Ligent intelligent photonics

LTE3680P-BC2 SFP GPON OLT Transceiver

CLASS C++ 2488/1244 Mb/s With Digital RSSI Function

The LTE3680P is a low cost point to multi point (P2MP) Fiber to the Home, Business or Curb (FTTX) GPON OLT transceiver. It is designed for 2488Mb/s downstream / 1244Mb/s upstream duplex data links that employ high-speed burst mode TDM receivers/transmitters. It is based on the ITU-T G.984.2 Class C++ specifications for bidirectional communications over a single fiber and incorporates a high performance 1310nm Burst Mode APD/TIA receiver and 1490nm CW mode DFB transmitter with internal optical isolator. The Burst Signal Detect (BSD), the Burst Mode Receiver Reset (Rx_RESET), Transmit Disable (Tx_DIS), Transmit Fault (Tx_FAULT) and the SFF-8472 I^2C diagnostic interface monitor and control functions are LVTTL compatible. The industry standard 2x10 small form pluggable (SFP) package incorporates the SC receptacle. It is fabricated with a rugged die cast metal housing and cage assembly. Commercial temperature range is available. It is IEC 60825-1 Class I laser safety compliant and meets the EEC Directive 2002/95/EC for RoHS compliance.

Applications

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

Features

- Dual Wavelength Bidirectional Transceiver
- 2488Mb/s Downstream
- 1244Mb/s Upstream
- BER<10^{-10}, 1244Mb/s, PRBS 2^{23}-1
- 1310nm APD/TIA Burst Mode Receiver
- 1490nm CW Mode DFB Laser with Isolator
- ITU-T G.984.2 Complaint
- SFF-8472 Ver9.3 compliant
- Single 3.3V DC supply
- Low Power Consumption
- 2x10 SFF Package Outline
- Single Fiber, Full Duplex Operation
- SC Optical Receptacle
- Case Operating Temperature Range:
  - Commercial: 0 to +70°C
- Data and Control interfaces

Tx_Data	LVPECL/AC Coupled
Rx_Data	LVPECL/DC Coupled
Tx_DIS	LVTTL
Tx_FAULT	LVTTL
Rx_Reset	LVTTL
BSD	LVTTL

- RoHS6

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units	Notes
Case Operating Temperature	T_{case}	0	25	+70	°C	Temperature Range = C
Module Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Module Supply Current	I_{IN}	-	350	500	mA	
Downstream Signaling Speed +/- 100ppm	S_{down}	-	2488	-	Mb/s	
Upstream Signaling Speed +/- 100ppm	S_{up}	-	1244	-	Mb/s	

Ordering Information

Part Number	Case Operating Temperature
LTE3680P-BC2	0 to 70°C

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Absolute Maximum Ratings					
Parameter	**Symbol**	**Min**	**Max**	**Units**	**Notes**
Storage Temperature	T_{stg}	-40	+85	ºC	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	%	
Module Supply Voltage	V_{CC}	0	3.6	V	
Absolute Maximum Ratings: Optical and Electrical Signal Levels					
Parameter	**Symbol**	**Min**	**Max**	**Units**	**Notes**
Transmit DISABLE Logic HIGH State	Tx_DIS	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)
BSD Logic HIGH State	BSD	0	V_{CC}+0.5	V	LVTTL
Receiver RESET Logic HIGH State	Rx_RESET	0	V_{CC}+0.5	V	LVTTL (Receiver is being RESET)
I^2C Serial Data Logic HIGH State	SDA	-	V_{CC}+0.5	V	LVTTL
I^2C Serial Clock HIGH State	SCL	-	V_{CC}+0.5	V	LVTTL

Transmitter Electrical Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions / Notes**
Tx_Data Differential Input Voltage	V_{IH}-V_{IL}	200	-	1600	mV	LVPECL Tx_DATA Electrical Signal
Tx_DIS = HIGH (Transmitter OFF / DISABLED)	V_{IH}	2.2	-	V_{CC}+0.3	V	LVTTL (Control INPUT)
Tx_DIS = LOW (Transmitter ON / ENABLED)	V_{IL}	0	-	0.8	V	LVTTL (Control INPUT)
Tx_FAULT = HIGH (Laser OFF / FAULT)	V_{OH}	2.4	-	V_{CC}+0.3	V	LVTTL (Monitor OUTPUT)
Tx_FAULT = LOW (Laser ON / NORMAL)	V_{OL}	0	-	0.4	V	LVTTL (Monitor OUTPUT)
Receiver Electrical Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions / Notes**
Rx_Data Differential Output Voltage	V_{IH}-V_{IL}	200	-	1600	mV	LVPECL Rx_DATA Electrical Signal
BSD (Burst Signal Detect) = HIGH	V_{OH}	2.0	-	V_{CC}+0.3	V	LVTTL
BSD (Burst Signal Detect) = LOW	V_{OL}	0	-	0.8	V	LVTTL
Rx_RESET = HIGH (Receiver RESET)	V_{IH}	2.2	-	V_{CC}+0.3	V	LVTTL (Control Input)
Rx_RESET = LOW (Receiver ON / NORMAL)	V_{IL}	0	-	0.8	V	LVTTL (Control Input)

I^2C Serial Logic						
Parameter	**Symbol**	**State**	**Logic**	**Min**	**Max**	**Units**
I^2C Serial Data	SDA	HIGH	LVTTL	2.2	V_{CC}+0.3	V
	SDA	LOW	LVTTL	0	0.8	V
I^2C Serial Clock	SCL	HIGH	LVTTL	2.2	V_{CC}+0.3	V
	SCL	LOW	LVTTL	0	0.8	V

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Transmitter Optical Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions / Notes**
Transmitter Type	1490nm DFB Laser with Isolator					CW Mode
Downstream Signaling Speed	STx		2488		Mb/s	
Average Launch Power (BOL)	P_{BOL}	5.5	-	10.0	dBm	
Average Launch Power (EOL)	P_{EOL}	4.5	-	10.0	dBm	
Average Launch Power with Tx OFF	P_{OFF}	-	-	-40	dBm	
Optical Rise and Fall Time	t_r / t_f	-	-	180	ps	20% to 80%
Optical Center Wavelength	λ	1480	1490	1500	nm	
Spectral Line Width @ -20dB	Δλ	-	-	1.0	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Extinction Ratio	ER	8.2	-	-	dB	
Transmit Output Eye	Compliant with G.984.2					Data Rate = 2488 Mb/s

Receiver Optical Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Units**	**Conditions / Notes**
Receiver Type	1310nm APD/TIA Burst Mode					
Optical Signal Indicator		Burst Packet Detect				
Upstream Signaling Speed	S		1244		Mb/s	
Optical Center Wavelength	λ	1280	1310	1360	nm	
Receiver Sensitivity (BOL)	P_{BOL1}	-	-	-33	dBm	BER<10^{-4}, 1244 Mb/s, PRBS 2^{23}-1
Receiver Sensitivity (EOL)	P_{EOL1}	-	-	-32	dBm	BER<10^{-4}, 1244 Mb/s, PRBS 2^{23}-1
Receiver Sensitivity (BOL)	P_{BOL2}	-	-	-31	dBm	BER<10^{-10}, 1244 Mb/s, PRBS 2^{23}-1
Receiver Sensitivity (EOL)	P_{EOL2}	-	-	-30	dBm	BER<10^{-10}, 1244 Mb/s, PRBS 2^{23}-1
Receiver Optical Overload	P_{IN}(SAT)	-12	-	-	dBm	BER<10^{-10}, 1244 Mb/s, PRBS 2^{23}-1
Maximum Input Optical Power	P_{IN}(MAX)	-	-	2	dBm	Damage Threshold
Receiver Reflectance	RFL	-	-	-20	dB	

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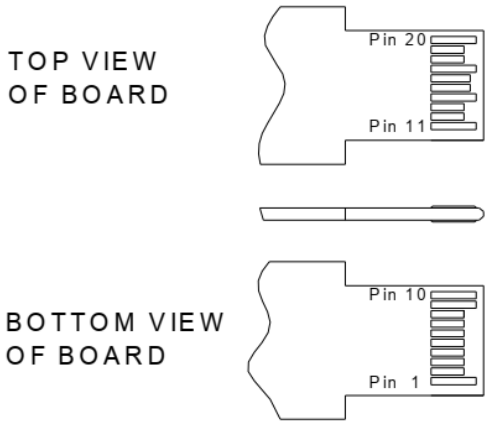
PIN Assignment



PIN Description

PIN	Symbol	Description	Notes
1	V_{EET}	Transmitter Ground	
2	Tx_FAULT	Transmitter Fault, LOW = Normal Operation, HIGH = Fault Indication	1
3	Tx_DIS	Transmit Disable, LOW = Normal Operation, HIGH = Disables Module	1
4	MOD_DEF 2	Module Definition 2 - Two-Wire Interface - Serial Data	1
5	MOD_DEF 1	Module Definition 1 - Two-Wire Interface - Clock Signal	1
6	MOD_DEF 0	Module Definition 0 - Two-Wire Interface Digital Ground	
7	Rx_RESET	Rx Reset Pulse Input, High Level Input at the end of Previous Packet	
8	BSD	Burst Signal Detect, Assert High when Burst Packet Coming, Assert Low when Reset Pulse Input	
9	RSSI_TRI	RSSI Trigger Input	
10	V_{EER}	Receiver Ground	
11	V_{EER}	Receiver Ground	
12	RD-	Rx_Data Output (Inverted)	2
13	RD+	Rx_Data Output (Non Inverted)	2
14	V_{EER}	Receiver Ground	
15	V_{CCR}	Receiver DC Power	3.3 V +/- 5%
16	V_{CCT}	Transmitter DC Power	3.3 V +/- 5%
17	V_{EET}	Transmitter Ground	
18	TD+	Tx_Data Input (Non Inverted)	3
19	TD-	Tx_Data Input (Inverted)	3
20	V_{EET}	Transmitter Ground	

Notes

1. The uncommitted Tx_Fault, MOD_DEF 1 and MOD_DEF 2 LVTTL monitor and control pins each require a pull up resistor of 4.7k to 10k Ohms
2. The 100Ohms differential Rx Data output is internally DC coupled.
3. The 100Ohms differential Tx Data input is internally AC coupled and terminated.

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EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0). Memory Contents of Serial ID are shown in Table below.

I²C Memory Map (Page A0 HEX, Unlisted Fields are Blank / Empty)

IIC Addr	Size	Name	Description	Values (HEX)
0	1	Identifier	SFP	03
1	1	Extended Identifier	Extended Identifier	04
2	1	Connector	Connector Type = SC	01
3-10	8	Transceiver	Compatibility	00 14 00 00 00 00 00 00
11	1	Encoding	Encoding Type = NRZ	03
12	1	BR, Nominal	Nominal Bit Rate 2488Mb/s	19
13	1	Reserved	Reserved	00
14	1	Length(9µm)-km	60km Link Length in Kilometers / SMF	3C
15	1	Length (9µm)-100m	60km Link Length in Hundreds of Meters / SMF	FF
16	1	Length (50µm)-10m	50-micron MMF Link Length = N/A	00
17	1	Length (62.5µm)-10m	62.5-micron MMF Link Length = N/A	00
18	1	Length (Copper)	Copper Link Length = N/A	00
19	1	Reserved	Reserved	00
20-35	16	Vendor name	Ligent Photonics	ASCII Format
36	1	Reserved	Reserved	00
37-39	3	Vendor OUI	SFP Vendor IEEE Company ID	Programmed by Factory
40-55	16	Vendor PN	The Part Number in the ordering information	ASCII Format
56-59	4	Vendor Revision Number	Programmed by Factory	Programmed by Factory
60-61	2	Wavelength	Laser Wavelength = 1490nm	05 D2
62	1	Reserved	Reserved	00
64-65	2	Transceiver Options	1. Rx_SD 2. Tx_FAULT 3. Tx_Disable	00 1C
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	Programmed by Factory	Programmed by Factory
92	1	Diagnostic Monitoring Type	Digital Diagnostic Monitoring Implemented Address Change Required	58
93	1	Enhanced Options	1. Optional Alarm/Warning Implemented 2. Soft Tx_DISABLE Monitor and Control 3. Soft Tx_FAULT Monitor	E0
94	1	SFF-8472 Compliance	SFF 8472 Revision 9.3 Implemented	01
95	1	CC_EXT	Check_Sum (64 to 94)	Programmed by Factory
96-127	32	Vendor Specific	Vendor Specific EEPROM	Programmed by Factory
128-255	128	Reserved	Reserved	Programmed by Factory

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A2 (hex) 8472 Digital Diagnostic Table - Summary of Parameters in the A2 (hex) Parametric Table

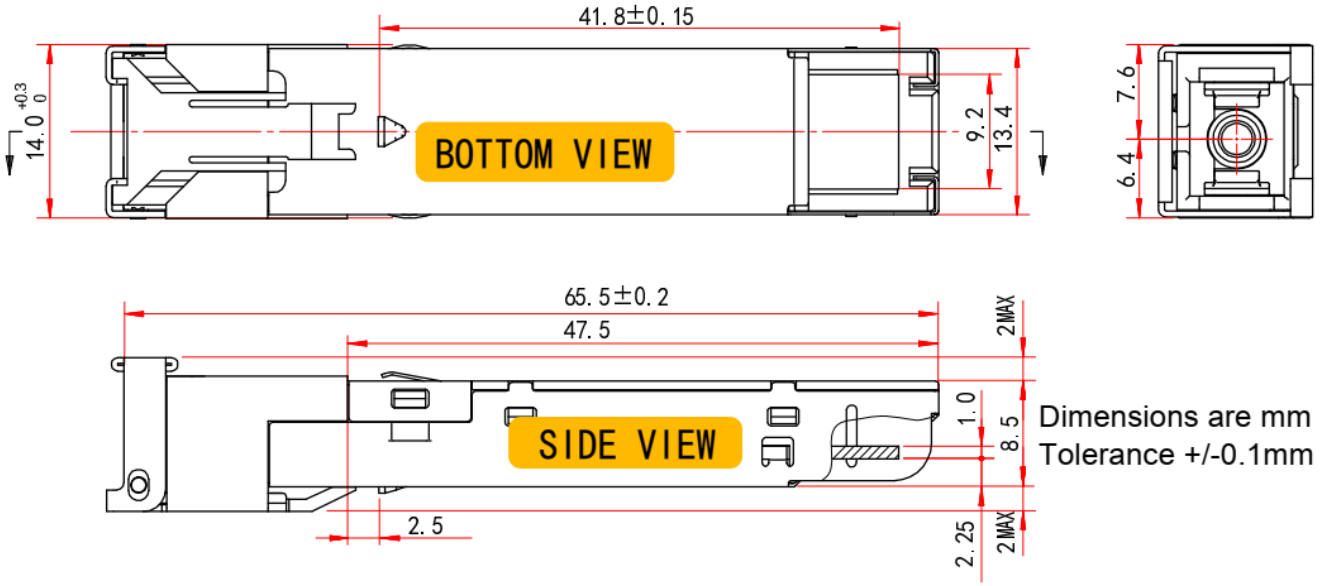
The data in the parameter tables are compared with the data in the measured data tables in order to create a warning or alarm status bit

The Warning or Alarm bit is set when the parameter drops below or exceeds the Low or High values stored in memory.

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

8472 Parameter	Alarm Threshold Data				Warning Threshold Data				Internally Measured Values		Alarm Bit (Set) Address + Position		Warning Bit (Set) Address + Position	
	High Value		Low Value		High Value		Low Value							
	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(6)	117(7)	117(6)

Mechanical Dimensions



Dimensions are mm
Tolerance +/-0.1mm

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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 meets the flammability requirements of UL94.

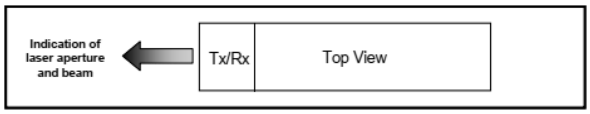
NOTICE

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 .

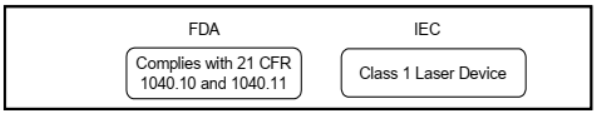
REQUIRED LABEL AND LASER EMISSION

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

REQUIRED LABEL



LASER EMISSION



LASER RADIATION INFORMATION	
Wavelength	1330nm
FDA Total Pout: 7mm aperture at 20cm distance	< 790µwatts
IEC Total Pout: 7mm aperture at 14cm distance	< 10,000µwatts
Beam Divergence	17.25º