz	

TRANSMITTER OPTICAL CHARACTERISTICS (Tcase = -40° to +85°C unless noted otherwise, CC= 3.3 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Optical Output	P _{out}	0	-	3	dBm	Into 9/125 micron fiber
Optical Rise / Fall Time	t _r / t _f	-	500	600	ps	20% to 80%
Operating Wavelength	λ	1280	1310	1340	nm	
Spectral Line Width	Δλ	-	-	4.0	nm	
Extinction Ratio	ER	10	12	-	dB	
Output Eye	-	-	-	-	-	ITU-T G.983 Mask
Relative Intensity Noise	RIN	-	-	-110	dB/Hz	
Total Jitter	T _J	-	-	0.2	UI	
Optical Cross Talk	C _{RT}	-	-40	-	dB	

TRANSMITTER ELECTRICAL CHARACTERISTICS (Tcase = -40° to +85°C unless noted otherwise, VCC = 3.3 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Supply Current	I _{CC}	-	-	150	mA	
Signal / Data Differential Input Voltage	V _{IH} - V _{IL}	300	-	1900	mV p-p	
Signal / Data Input Voltage / LOW	V _{IL} - V _{CC}	-2.0	-	-1.58	V	LVPECL Interface
Signal / Data Input Voltage / HIGH	V _{IH} - V _{CC}	-1.1	-	-0.75	V	LVPECL Interface
Tx_BEN Burst Mode Enable Time	T _{XENABLE}	-	-	10	ns	
Tx_BEN Burst Mode Disable Time	T _{XDISABLE}	-	-	10	ns	
Tx OFF Optical Output Power	P _{OUTOFF}	-	-	-45	dBm	Tx_BEN in the Disable State



LTY9610 and LTY9613

B-PON FSN G.983.3 ONU Triplexers with 8472 DDM

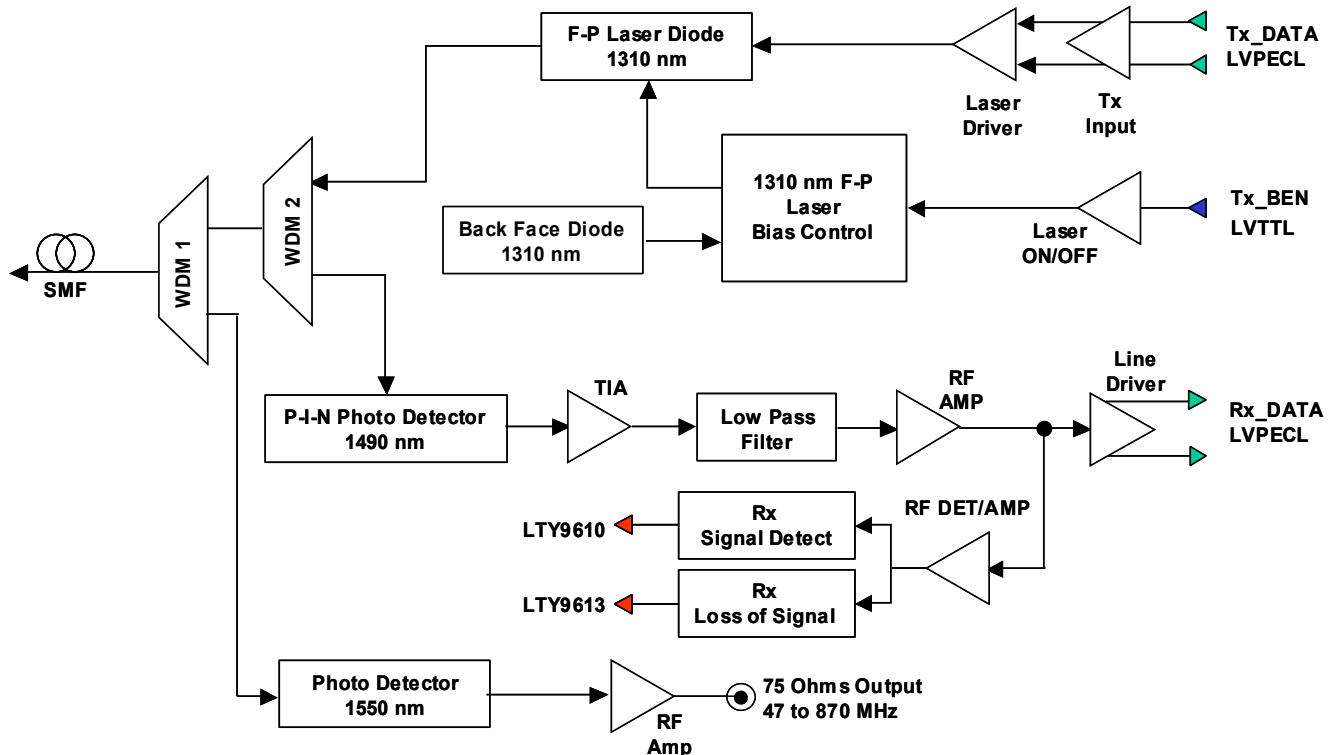
DIGITAL RECEIVER OPTICAL CHARACTERISTICS (Tcase = -40°C to +85°C unless noted otherwise, VCC = 3.3 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Wavelength	λ	1480	1490	1500	nm	
Optical Input Power	Pin	-28	-	-3	dBm	BER < 10E-10, 622 Mb/s, 2 ²³ -1 PRBS
Optical Input Power MAX	Pin _{MAX}	-	-	0	dBm	
Optical Return Loss	RL	20	-	-	dB	
Data Output Rise / Fall Time	t _r / t _f	-	-	600	ps	20% to 80%
Signal Detect: ASSERT	Pa	-44	-	-30	dBm	
Signal Detect: DEASSERT	Pd	-45	-	-31	dBm	
Signal Detect: Hysteresis	-	1	-	-	dB	
Signal Detect: ASSERT / DEASSERT Time	-	-	-	100	μs	

DIGITAL RECEIVER ELECTRICAL CHARACTERISTICS (Tcase = -40°C to +85°C unless noted otherwise, VCC = 3.3 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Supply Current	I _{CCR}	-	-	125	mA	Not including Output Load Current
Signal / Data Differential Output Voltage	-	600	-	1900	mV p-p	
Signal Detect Output Voltage: LOW State	V _{IL}	0	-	0.8	V	
Signal Detect Output Voltage: HIGH State	V _{IH}	2.4	-	3.3	V	

LTY9610 / LTY9613 BLOCK DIAGRAM





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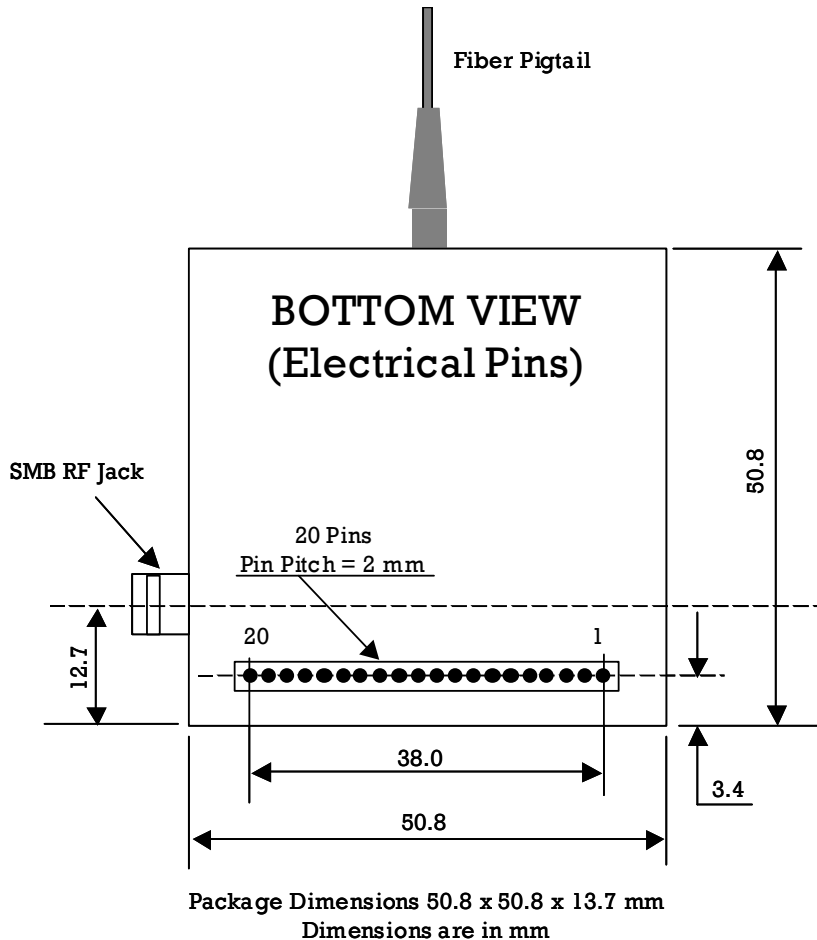
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LTY9610 and LTY9613

B-PON FSN G.983.3 ONU Triplexers with 8472 DDM

LOGIC STATES				
Parameter	Logic State	Logic Type	Part Number	Description
Rx_SD	HIGH	LVTTTL	LTY9610	Normal Operation
	LOW			Loss of Signal
Rx_LOS	HIGH	LVTTTL	LTY9613	Loss of Signal
	LOW			Normal Operation
Tx_BEN	HIGH	LVTTTL	Both	Burst Mode Transmitter ENABLED
	LOW			Burst Mode Transmitter DISABLED
MOD_DEF 0	GROUND	N/A	Both	Ground State for the DDM
MOD_DEF 1	HIGH	LVTTTL		Serial Clock HIGH State
	LOW			Serial Clock LOW State
MOD_DEF 2	HIGH	LVTTTL		Serial DATA High State
	LOW			Serial DATA Low State

LTY9610 / LTY9613 PACKAGE OUTLINE DRAWING





LTY9610 and LTY9613

B-PON FSN G.983.3 ONU Triplexers with 8472 DDM

VIDEO (RF) RECEIVER CHARACTERISTICS (Tamb = -40°C to +85°C unless noted otherwise, VDD = 12 V)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Wavelength	λ	1530	1550	1560	nm	
RF Bandwidth	BW	47	-	870	MHz	
Optical Input Power	Pin	-6	-4	+2	dBm	
RF Ripple	-	-	± 0.5	± 0.75	dB	47 to 870 MHz
RF Output Gain Flatness	-	-	-	± 0.5	dB	Adjacent Channel
RF Output	Pout	+13	-	-	dBmV	F = 870 MHz
Linear Slope Correction	-	0	2	5	dB	46MHz to 870 MHz
Compound Second Order	CSO	-	-68	-65	dBc	0 dBm power, 3.6% OMI, 82 NTSC Channels
Compound Triple Beat	CTB	-	-70	-65	dBc	0 dBm power, 3.6% OMI, 83 NTSC Channels
Carrier to Noise Ratio	CNR (1)	48	-	-	dBc	-6 dBm input, 3.6% OMI, 82 NTSC Channels
Carrier to Noise Ratio	CNR (2)	54	-	-	dBc	0 dBm input, 3.6% OMI, 82 NTSC Channels
Output Impedance	Z _{out}	-	75	-	Ohms	Unbalanced
Output Return Loss (RF)	RL	-	-	-12	dB	47 to 870 MHz
Video Power Supply	V _{DD}	10.8	12.0	13.2	VDC	
Power Consumption	P _{DC}	-	-	1.6	Watts	

WDM CHARACTERISTICS

Parameter	Wavelength	Min	Typ	Max	Units
Tx Channel	-	1260	-	1360	nm
Digital Rx Channel	-	1480	-	1500	nm
Video Rx Channel	-	1539	-	1565	nm
Optical Isolation: From External Source to Digital Rx	1260 nm to 1310 nm into 1490 nm	50	-	-	dB
Optical Isolation: From External Source to Digital Rx	1550 nm to 1560 nm into 1490 nm	40	-	-	dB
Optical Cross Talk from Internal Laser to Digital Rx	1260 nm to 1360 nm into 1490 nm	50	-	-	dB
Optical Isolation from External Source to Video Rx	1260 nm to 1360 nm into 1550 nm	50	-	-	dB
Optical Isolation from External Source to Video Rx	1480 nm to 1500 nm into 1550 nm	36	-	-	dB
Optical Cross Talk from Internal Laser into Video Rx	1260 nm to 1360 nm into 1550 nm	48	-	-	dB

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°


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LTY9610 and LTY9613
B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM
LTY9610 PIN OUT TABLE (RF Output via 75-Ohm SMB Jack, Receiver Monitor Function = Signal Detect)

Pin Number	Symbol	Description	Notes
1	GND	Ground	
2	V _{CCR}	3.3 Volt DC Digital Receiver Voltage Input	
3	Rx_SD	Digital Receiver Signal Detect Function	LVTTTL (External Pull-Up Required)
4	Rx_DATA(+)	Digital Receiver Rx_DATA Non-Inverted Output	LVPECL
5	Rx_DATA(-)	Digital Receiver Rx_DATA Inverted Output	LVPECL
6	Tx_BEN	Transmitter Burst Mode Enable	LVTTTL (External Pull-Up Required)
7	NC	Not Connected	
8	GND	Ground	
9	Tx_DATA(+)	Transmitter Tx_DATA Non-Inverted Input	LVPECL
10	NC	Not Connected	
11	Tx_DATA(-)	Transmitter Tx_DATA Inverted Input	LVPECL
12	V _{CCT}	3.3 Volt DC Transmitter Voltage Input	
13	SDA	I ² C Serial Data I/O	LVTTTL (External Pull-Up Required)
14	SCL	I ² C Serial Clock	LVTTTL (External Pull-Up Required)
15	NC	Not Connected	
16	V _{DD}	12.0 Volt Video Photo Detector Bias	
17	V _{MON}	Video Photo Detector Monitor Output	Analog Signal is Proportional to Optical Input
18	NC	Not Connected	
19	GND	Ground	
20	NC	Not Connected	


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LTY9610 and LTY9613
B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM
LTY9613 PIN OUT TABLE (RF Output via 75-Ohm SMB Jack, Receiver Monitor Function = Loss of Signal)

Pin Number	Symbol	Description	Notes
1	GND	Ground	
2	V _{CCR}	3.3 Volt DC Digital Receiver Voltage Input	
3	Rx_LOS	Digital Receiver Signal Detect Function	LVTTTL (External Pull-Up Required)
4	Rx_DATA(+)	Digital Receiver Rx_DATA Non-Inverted Output	LVPECL
5	Rx_DATA(-)	Digital Receiver Rx_DATA Inverted Output	LVPECL
6	Tx_BEN	Transmitter Burst Mode Enable	LVTTTL (External Pull-Up Required)
7	NC	Not Connected	
8	GND	Ground	
9	Tx_DATA(+)	Transmitter Tx_DATA Non-Inverted Input	LVPECL
10	NC	Not Connected	
11	Tx_DATA(-)	Transmitter Tx_DATA Inverted Input	LVPECL
12	V _{CCT}	3.3 Volt DC Transmitter Voltage Input	
13	SDA	I ² C Serial Data I/O	LVTTTL (External Pull-Up Required)
14	SCL	I ² C Serial Clock	LVTTTL (External Pull-Up Required)
15	NC	Not Connected	
16	V _{DD1}	12.0 Volt Video Photo Detector Bias	
17	V _{MON}	Video Photo Detector Monitor Output	Analog Signal is Proportional to Optical Input
18	NC	Not Connected	
19	GND	Ground	
20	NC	Not Connected	



B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM

SFP MSA and SFF 8472 REVISION 9.3 DIGITAL DIAGNOSTICS

This device incorporates the SFF-8472 Revision 9.3 digital diagnostic monitoring and control functions, which provide backward compatibility with the SFP-MSA digital diagnostic interface.

This device incorporates two 128-bytes data tables:

1. Table A0 (HEX) contains 128-bytes of information relating to the type of device as shown in the table below. The data is programmed into memory at the time the device is manufactured and is normally WRITE PROTECTED.
2. Table A2 (HEX) contains 128-bytes of real-time dynamic data from the internal calibration of the device, which includes the module temperature, the transmit output power, the receiver input power, the module DC operating current and the DC oper-

ating voltage. At the time the device is manufactured upper and lower WARNING and ALARM limits are stored in the EEPROM and WRITE PROTECTED. During operation, the stored values are compared with the real time data generated by the transceiver and a FLAG is SET if the WARNING or ALARM values are exceeded.

The SFF-8472 Revision 9.3 digital diagnostic interface enables the system host to discover the transceiver's parametric and data functions via a 2-wire system with one wire providing the clock and timing information and the other wire providing two-way communications with the transceiver. Additional information can be found in the SFF-8472 Rev 9.3 documentation.

Code Table for 8472 Digital Diagnostics - Page A0 HEX

Data Address	No of Bytes	Name of Field	Field Description
0	1	ID Field	Version Dependent
1	1	Extended ID Field	SFP function is defined by serial ID only
2	1	Connector ID Field	SC/PC optical connector
6	1	Transceiver ID Field	SONET OC-3 Intermediate Reach
11	1	Transceiver Encoding	SONET Scrambled
12	1	Nominal Bit Rate	155 Mb/s (Tx)
14	1	Link Length	20 km
15	1	Link Length > 25.4 km	GBIC compatibility requirement
20 to 35	16	Vendor Name	Ligent Photonics
37 to 39	3	Vendor IEEE ID	TBD
40 to 55	16	Ligent Part Number	LTY9610 or LTY9613
56 to 59	4	Ligent Rev Number	1.0
60 to 61	2	Wavelength	1310 nm (Tx)
65	1	SFP Codes	Version Dependent
66, 67	1	Bit Rate Max Tolerance	20 percent
68 to 83	16	Ligent Serial Number	Loaded at time of manufacture
84 to 91	8	Ligent Date Code	Loaded at time of manufacture
92	1	Type of Diagnostics	Average Power, Internal Calibration, DDM
93	1	Enhanced Options	Alarm / Warning Flags, Soft Fault, LOS
94	1	8472 Compatibility	Compatible with 8472 Rev 9.3



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LTY9610 and LTY9613

B-PON FSAN G.983.3 ONU Triplexers with 8472 DDM

PAGE A2 (HEX) SFF 8472 REVISION 9.3 DIGITAL DIAGNOSTICS

Page A2 (HEX) contains the ALARM, WARNING and ACTUAL data for 5 different transceiver parameters. The information is stored in the "two's-complement" format with the MSB occupying the lower byte and the LSB occupying the higher byte as shown in the table below. For each of the 5 parameters there are 10 memory locations:

1. High ALARM Value
2. Low ALARM Value
3. High WARNING Value
4. Low WARNING Values
5. Real Time Data

When an ALARM or WARNING value is reached, a FLAG is set that can be read by the I²C serial interface. The FLAG is a single bit in a specific 8-bit memory location. It is possible to have several ALARM and WARNING FLAGS set within a single 8-bit byte. In the table below, bytes 112, 113, 116 and 117 are the FLAG memory locations and the number in the parenthesis is the bit location with the 8-bit byte.

SFF-8472 Rev 9.3 A2 (HEX) Address Table for Alarm and Warning Data

8472 Parameter	Alarm Threshold Data				Warning Threshold Data				Measured Values		Alarm Bit (Set) Address + Position		Warning Bit (Set) Address + Position	
	High Value		Low Value		High Value		Low Value				High	Low	High	Low
	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	High	Low	High	Low
Temperature	00	01	02	03	04	05	06	07	96	97	112 (7)	112 (6)	116 (7)	116 (6)
Vcc	08	09	10	11	12	13	14	15	98	99	112 (5)	112 (4)	116 (5)	116 (4)
Tx Bias	16	17	18	19	20	21	22	23	100	101	112 (3)	112 (2)	116 (3)	116 (2)
Tx Out	24	25	26	27	28	29	30	31	102	103	112 (1)	112 (0)	116 (1)	116 (0)
Rx Input	32	33	34	35	36	37	38	39	104	105	113 (7)	113 (8)	117 (7)	117 (6)

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 61000-4-3. 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 require-

ments including UL1950, CSA 22.2, and IEC 60950-1, and has been designed to meet 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.