



# LTB3445 622 Mbps Tx / 155 Mbps Rx P2MP OLT 2x10 SFF B-PON Class C Transceiver

The LTB3445 is a low cost point to multi point (P2MP) Fiber to the Home, Business or Curb (FTTx) B-PON OLT transceiver. It is designed for 622.08 Mb/s downstream / 155.52 Mb/s upstream duplex data links that employ high-speed burst mode TDM receivers/transmitters. It is based on the ITU-TG.983.1 and G.983.3 specification for bidirectional communications over a single fiber and incorporates a high performance 1310 nm Burst Mode APD/TIA receiver and 1490 nm CW mode DFB transmitter. It is intended to serve up to 32 subscribers over distances of up to 20 km. The Receiver Signal Detect (Rx\_SD), Transmit Disable (Tx\_DIS), Transmit Fault (Tx\_FAULT) and the Page A0 (HEX) I<sup>2</sup>C diagnostic interface (equivalent to SFP MSA specification) monitor and control functions are LVCMOS compatible. The high-speed Receiver Reset (Rx\_RESET) control function is LVPECL compatible. The industry standard 2x10 small form factor (SFF) package incorporates a pigtail fiber with SC/APC or SC/UPC optical connector. It is fabricated with a rugged die cast metal housing and cage assembly and operates over the temperature range from 0°C to +75°C.



### Applications

- Access Networks
- Fiber to the Home, Curb, Office (FTTx)
- Point to Multi Point Service (P2MP)
  - Up to 20 km Reach (32:1 Split)
  - Class C FSAN B-PON OLT

### Features

- Dual Wavelength Bidirectional Transceiver
- 622.08.08 Mb/s Downstream
- 155.52 Mb/s Upstream
- BER<10<sup>-10</sup>, 155.52 Mb/s, PRBS 2<sup>23</sup>-1
- 1310 nm APD/TIA Burst Mode Receiver
- 1490 nm CW Mode DFB Laser
- ITU-G.983.1 and G.983.3 Complaint
- Single 3.3 Volt DC supply
- Low Power Consumption
- 2x10 SFF Package Outline
- Single Fiber, Full Duplex Operation
- Fiber Pigtail with Optional Optical Connector
- 0°C to 75°C Operating Temperature Range
- Tx DATA
  - LVPECL Differential Data Interface
  - Internally AC Coupled and Terminated
- Rx DATA
  - LVPECL Differential Data Interface
  - Internally DC Coupled
- LVCMOS Monitor and Control Interfaces
  - Rx Signal Detect
  - Tx Disable
  - Tx Fault
  - I<sup>2</sup>C Serial Data (Page A0 HEX)
  - I<sup>2</sup>C Serial Clock
- LVPECL Differential Control Interface
  - Rx RESET

### Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Ambient Operating Temperature	T <sub>amb</sub>	0	25	75	°C
DC Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	Volts
Module Supply Current	I <sub>IN</sub>	-	200	250	mA
Module Power Dissipation	P <sub>D</sub>	-	660	850	mW
Downstream Signaling Speed +/- 100 ppm	Sdown	-	622.08.08	-	Mb/s
Upstream Signaling Speed +/- 100 ppm	Sup	-	155.52	-	Mb/s
Useful Reach (32:1 Split)	D	-	20	-	km

### Ordering Information

Part Number	Package Option (X)	
<b>LTB3445 X</b>	<b>A</b>	Pigtail, no connector
	<b>B</b>	Pigtail, SC/APC
	<b>C</b>	Pigtail, SC/PC



Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	T <sub>stg</sub>	-40	+85	°C	Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device.
Operating Temperature	T <sub>O</sub>	0	+75	°C	
Relative Humidity - Storage	RH <sub>S</sub>	0	95	%	
Relative Humidity - Operating	RH <sub>O</sub>	0	85	%	The device is not intended to be operated under the condition of simultaneous Absolute Maximum Ratings, a condition which may cause irreversible damage to the device.
DC Supply Voltage	V <sub>CC</sub>	0	3.6	V	
Soldering Temperature	T <sub>slid</sub>	0	260	°C	
Soldering Duration	t <sub>slid</sub>	0	10	sec	

Absolute Maximum Ratings: Control Function Logic Levels					
Parameter	Symbol	Min	Max	Units	Notes
Transmit DISABLE Logic HIGH State	Tx_DIS	0	V <sub>CC</sub> +0.5	V	LVC MOS
Transmit FAULT Logic HIGH State	Tx_FAULT	0	V <sub>CC</sub> +0.5	V	LVC MOS
Receiver SIGNAL DETECT Logic HIGH State	Rx_SD	0	V <sub>CC</sub> +0.5	V	LVC MOS
Receiver RESET Logic HIGH State	Rx_RESET	0	V <sub>CC</sub> +0.5	V	LVPECL
I <sup>2</sup> C Serial Data Logic HIGH State	SDA	-	V <sub>CC</sub> +0.5	V	LVC MOS
I <sup>2</sup> C Serial Clock HIGH State	SCL	-	V <sub>CC</sub> +0.5	V	LVC MOS

Transmitter Electrical Specifications						
Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Tx DC Supply Current	I <sub>CC</sub>	-	-	150	mA	
Tx_Data Differential Input Voltage	V <sub>IH-VIL</sub>	300	-	1900	mV p-p	LVPECL Tx_DATA Electrical Signal
Tx_DIS = HIGH (Transmitter OFF / DISABLED)	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	LVC MOS (Control INPUT)
Tx_DIS = LOW (Transmitter ON / ENABLED)	V <sub>IL</sub>	0	-	0.8	V	LVC MOS (Control INPUT)
Tx_FAULT = HIGH (Laser OFF / FAULT Condition)	V <sub>OH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	LVC MOS (Monitor OUTPUT)
Tx_FAULT = LOW (Laser ON / NORMAL)	V <sub>OL</sub>	0	-	0.8	V	LVC MOS (Monitor OUTPUT)

Receiver Electrical Specifications						
Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Rx DC Supply Current	I <sub>RX</sub>	-	-	125	mA	Not Including the Output Load Current
Rx_Data Differential Output Voltage	V <sub>IH-VIL</sub>	600	-	1900	mV p-p	LVPECL Rx_DATA Electrical Signal
Rx_SD = HIGH (Receiver ON / NORMAL)	V <sub>OH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	LVC MOS (Monitor OUTPUT)
Rx_SD = LOW (Receiver OFF / LOSS OF SIGNAL)	V <sub>OL</sub>	0	-	0.8	V	LVC MOS (Monitor OUTPUT)
Rx_RESET = HIGH (Receiver RESET)	V <sub>IH</sub>	V <sub>CC</sub> -1.165	-	V <sub>CC</sub> -0.88	V	LVPECL (Control Input)
Rx_RESET = LOW (Receiver ON / NORMAL)	V <sub>IL</sub>	V <sub>CC</sub> -1.810	-	V <sub>CC</sub> -1.475	V	LVPECL (Control Input)

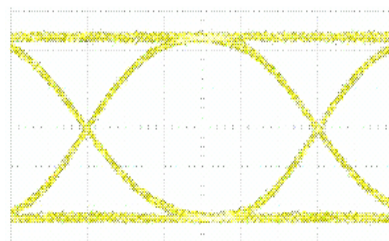
I <sup>2</sup> C Serial Logic						
Parameter	Symbol	State	Logic	Min	Max	Units
I <sup>2</sup> C Serial Data	SDA	HIGH	LVC MOS	2.0	V <sub>CC</sub> +0.3	V
	SDA	LOW	LVC MOS	0	0.8	V
I <sup>2</sup> C Serial Clock	SCL	HIGH	LVC MOS	2.0	V <sub>CC</sub> +0.3	V
	SCL	LOW	LVC MOS	0	0.8	V



Transmitter Optical Specification						
Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Transmitter Type		1490 nm DFB CW Mode				
Average Output Power (9/125 $\mu$ SMF)	P <sub>out</sub>	0	-	4	dBm	
Optical Output with Tx OFF	P <sub>out</sub>	-	-	-45	dBm	
Optical Rise and Fall Time	t <sub>r</sub> / t <sub>f</sub>	-	500	600	ps	20% to 80%
Tx Wavelength	$\lambda$	1480	1490	1500	nm	
Spectral Line Width @ -20 dB	$\Delta\lambda$	-	-	1.0	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Extinction Ratio	ER	10	-	-	dB	
Relative Intensity Noise	RIN	-	-	-118	dB/Hz	
Optical Return Loss	RL	-	-	15	dB	
Total Jitter	T <sub>J</sub>	-	-	0.2	UI	
Optical Cross Talk	C <sub>RT</sub>	-	40	-	dB	

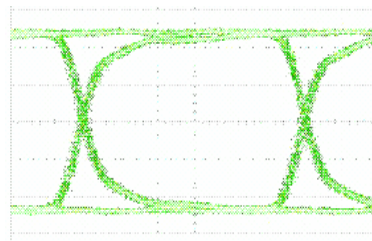
Receiver Optical Specifications						
Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Receiver Type		1310 nm APD/TIA Burst Mode				
Optical Signal Indicator		Signal Detect				
Wavelength	$\lambda$	1260	1310	1360	nm	
Received Optical Power	P <sub>in</sub>	-33	-	-8	dBm	BER<10 <sup>-10</sup> , 155.52 Mb/s, PRBS 2 <sup>23</sup> -1
Maximum Input Optical Power	P <sub>in(max)</sub>	-	-	-8	dBm	
Receiver Reflectance	RFL	-	-	-20	dB	
Receiver Settling Time	t <sub>rx</sub>	-	-	200	ns	
Rx_Signal Detect Assert	P <sub>a</sub>	-42	-	-33	dBm	
Rx_Signal Detect Deassert	P <sub>d</sub>	-42.5	-	-33.5	dBm	
Rx_Signal Detect Hysteresis	P <sub>hy</sub>	0.5	-	5	dB	

Eye Diagram



**Transmitter Test Conditions**

- Optical Output Power = 0 dBm
- Test Pattern = 2<sup>23</sup>-1 NRZ PRBS



**Receiver Test Conditions**

- Optical Input Power = -20 dBm
- Test Pattern = 2<sup>23</sup>-1 NRZ PRBS



**Ligent**

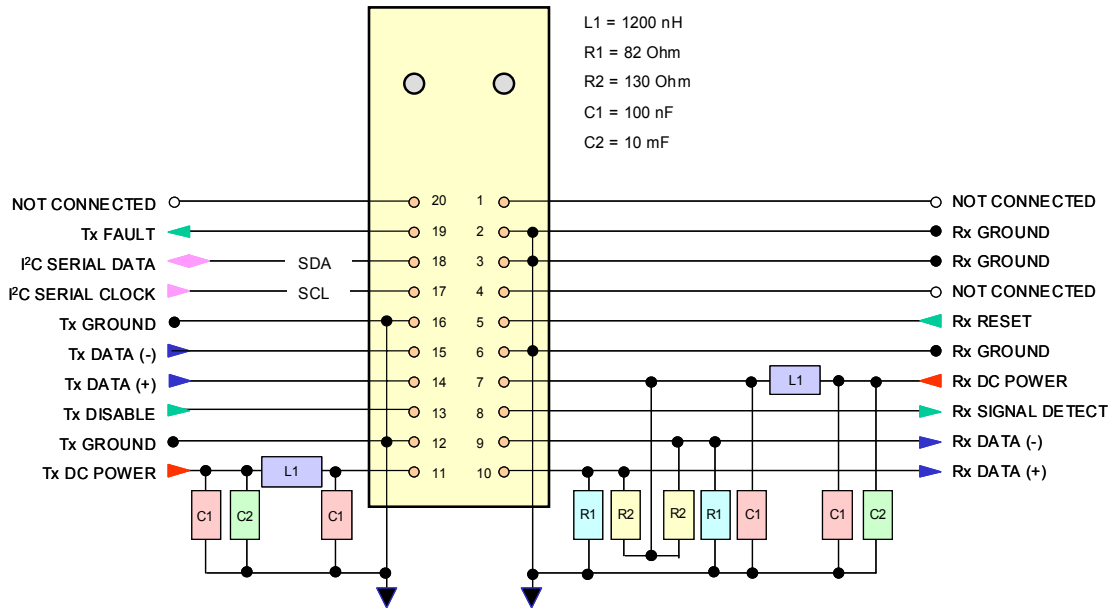
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# LTB3445 622 Mbps Tx / 155 Mbps Rx P2MP OLT 2x10 SFF B-PON Class C Transceiver

LTB3445 I2C Memory Map (Page A0 HEX, UNLISTED FIELDS ARE BLANK / EMPTY)							
Address		Memory Contents		Description	Name of Field	SFP MSA Reference	Notes
Decimal	HEX	ASCII	HEX				
0	00	002	02	Module is soldered to PCB	Identifier	Table 3.2	
1	01	004	04	Non Standard GBIC Interface	Extended Identifier	Table 3.3	
2	02	128	80	Pigtail Fiber with SC/PC Connector	Connector Values	Table 3.4	LTB3445 C
2	02	129	81	Pigtail Fiber with SC/APC Connector	Connector Values	Table 3.4	LTB3445 B
2	02	130	82	Pigtail Fiber without Connector	Connector Values	Table 3.3	LTB3445 A
4	04	016	10	Intermediate Reach	Transceiver Codes	Table 3.5a	
5	05	032	20	OC-12 Intermediate Reach	Transceiver Codes	Table 3.5	
11	0B	003	03	NRZ Encoding	Encoding Codes	Table 3.6	
12	0C	006	06	Nominal 622.08.08 Mb/s Data Rate	Nominal Bit Rate		
14	0E	020	14	Link Length in km Units = 20	9 micron fiber length		
15	0F	200	C8	Link Length in 100 m Units = 200	9 micron fiber length		
20 to 35	14 to 23	XXX	XX	Vendor Name	"Ligent Photonics"		ASCII Format
40 to 48	28 to 30	XXX	XX	Vendor Part Number	"LTB3445 X"		ASCII Format
56 to 59	37 to 3B	XX	XX	Vendor Revision Number	Revision 1.5		
60	3D	014	0E	Wavelength = 1490 nm			
61	3E	090	5A	Wavelength = 1490 nm			
65	41	28	1C	Tx_DIS, Tx_FAULT, Rx_SD	Option Values	Table 3.6	
66	42	20	14	Maximum Bit Rate Tolerance			
67	43	20	14	Minimum Bit Rate Tolerance			
68 to 83	44 to 53	XXX	XX	Vendor Serial Number	Ligent Serial Number		
84 to 91	54 to 5B	XXX	XX	Vendor Date Code	Ligent Date Code		



LTB3445 2x10 SFF Interface (Bottom View)



**2x10 SFF PIN ASSIGNMENT**

Pin	Symbol	Description	Pin	Symbol	Description
1	N/C	Not Connected	20	N/C	Not Connected
2	V <sub>EER</sub>	Receiver Ground	19	Tx_Fault	Transmitter Fault (LVCMOS)
3	V <sub>EER</sub>	Receiver Ground	18	SDA	I2C Serial Data (LVCMOS)
4	N/C	Not Connected	17	SCL	I2C Serial Clock (LVCMOS)
5	Rx_RESET	Receiver Burst Mode Reset (LVTTTL)	16	V <sub>EET</sub>	Transmitter Ground
6	V <sub>EER</sub>	Receiver Ground	15	TD-	Tx_DATA Inverted Differential Input (AC-Coupled)
7	V <sub>CCR</sub>	Receiver +3.3 VDC Power Supply	14	TD+	Tx_DATA Non Inverted Differential Input (AC-Coupled)
8	Rx_SD	Receiver SIGNAL DETECT (LVCMOS)	13	Tx_DIS	Transmit Disable (LVCMOS)
9	RD-	Rx_DATA Inverted Differential Output DC-Coupled )	12	V <sub>EET</sub>	Transmitter Ground
10	RD+	Rx_DATA Non Inverted Differential Output (DC-Coupled )	11	V <sub>CC1</sub>	Transmitter +3.3 VDC Power Supply
Mounting Posts	The mounting posts are provided for mechanically attaching the transceiver to the circuit board. They should not be connected to the circuit ground but can be connected to the chassis ground.				
Housing Leads	The housing leads should be connected to circuit ground				

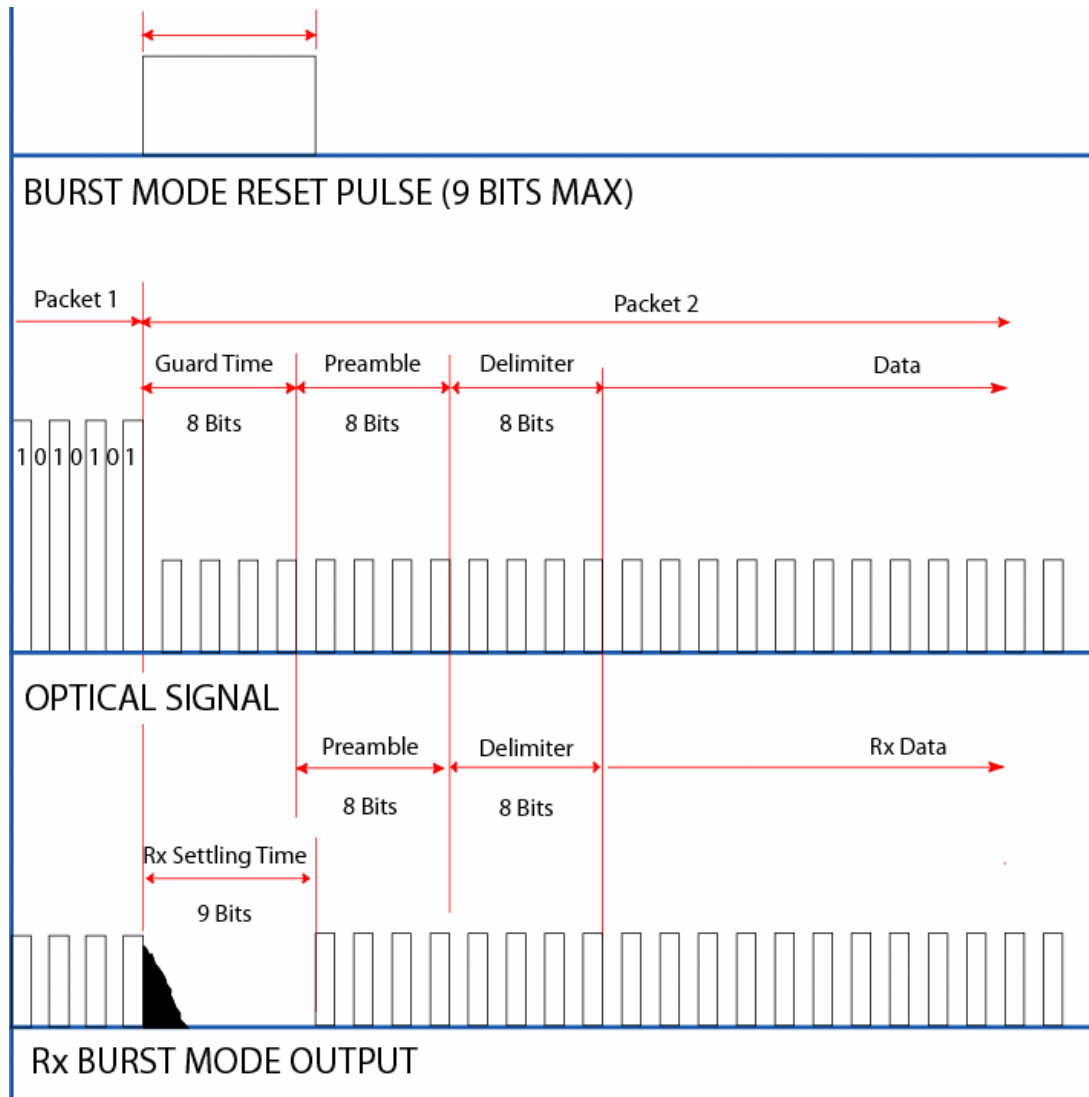


622.08.08 Mb/s B-PON Timing Diagram

1. ITU recommended allocation of burst mode overhead time for OLT functions

Upstream Data Rate	Tx Enable (Bits)	Tx Disable (bits)	Guard Time (bits)	Preamble Time (bits)	Delimiter Time (bits)
155.52.52 Mb/s	2	2	8	8	8

2. OLT Timing Diagram



1. Rx Settling Time = Rx Dynamic Sensitivity Time + Rx Level Recovery Time
2. Burst Mode RESET is a differential LVPECL control signal, active HIGH
3. Burst Mode RESET pulse width needs to be set between 6.43 ns and 57.87 ns depending upon the dynamic range requirement and the overlap with the Preamble signal.



### Eye Safety

The transceiver is a Class 1 eye-safe device according to FDA 21CFR1040.10 and 1040.11, IEC 60825-1 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 3015.4 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, and has been designed to meet the flammability requirements of UL94.

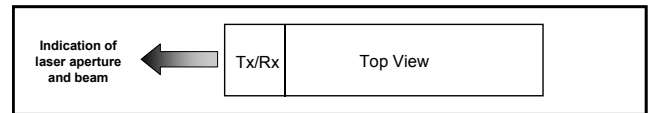
### Notice

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.

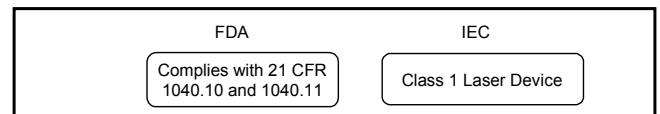
### Required Label and Laser Emission

This device is labeled in accordance with FDA and IEC requirements for laser safety.

#### Required Label



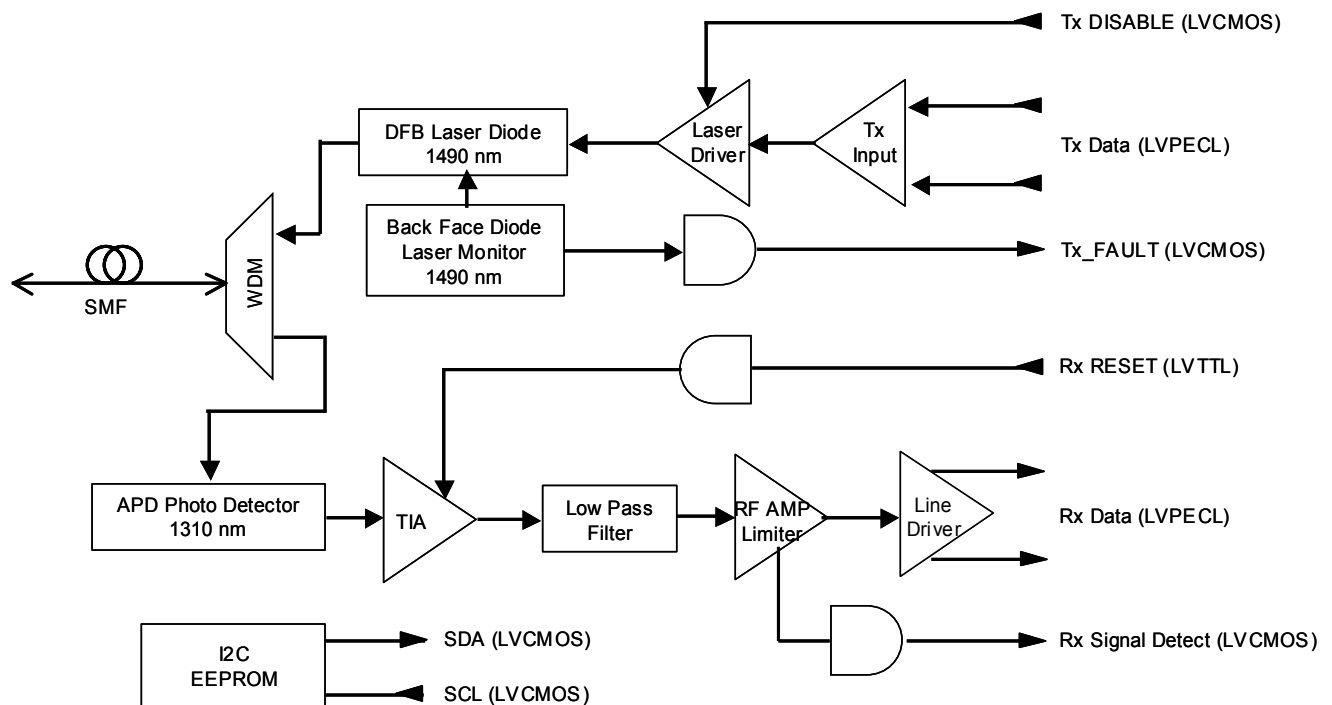
#### Laser Emission



#### Laser Radiation Information

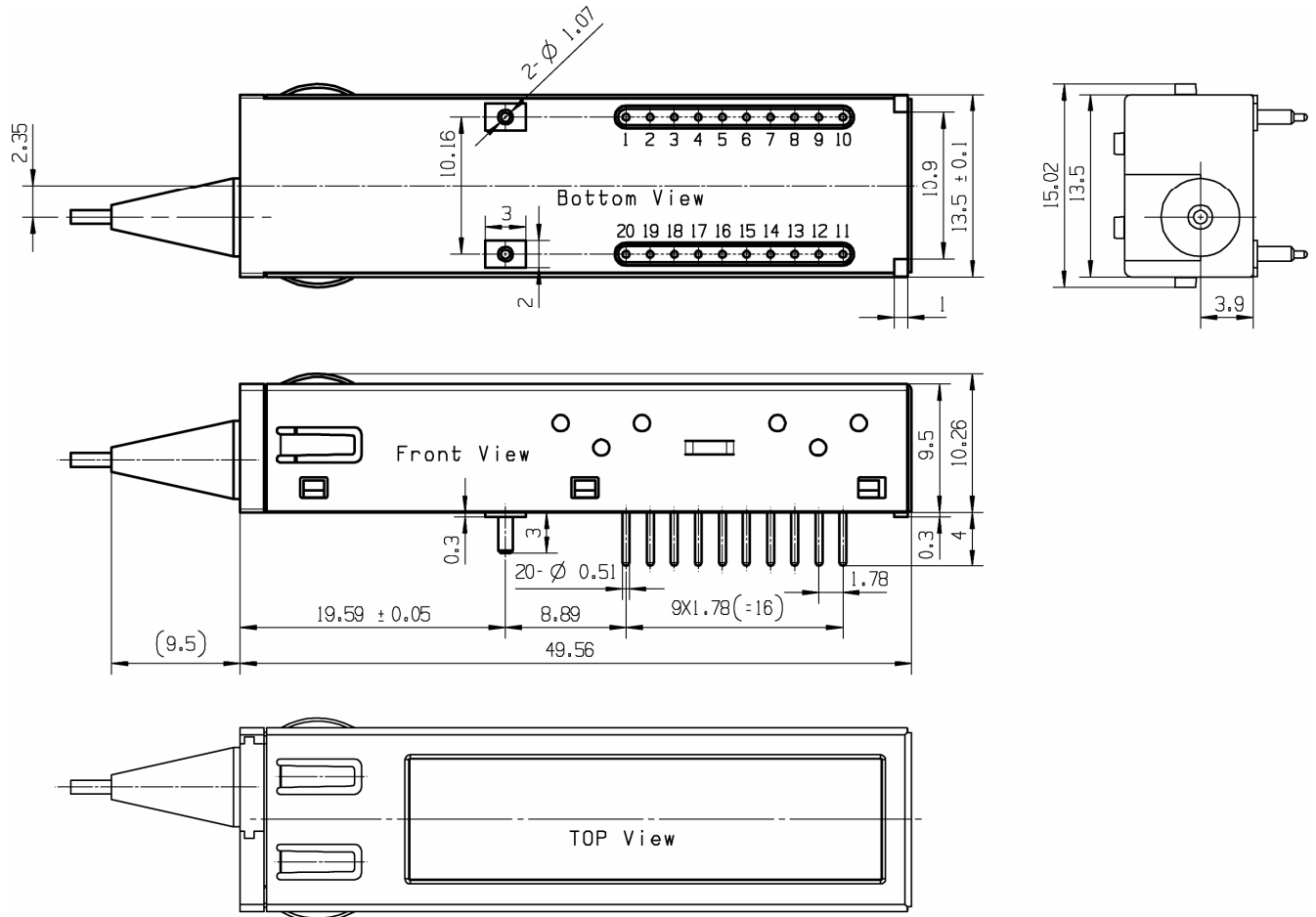
Wavelength	1490 nm
FDA Total Optical Pout : 7 mm aperture at 20 cm distance	< 790 microwatts
IEC Total Optical Pout: 7 mm aperture at 14 cm distance	< 10000 microwatts
Beam Divergence	17.25°

### LTB3445 Block Diagram





2x10 SFF Outline Drawing (Fiber Pigtail)





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**LTB3445 622 Mbps Tx / 155 Mbps Rx P2MP OLT**

**2x10 SFF B-PON Class C Transceiver**

**Ligent Sales Offices**

**Ligent Photonics**

2701 Dukane Drive  
Suite 200  
St. Charles, IL 60174  
PH (630) 513-7226  
FX (630) 513-9173  
WS www.ligentphotonics.com

**Ligent Photonics**

(Virginia Sales Office)  
8210 Strathmore Lane  
Roanoke, VA 24019  
PH (540) 797-5793  
FX (540) 366-5793  
WS www.ligentphotonics.com

**Bitel Technologies LTD**

Nur Building  
43 Ha'Atzmaut Way  
PO BOX 94  
Yehud, 56302, Israel  
PH +(972) 3-6322655  
FX +(972) 3-6322279  
WS www.bitel.co.il

**Gigatron Associates**

968 St. Laurent Boulevard  
Ottawa, Ontario K1K 3B3  
PH (613) 747-3472  
FX (613) 747-3474  
WS www.gigatron.com

**Gigatron Associates**

56 Bartleman Crescent  
Cambridge, ON  
PH: (519) 220-1856  
FX: (510) 220-1938  
WS: www.gigatron.com

**Gigatron Associates**

450 Avenue Racine PH #5  
Dorval, QB H9S 3K8  
PH: (514) 984-2598  
FX: (514) 620-7812  
WS: www.gigatron.com

**Gigatron Associates**

2388 Eversyde Avenue SW  
Calgary, AB T2Y 4X6  
PH: (403) 257-0636  
FX: (403) 257-0569  
www.gigatron.com

**Gigatron Associates**

406-838 Agnes Street  
New Westminster, BC V3M 6R3  
PH: (604) 787-2340  
FX: (604) 787-2343  
WS: www.gigatron.com

**New Age Electronics**

3000 Northwood's Parkway  
Suite 280  
Norcross, GA 30071  
PH (770) 242-8800  
FX (770) 242-8180  
WS www.newagelec.com

**New Age Electronics**

8376 Six Forks Road  
Suite 202  
Raleigh, NC 27615  
PH (919) 866-0620  
FX (919) 866-0621  
WS www.newagelec.com

**New Age Electronics**

4900 Corporate Drive  
Suite B  
Huntsville, AL 35805  
PH (256) 430-8000  
FX (256) 430-8414  
WS www.newagelec.com

**New Age Electronics**

182 Sunset Drive  
Mt. Dora, FL 32757  
PH: (352) 735-6101  
FX: (352) 735-6116  
WS: www.newagelec.com

**New Age Electronics**

100 SE 5th Court  
Suite 37  
Pompano Beach, FL 33060  
PH: (407) 804-1210  
FX: (954) 928-2889  
WS: www.newagelec.com

**KJS Marketing**

PO Box 72  
Crystal Lake, IL 60039  
PH (815) 788-1002  
FX (815) 788-1004  
WS www.kjsmarketing.com

**KJS Marketing**

7872 Olive Lane North  
Maple Grove, MN 55311  
PH (763) 391-6557  
FX (763) 391-6554  
WS www.kjsmarketing.com

**KJS Marketing**

2A Street  
Lake Lotawana, MO 64086  
PH (816) 578-4751  
FX (816) 774-2571  
WS www.kjsmarketing.com

**KJS Marketing**

1802 Hammer Drive, NW  
Cedar Rapids, IA 52405  
PH (319) 265-8592  
FX (319) 265-8593  
WS www.kjsmarketing.com

**KJS Marketing**

PO Box 1521  
Maryland Heights, MO 63043  
PH (314) 469-4544  
FX (314) 469-4535  
WS www.kjsmarketing.com

**KJS Marketing**

154 Struckman Blvd  
Bartlett, IL 60103  
PH (630) 289-4548  
FX (630) 289-3778  
WS www.kjsmarketing.com

**Kruvand Associates**

1202 Richardson Drive  
Suite 113  
Richardson, TX 75080  
PH (972) 437-3355  
FX (972) 680-8854  
WS www.kruvand.com

**Kruvand Associates**

8100 Shoal Creek Boulevard  
Suite 250  
Austin, TX 75080  
PH (512) 454-1111  
FX (512) 454-9858  
WS www.kruvand.com

**Kruvand Associates**

10601 Grant Road  
Suite 104  
Houston, TX 77070  
PH (713) 956-6741  
FX (713) 972-680-8854  
WS www.kruvand.com

**K-Tech Sales**

100 Century Center Court  
Suite 405  
San Jose, CA 95112  
PH (408) 437-1808  
FX (408) 437-1883  
WS www.ktechsales.com