



LTB3468 Series GPON ONU Transceiver CLASS B+ 1244/2488Mb/s With Tx_Indication

The LTB3468 Series Modules are low-cost 2488Mb/s downstream and 1244Mb/s upstream GPON bidirectional transceivers designed to meet the requirements of the ITU-T G.984.2 and the ITU-T G.984.5 specifications for point-to-multi point service in advanced “triple play” Optical Network Termination (ONT) or Optical Network Unit (ONU) equipment. They incorporate a high performance 1310nm burst mode DFB transmitters and 1490nm CW mode APD receivers. The Receiver Signal Detect (Rx_SD), Transmit Burst Control (Tx_Burst), Transmit Fault (Tx_FAULT) and the 8472 I²C diagnostic interface monitor and control functions are LVTTTL compatible. The device parameters can be accessed in real time by the I²C data interface, including the ALARM and WARNING values for temperature, V_{cc}, I_{cc}, Tx Burst Mode Optical Power and RSSI. The industry standard 2x10 small form factor (SFF) package incorporates a fiber pigtail with SC/PC connector or SC optical receptacle. They are fabricated with a rugged die cast metal housing and cage assembly, are Class I laser safety compliant and meet the EEC Directive 2002/95/EC for RoHS6 compliance.



2x10 SFF with SC/PC Pigtail



2x10 SFF with SC Receptacle

Applications

- Access Networks
- Fiber to the Home, Curb, Office (FTTx)
- Point to Multi Point Service (P2MP)
- ITU-T G.984.2
- ITU-T G.984.5 Filter
- FSAN Class B+
- SFF-8472

Bidirectional Transceiver

- Dual Lambda Bidirectional Transceiver
- Single 3.3V DC supply
- Low Power Consumption
- Full Duplex Operation
- RoHS6 Compliant

Upstream Burst Mode Transmitter

- 1310nm DFB Burst Mode Laser
- 1244Mb/s Data Rate

- Tx Power Level Control*
- LVPECL Differential Data Interface
- Internally DC Coupled and Terminated
- LVTTTL Tx Burst Control Input
- LVTTTL Tx Fault Monitor Output

Downstream CW Mode Receiver

- 1490nm APD/TIA CW Mode Receiver
- 2488Mb/s Data Rate
- BER<10⁻¹⁰, 2488Mb/s, PRBS 2²³-1
- CML Differential Data Interface
- Internally AC Coupled
- LVTTTL Rx Signal Detect Monitor Output

Case Operating Temperature Options:

- Commercial: 0 to 70°C
- Industrial: -40 to 85°C

Active I²C Interface

- I²C Serial Clock
- I²C Serial Data (SFF8472)
 - Module Temperature
 - V_{cc}
 - Bias
 - Rx RSSI
 - Tx Burst Mode Peak Optical Power

Package Options

- 2x10 SFF with SC/APC Pigtail
- 2x10 SFF with SC/UPC Pigtail
- 2x10 SFF with SC Receptacle

ITU-T Compliance

- G.984.2 (LTB3468)
- G.984.5 (LTB3468-XXG)
- * Relative to the actual maximum module optical output power

Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units
Case Operating Temperature	T _{case}	0	25	70	°C
		-40	25	85	°C
Module Supply Voltage	V _{CC}	3.135	3.3	3.465	V
Module Supply Current	I _{IN}	-	-	400	mA
Downstream Signaling Speed +/- 100 ppm	S _{down}	-	2488	-	Mb/s
Upstream Signaling Speed +/- 100 ppm	S _{up}	-	1244	-	Mb/s



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Ordering information

2x10 SFF with Fiber Pigtail and SC/PC Optical Connector

Part Number	ITU-T G.984.5 Compliant	Burst Enable	Optical Interface	Case Temperature	Notes
LTB3468-BC	No	Standard = HIGH	Pigtail, SC/APC connector	0 to 70 °C	Standard Product
LTB3468-BH	No	Standard = HIGH	Pigtail, SC/APC connector	-40 to 85 °C	Standard Product
LTB3468-CC	No	Standard = HIGH	Pigtail, SC/UPC connector	0 to 70 °C	Standard Product
LTB3468-CH	No	Standard = HIGH	Pigtail, SC/UPC connector	-40 to 85 °C	Standard Product
LTB3468L-BC	No	Option = LOW	Pigtail, SC/APC connector	0 to 70 °C	Special Order Product
LTB3468L-BH	No	Option = LOW	Pigtail, SC/APC connector	-40 to 85 °C	Special Order Product
LTB3468L-CC	No	Option = LOW	Pigtail, SC/UPC connector	0 to 70 °C	Special Order Product
LTB3468L-CH	No	Option = LOW	Pigtail, SC/UPC connector	-40 to 85 °C	Special Order Product

LTB3468-BCG	Yes	Standard = HIGH	Pigtail, SC/APC connector	0 to 70 °C	Standard Product
LTB3468-BHG	Yes	Standard = HIGH	Pigtail, SC/APC connector	-40 to 85 °C	Standard Product
LTB3468-CCG	Yes	Standard = HIGH	Pigtail, SC/UPC connector	0 to 70 °C	Standard Product
LTB3468-CHG	Yes	Standard = HIGH	Pigtail, SC/UPC connector	-40 to 85 °C	Standard Product
LTB3468L-BCG	Yes	Option = LOW	Pigtail, SC/APC connector	0 to 70 °C	Special Order Product
LTB3468L-BHG	Yes	Option = LOW	Pigtail, SC/APC connector	-40 to 85 °C	Special Order Product
LTB3468L-CCG	Yes	Option = LOW	Pigtail, SC/UPC connector	0 to 70 °C	Special Order Product
LTB3468L-CHG	Yes	Option = LOW	Pigtail, SC/UPC connector	-40 to 85 °C	Special Order Product

2x10 SFF SC Receptacle

Part Number	ITU-T G.984.5 Compliant	Burst Enable	Optical Interface	Case Temperature	Notes
LTB3468-SC	No	Standard = HIGH	SC Receptacle	0 to 70 °C	Standard Product
LTB3468-SH	No	Standard = HIGH	SC Receptacle	-40 to 85 °C	Standard Product
LTB3468L-SC	No	Option = LOW	SC Receptacle	0 to 70 °C	Special Order Product
LTB3468L-SH	No	Option = LOW	SC Receptacle	-40 to 85 °C	Special Order Product
LTB3468-SCG	Yes	Standard = HIGH	SC Receptacle	0 to 70 °C	Standard Product
LTB3468-SHG	Yes	Standard = HIGH	SC Receptacle	-40 to 85 °C	Standard Product
LTB3468L-SCG	Yes	Option = LOW	SC Receptacle	0 to 70 °C	Special Order Product
LTB3468L-SHG	Yes	Option = LOW	SC Receptacle	-40 to 85 °C	Special Order Product



Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Ambient Temperature	T _{stg}	-40	+85	°C	Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device. 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.
Relative Humidity - Storage	RH _s	0	95	%	
Relative Humidity - Operating	RH _o	0	85	%	
Fiber Pull Strength	-	-	10	N	
Fiber Bending Radius	-	30	-	mm	
Pigtail Fiber contact Temperature	-	-	+85	°C	
Module Supply Voltage	V _{CC}	0	3.6	V	
Soldering Temperature/Time	T _{sl} d	-	260/10	°C/s	Wave Soldering
		-	380/10	°C/s	Hand Soldering

Absolute Maximum Ratings: Control Function Logic Levels					
Parameter	Symbol	Min	Max	Units	Notes
Transmit Burst Control Logic HIGH State	Tx_Burst	0	V _{CC} +0.5	V	LVTTL (Tx is OFF / DISABLED)
Transmit FAULT Logic HIGH State	Tx_FAULT	0	V _{CC} +0.5	V	LVTTL (Laser is OFF / FAULT)
Receiver Signal Detect Logic HIGH State	Rx_SD	0	V _{CC} +0.5	V	LVTTL (Receiver is ON / NORMAL)
I ² C Serial Data Logic HIGH State	SDA	-	V _{CC} +0.5	V	LVTTL
I ² C Serial Clock HIGH State	SCL	-	V _{CC} +0.5	V	LVTTL

Transmitter Electrical Characteristics / Standard Configuration Tx Burst = HIGH (Enables the Transmitter)					
Parameter	Symbol	Min	Max	Units	Conditions / Notes
Tx_Data Differential Input Voltage	V _{IN}	200	1600	mV	LVPECL Tx_DATA Electrical Signal
Tx_Burst = HIGH (Transmitter ON / ENABLED)	V _{IH}	2.4	3.3	V	LVTTL (Control INPUT)
Tx_Burst = LOW (Transmitter OFF / DISABLED)	V _{IL}	0	0.8	V	LVTTL (Control INPUT)
Tx_FAULT = HIGH (Laser OFF / FAULT Condition)	V _{OH}	2.4	3.3	V	LVTTL (Monitor OUTPUT)
Tx_FAULT = LOW (Laser ON / NORMAL)	V _{OL}	0	0.8	V	LVTTL (Monitor OUTPUT)

Transmitter Electrical Characteristics / Optional Configuration Tx Burst = LOW (Enables the Transmitter)					
Parameter	Symbol	Min	Max	Units	Conditions / Notes
Tx_Data Differential Input Voltage	V _{IN}	200	1600	mV	LVPECL Tx_DATA Electrical Signal
Tx_Burst = HIGH (Transmitter OFF / DISABLED)	V _{IH}	2.4	3.3	V	LVTTL (Control INPUT)
Tx_Burst = LOW (Transmitter ON / ENABLED)	V _{IL}	0	0.8	V	LVTTL (Control INPUT)
Tx_FAULT = HIGH (Laser OFF / FAULT Condition)	V _{OH}	2.4	3.3	V	LVTTL (Monitor OUTPUT)
Tx_FAULT = LOW (Laser ON / NORMAL)	V _{OL}	0	0.8	V	LVTTL (Monitor OUTPUT)

Receiver Electrical Characteristics					
Parameter	Symbol	Min	Max	Units	Conditions / Notes
Rx_Data Differential Output Voltage	V _{OUT}	200	1600	mV	CML Rx_DATA Electrical Signal
Rx_SD = HIGH (Receiver ON / NORMAL)	V _{OH}	2.4	3.3	V	LVTTL (Monitor OUTPUT)
Rx_SD = LOW (Receiver OFF / LOSS of SIGNAL)	V _{OL}	0	0.8	V	LVTTL (Monitor OUTPUT)



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I²C Serial Logic

Parameter	Symbol	State	Min	Max	Units
I ² C Serial Data	SDA	HIGH	2.0	V _{CC} +0.3	V
I ² C Serial Data	SDA	LOW	0	0.8	V
I ² C Serial Clock	SCL	HIGH	2.0	V _{CC} +0.3	V
I ² C Serial Clock	SCL	LOW	0	0.8	V

Upstream Burst Mode Transmitter Optical Characteristics

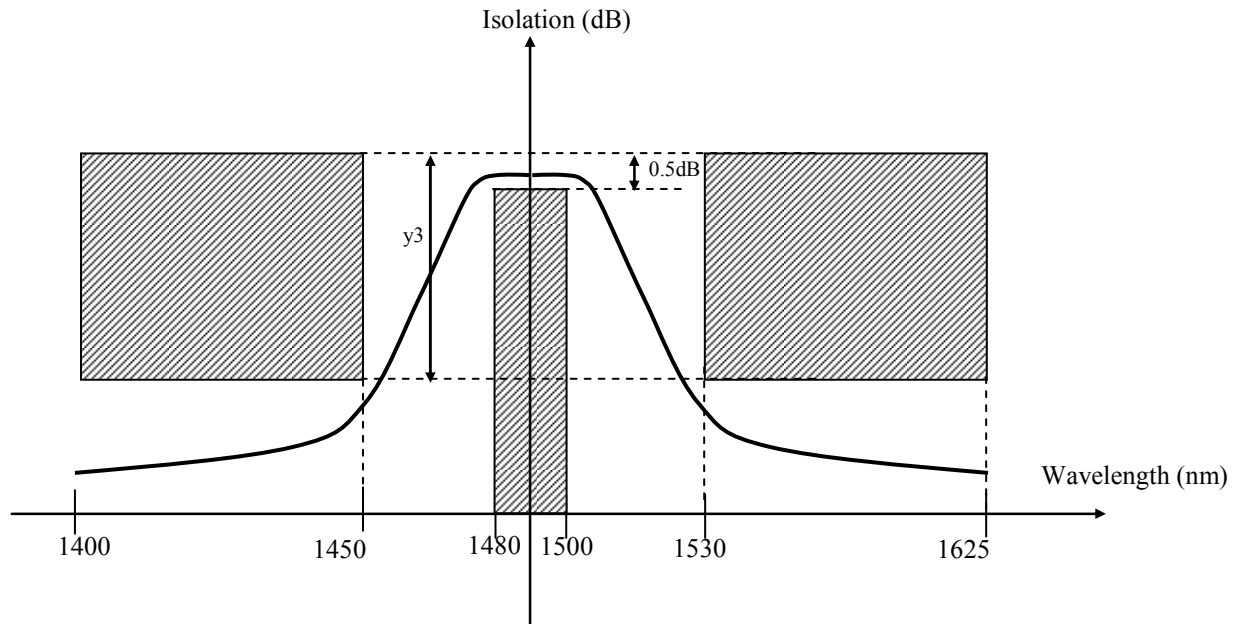
Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Transmitter Type		1310nm DFB Burst Mode				
Transmitter Control		Burst Mode ON / OFF				
Upstream Signaling Speed	S _{up}	-	1244	-	Mb/s	
Average Launch Power (Mode 0)	P _{OUT}	0.5	-	5.0	dBm	Measured with PRBS 2 ²³ -1 plus 72 bits CID test pattern @1244Mb/s 1310nm, ER=10dB, 9/155µm G.652 SMF
Average Launch Power (Mode 1)		-2.5	-	2		
Average Launch Power (Mode 2)		-5.5	-	-1		
Optical Output with Tx OFF	P _{OFF}	-	-	-45	dBm	
Optical Rise and Fall Time	t _r / t _f	-	150	260	ps	20% to 80%
Optical Center Wavelength	λ	1290	1310	1330	nm	
Spectral Line Width @ -20 dB	Δλ	-	-	1.0	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Extinction Ratio	ER	10	-	-	dB	
Peak to Peak Jitter	J _{P-P}	-	-	0.2	UI	

LTB3468 Downstream CW Mode Receiver Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Conditions / Notes
Receiver Type		1490 nm APD / TIA CW Mode				
Optical Signal Monitor		Signal Detect				Rx_SD Monitors Rx ON / OFF state
Optical Center Wavelength	λ	1480	1490	1500	nm	
Rx Signaling Speed	S _{down}	-	2488	-	Mb/s	
Receiver Sensitivity	P _{IN}	-	-	-28	dBm	BER<10 ⁻¹⁰ , 2488Mb/s, PRBS 2 ²³ -1
Receiver Optical Overload	P _{IN} (SAT)	-8	-	-	dBm	BER<10 ⁻¹⁰ , 2488Mb/s, PRBS 2 ²³ -1
Maximum Input Optical Power	P _{IN} (MAX)	-	-	4	dBm	Damage Threshold
Continuous Identical Digits	CID	-	72	-	bits	
Polarization Dependent Loss	PDL	-	-	0.5	dB	1490nm to 1500nm
Rx_Signal Detect Assert	P _a	-	-	-28.5	dBm	
Rx_Signal Detect Deassert	P _d	-45	-	-	dBm	
Rx_Signal Detect Hysteresis	P _{hy}	0.5	-	-	dB	
Optical Isolation from External Source	ISO	25	-	-	dB	WBF Isolation (Only for the ITU-T G.984.5)



WBF Isolation characteristics (ITU-T G.984.5)



WBF Isolation characteristics

Wavelength (nm)	1400~1441	1450	1530	1539~1625
Isolation (dB)	y3	y3	y3	y3
	>35	>25	>25	>35

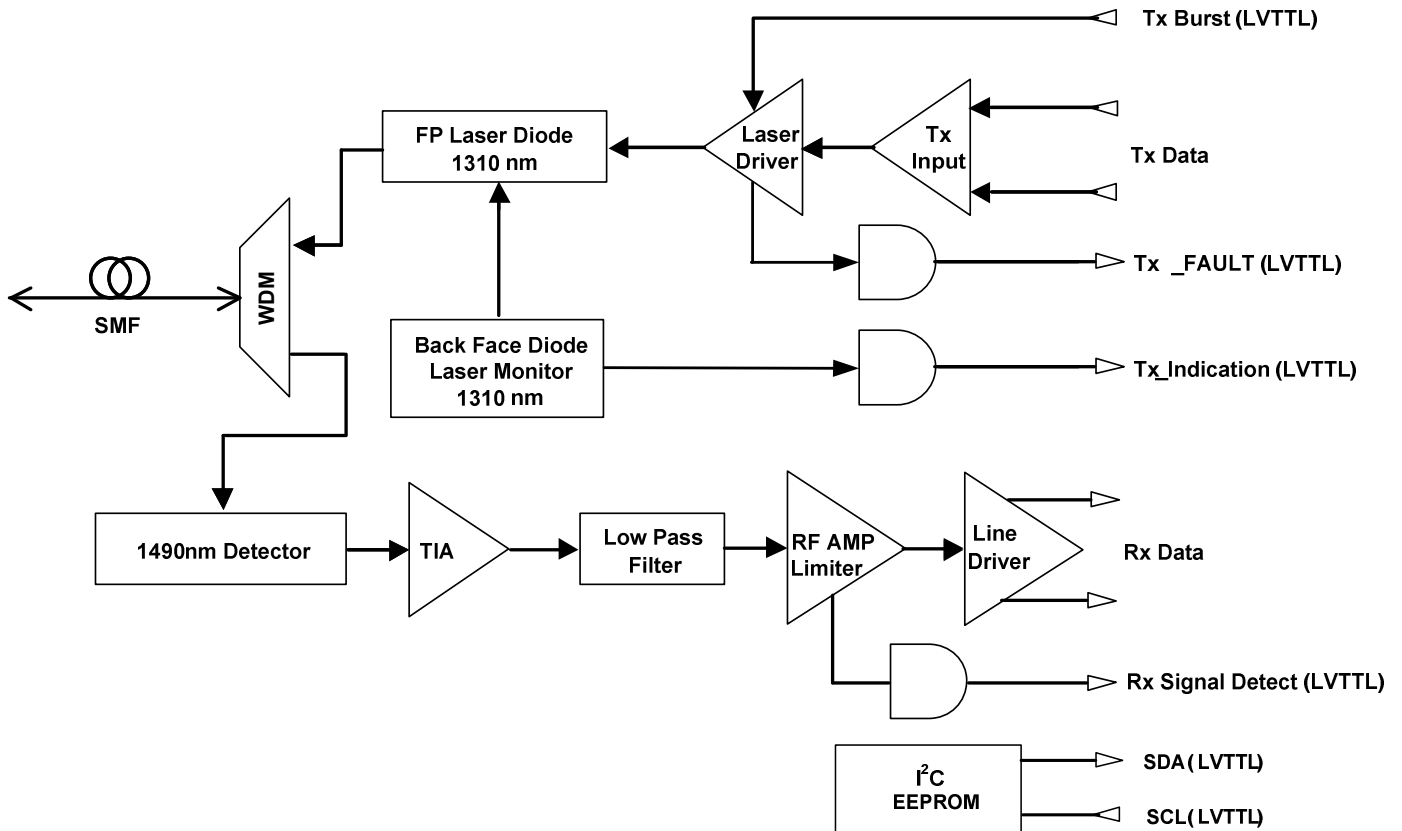


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LTB3468 Series Block Diagram





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Memory Map(Page 0xA0 HEX, Unlisted Fields are Blank/Empty, Memory is WRITE PROTECTED, SDA Communications is READ ONLY)

Address	Size (Byte)	Name of Field	Description	Values (HEX)
0	1	Identifier	SFF	02
1	1	Ext. Identifier	Non Standard GBIC Interface	04
2	1	Connector	Pigtail, SC/APC connector	0B
			SC Receptacle	01
3-10	8	Transceiver	OC-48 IR-2	00 0A 00 00 00 00 00 00
11	1	Encoding	NRZ	03
12	1	BR, Nominal	1244Mb/s	0C
13	1	Reserved	Reserved	00
14	1	Length(9µm)-km	20(units = km)	14
15	1	Length (9µm)-100m	200(units = 100m)	C8
16	1	Length (50µm)-10m	MMF Not Supported	00
17	1	Length (62.5µm)-10m	MMF Not Supported	00
18	1	Length (Copper)	Copper Not Supported	00
19	1	Reserved		00
20-35	16	Vendor name	"Ligent Photonics"	ASCII Format
36	1	Reserved		00
37-39	3	Vendor OUI	Programmed by Factory	Programmed by Factory
40-55	16	Vendor PN	The Part Number in the ordering information	ASCII Format
56-59	4	Vendor Rev No.	Programmed by Factory	Programmed by Factory
60 to 61	1	Tx Wavelength	Tx wavelength = 1310nm	05 1E
62	1	Reserved	Reserved	00
63	1	CC_BASE	Check sum of bytes 0-62	Programmed by Factory
64-65	2	Transceiver Options	Rx_SD, Tx_Fault, Tx_Burst	00 0C
66	1	BR, max	20%	14
67	1	BR, min	20%	14
68-83	16	Vendor SN	Programmed by Factory	Programmed by Factory
84-91	8	Date code	Year,Month,Day	Programmed by Factory
92	1	Diagnostic Monitoring Type	Compliant with SFF-8472 V9.3 Internally Calibrated Received power measurement type-Average Power	68
93	1	Enhanced Options	Optional Alarm/warning implemented Soft Tx_Burst ,Tx_FAULT implemented	E0
94	1	SFF-8472 Compliance	SFF-8472 V9.3	01
95	1	CC_EXT	Check sum of bytes 64-94	Programmed by Factory
96-127	32	Vendor Specific	Vendor Specific	Programmed by Factory
128-255	128	Vendor Specific	Vendor Specific	Programmed by Factory

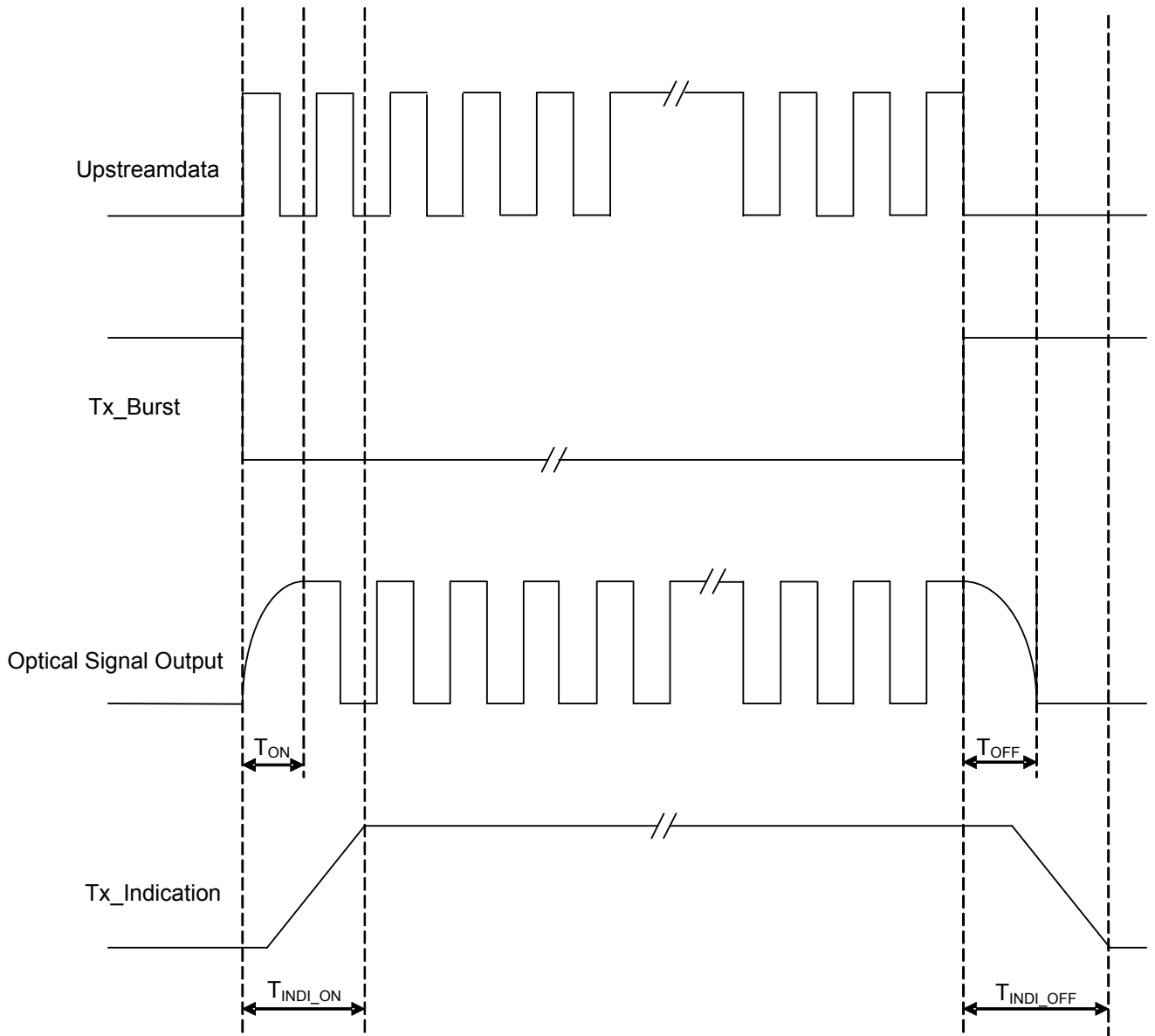


DDMI A2 (HEX) Address Table for Alarm and Warning Data

DDMI 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 Power	24	25	26	27	28	29	30	31	102	103	112 (1)	112 (0)	116 (1)	116 (0)
Rx Power	32	33	34	35	36	37	38	39	104	105	113 (7)	113 (6)	117 (7)	117 (6)



Tx Upstream Burst Mode Timing (Tx_Burst Low Enable)



LTB3468L Timing Diagram Characteristics

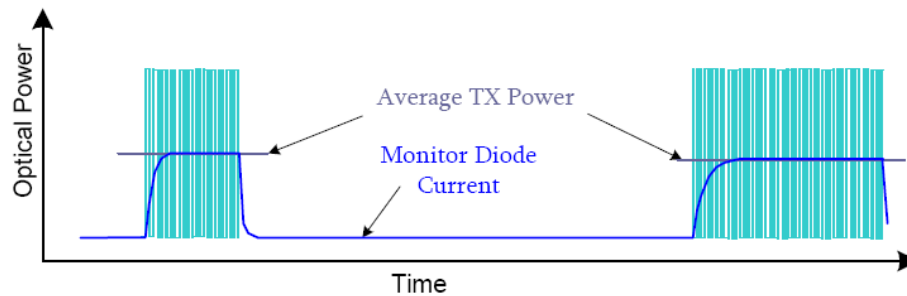
Parameter	Symbol	Min	Typ	Max	Units
Transmitter Turn ON Time	T_{ON}	-	-	12.8	ns
Transmitter Turn OFF Time	T_{OFF}	-	-	12.8	ns
Transmitter State Indication Turn ON Time	T_{INDI_ON}	-	-	350	ns
Transmitter State Indication Turn OFF Time	T_{INDI_OFF}	-	-	350	ns



Transceiver I ² C Monitor and Control Functions		
Parameter	Section	Description
1	Digital Transceiver	Transceiver Case Temperature
2	Digital Transceiver	V _{CC}
3	Digital Transceiver	Burst Mode Tx Optical Output Power
4	Digital Transceiver	Burst Mode Tx BIAS Current
5	Digital Transceiver	Tx Laser Transmitter Soft Disable Control
6	Digital Transceiver	Tx Laser Transmitter failure
7	Digital Transceiver	Rx Receiver Rower - RSSI

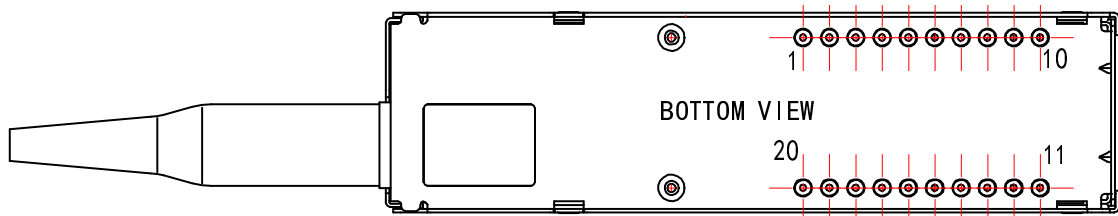
Burst Mode Digital Diagnostic Monitor Interface (DDMI) Description

Passive optical networks (PON) employ Burst Mode optical transmitters. Burst Mode transmitters are active a small percentage of the time (low duty cycle) and the Burst Time can vary from one Burst Period to another. The LTB3468 monitors the Tx Burst Mode power and the photo detector monitor current (BIAS). The DDMI WARNING and ALARM memory positions and addresses are compliant with the SFF 8472 Rev 9.3 specification.





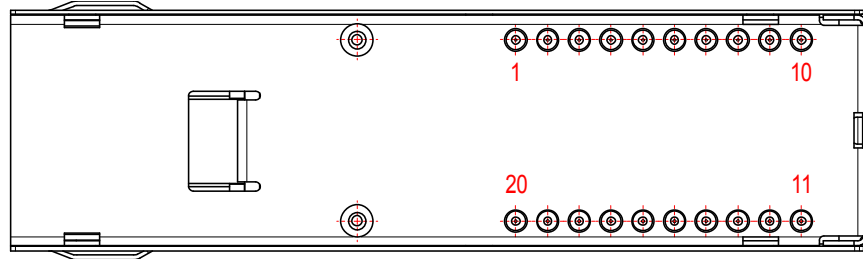
LTB3468 2X10 SFF Pigtail Pin Assignment



Pin Description			
Pin	Symbol	Description	Notes
1	N/C	Not Connected	
2	V _{EER}	Receiver Ground	
3	V _{EER}	Receiver Ground	
4	N/C	Not Connected	
5	N/C	Not Connected	
6	V _{EER}	Receiver Ground	
7	V _{CCR}	Receiver +3.3V DC Power Supply	
8	Rx_SD	Receiver Signal-Detected Indication	1
9	RD-	Rx_DATA Inverted Differential Output	2
10	RD+	Rx_DATA Non Inverted Differential Output	2
11	V _{CCT}	Transmitter +3.3V DC Power Supply	
12	V _{EET}	Transmitter Ground	
13	Tx_Burst	Transmit Burst Control	
14	TD+	Tx_DATA Non Inverted Differential Input	3
15	TD-	Tx_DATA Inverted Differential Input	3
16	V _{EET}	Transmitter Ground	
17	SCL	I ² C Serial Clock	4
18	SDA	I ² C Serial Data	4
19	Tx_Fault	Transmitter Fault	1
20	Tx_Indication	Tx Transmitter State Indication	
Notes			
1	LVTTTL logic output,with internal 10k pull-up resistor		
2	The 100 Ohm differential Rx Data output is internally AC coupled and terminated.		
3	The 100 Ohm differential Tx Data input is internally DC coupled and terminated.		
4	Require a pull up resistor of 4.7k to 10k Ohms.		



LTB3468 2X10 SFF SC Receptacle Pin Assignment



Pin Description			
Pin	Symbol	Description	Notes
1	N/C	Not Connected	
2	V _{EER}	Receiver Ground	
3	V _{EER}	Receiver Ground	
4	N/C	Not Connected	
5	N/C	Not Connected	
6	V _{EER}	Receiver Ground	
7	V _{CCR}	Receiver +3.3V DC Power Supply	
8	Rx_SD	Receiver Signal-Detected Indication	1
9	RD-	Rx_DATA Inverted Differential Output	2
10	RD+	Rx_DATA Non Inverted Differential Output	2
11	V _{CCT}	Transmitter +3.3V DC Power Supply	
12	V _{EET}	Transmitter Ground	
13	Tx_Burst	Transmit Burst Control	
14	TD+	Tx_DATA Non Inverted Differential Input	3
15	TD-	Tx_DATA Inverted Differential Input	3
16	V _{EET}	Transmitter Ground	
17	SCL	I ² C Serial Clock	4
18	SDA	I ² C Serial Data	4
19	Tx_Fault	Transmitter Fault	1
20	Tx_Indication	Tx Transmitter State Indication	
Notes			
1	LVTTTL logic output,with internal 10k pull-up resistor		
2	The 100 Ohm differential Rx Data output is internally AC coupled and terminated.		
3	The 100 Ohm differential Tx Data input is internally DC coupled and terminated.		
4	Require a pull up resistor of 4.7k to 10k Ohms.		



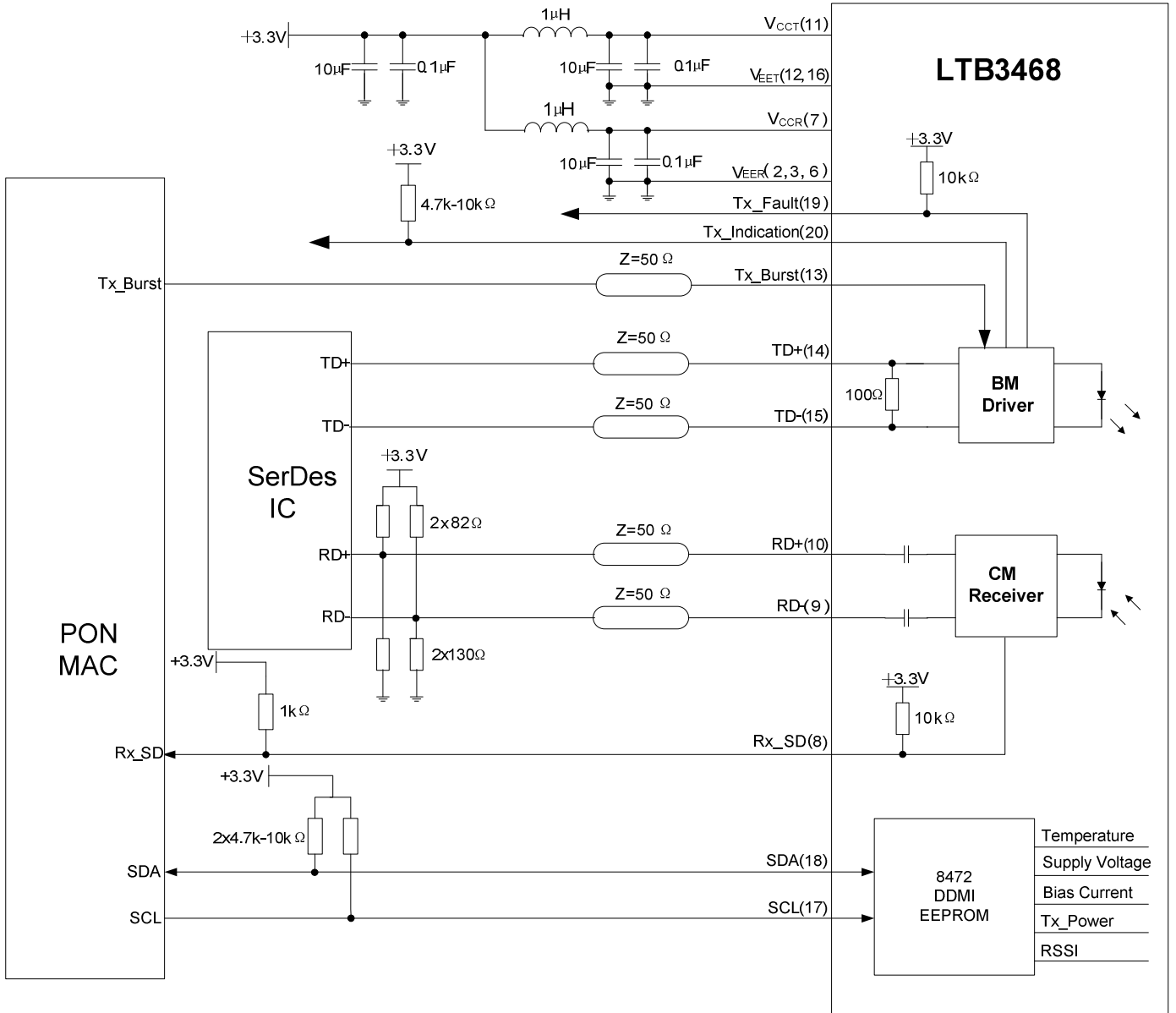
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LTB3468 SFF2x10 Pigtail Electrical Interface





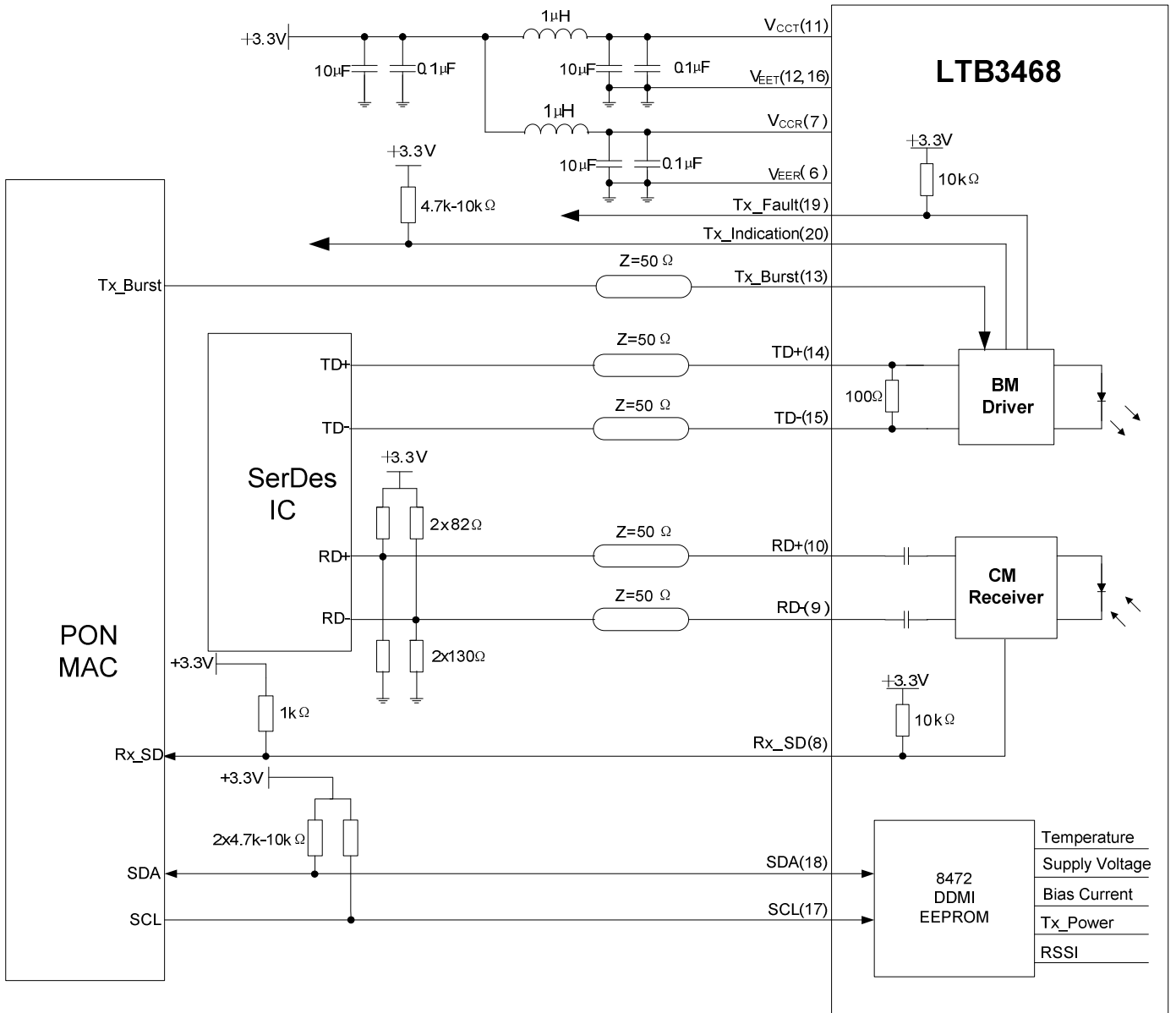
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LTB3468 Series GPON ONU Transceiver

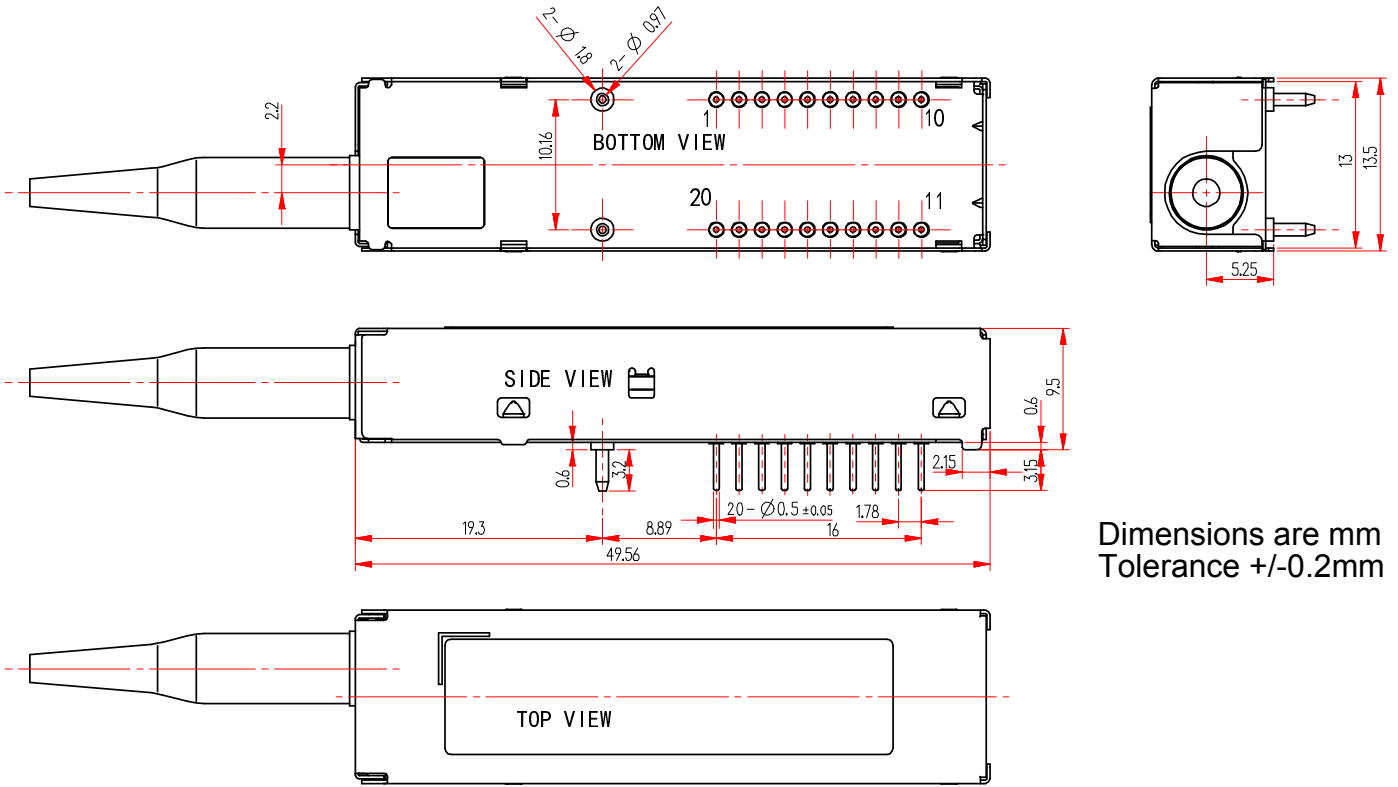
CLASS B+ 1244/2488Mb/s With Tx_Indication

LTB3468 SFF2x10 SC Receptacle Electrical Interface



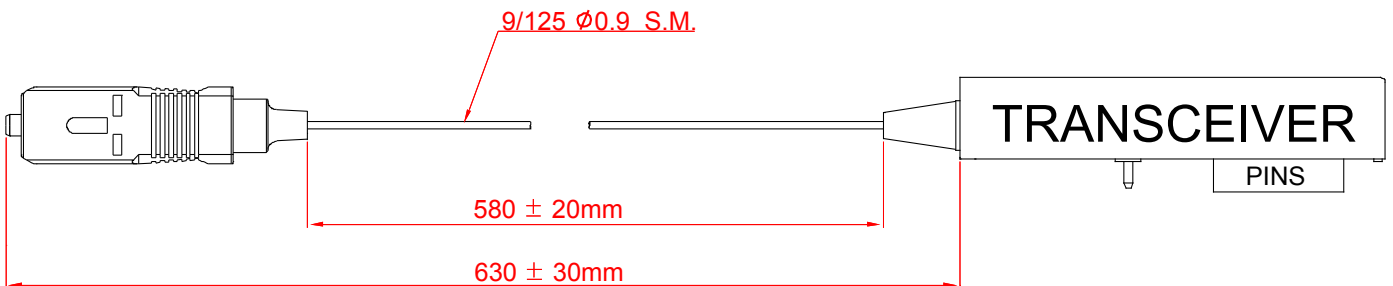


LTB3468 2x10 SFF Pigtail Outline Drawing



Dimensions are mm
Tolerance +/-0.2mm

LTB3468 2x10 SFF Pigtail Detail



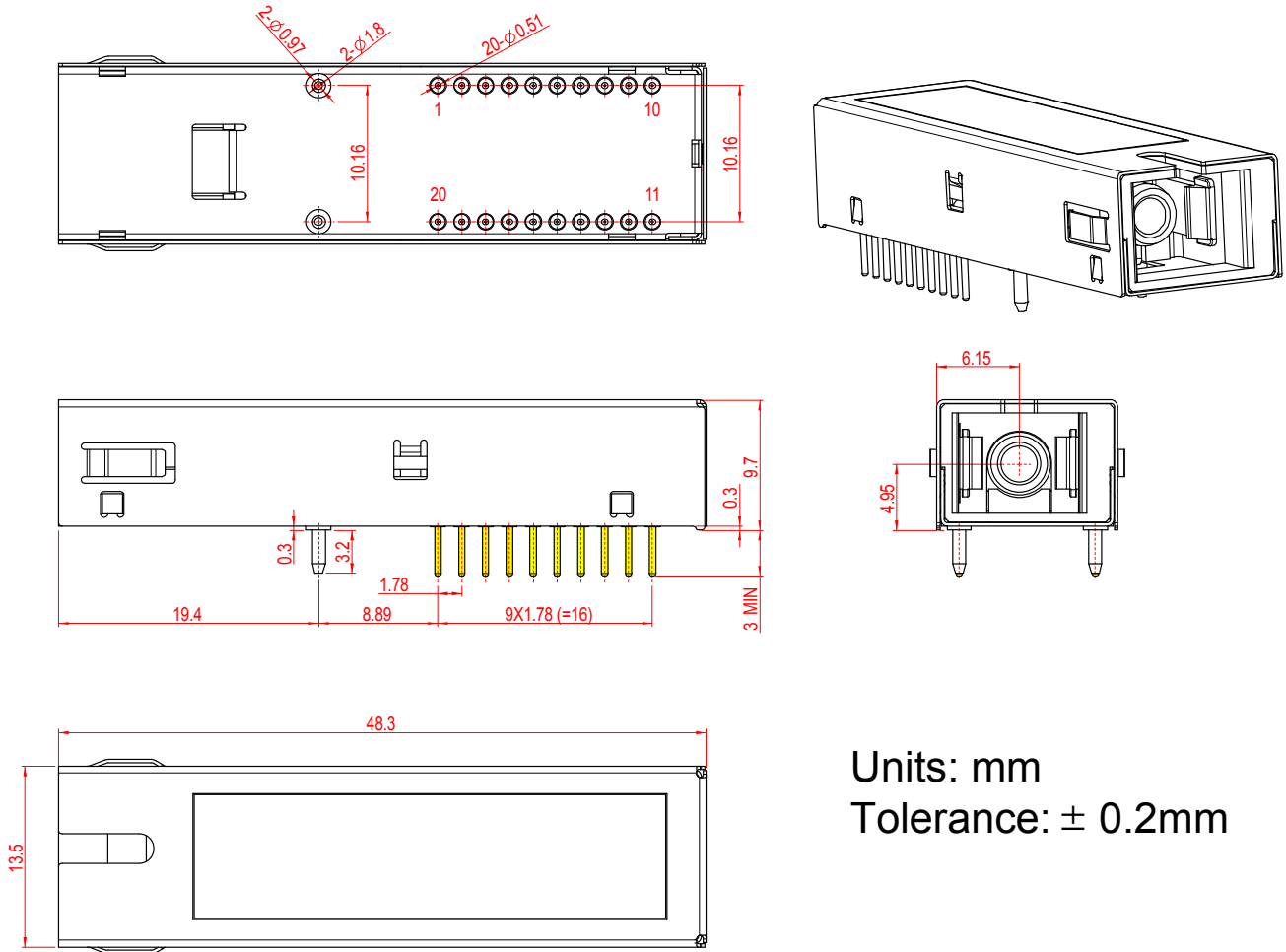


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LTB3468 Series GPON ONU Transceiver CLASS B+ 1244/2488Mb/s With Tx_Indication

LTB3468 Series 2x10 SFF Receptacle Package Outline Drawing





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.

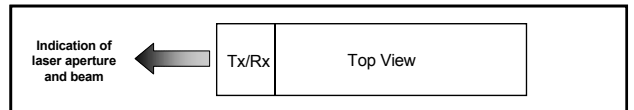
NOTICE

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 .

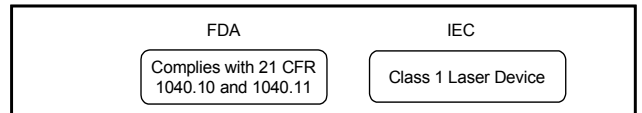
REQUIRED LABEL AND LASER EMISSION

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

REQUIRED LABEL



LASER EMISSION



LASER RADIATION INFORMATION	
Wavelength	1310nm
FDA Total Pout: 7mm aperture at 20 cm distance	< 195µwatts
IEC Total Pout : 7mm aperture at 10 cm distance	< 15,600µwatts
Beam Divergence	17.25°