

# LC GIGABIT 80KM 1490/1570NM SFP TRANSCEIVER W/ DIGITAL DIAGNOSTICS

**TRBCG1HXZx000E1G**



## Product Description

The TRBCG1HKZx000E1G and TRBCG1HMZx000E1G modules are single fiber, bi-directional SFP transceivers that provide a quick and reliable interface for 100BASE-BX-D/U Gigabit Ethernet applications.

Two types of modules are available: the 1490nm DFB laser-based transceiver (BX-U) and the 1570nm DFB laser-based transceiver (BX-D). The transceivers possess option to be integrated with digital diagnostics monitoring, which provides features to detect a problem before system performance is impacted. The diagnostic functions, alarms and warning features are provided via an I<sup>2</sup>C serial interface as described per the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.4).

All modules meet Class I Laser Safety requirements in accordance with the U.S. and international standards as described in the FDA/CDRH and IEC-60825 documents, respectively.

The TRBCG1HKZx000E1G and TRBCG1HMZx000E1G transceivers connect to standard 20-pad SFP connectors for hot plug capability. This allows the system designer to make configuration or maintenance changes by simply plugging in different types of transceivers without removing the power supply from the host system.

The transceivers have color-coded latches that identify the TX wavelength. The MSA compliant latch offers an easy and convenient way to release the module.

The transmitter and receiver DATA interfaces are AC-coupled internally. LV-TTL Transmitter Disable control input and Loss of Signal output interfaces are also provided. The transceivers operate from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C or -40°C to +85°C. The package is made of metal for EMI immunity.



## Features

- Lead Free Design & Fully RoHS Compliant
- Compatible with SFP MSA
- Compatible with IEEE 802.3z Gigabit Ethernet Standard
- Wavelengths of 1490nm and 1570nm
- Distances up to 80km over Single Mode Fiber
- Option of -40°C to +85°C Operating Temperature Range
- Eye Safe (Class I Laser Safety)
- Simplex LC Optical Interface
- Hot-pluggable
- TX Fault & Loss of Signal Outputs
- TX Disable Input
- Single +3.3V Power Supply
- Digital Diagnostics function

## Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature Range	$T_{ST}$	- 40	+ 85	°C
Case Operating Temperature <sup>[1]</sup>	Commercial	- 5	+ 70	°C
	Industrial	- 40	+ 85	
Supply Voltage	$V_{CC}$	0	+ 4.5	%
Input Voltage	$V_{IN}$	0	$V_{CC}$	V

<sup>[1]</sup> Measured on top side of SFP module at the front center vent hole of the cage.

**Transmitter Performance Characteristics** (Over Operating Case Temperature.  $V_{cc} = 3.13$  to  $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units	
Operating Data Rate		$B$	-	1250	-	Mb/s	
Optical Output Power <sup>(1)</sup>		$P_o$	-2	-	3	dBm	
Center Wavelength	BX-U	1490nm DFB	$\lambda_c$	1460	1490	1520	nm
	BX-D	1570nm DFB		1560	1570	1620	
Spectral Width (-20dB)	BX-U	1470 - 1510nm	$\Delta\lambda_{20}$	-	-	1	nm
	BX-D	1550 - 1590nm		-	-	1	
Extinction Ratio		$P_{hi}/P_{lo}$	6	-	-	dB	
Transmitter OFF Output Power		$P_{OFF}$	-	-	-45	dBm	
Relative Intensity Noise		$RIN_{12,OMA}$	-	-	-113	dB/Hz	
Total Jitter		$T_J$	-	-	227	ps	
Transmitter Output Eye		Compliant with Eye Mask Defined in IEEE 802.3-2005 Standard					
<sup>(1)</sup> Measured average power coupled into single mode fiber							

**Receiver Performance Characteristics** (Over Operating Case Temperature.  $V_{cc} = 3.13$  to  $3.47V$ )

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate		$B$	-	1250	-	Mb/s
Minimum Input Optical Power ( $10^{-12}$ BER) <sup>(1)</sup>		$P_{min}$	-26.0	-	-	dBm
Maximum Input Optical Power ( $10^{-12}$ BER) <sup>(1)</sup>		$P_{max}$	-1	-	-	dBm
LOS Thresholds	Increasing Light Input	$P_{los+}$	-	-	-26.0	dBm
	Decreasing Light Input	$P_{los-}$	-45.0	-	-	
LOS Hysteresis <sup>(1)</sup>		-	0.5	-	-	dB
Total Jitter		$T_J$	-	-	266	ps
Wavelength of Operation	BX-U	$\lambda$	1560	1570	1620	nm
	BX-D		1460	1490	1520	
Receiver Reflectance		-	-	-	-12	dB
<sup>(1)</sup> Measured at 1250 Mb/s with 2 <sup>7</sup> -1 PRBS and 1310nm, 1490nm & 1570nm wavelengths.						

**Laser Safety:**

All transceivers are Class I Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.

	<b>Oplink Communications, Inc.</b> DATE OF MANUFACTURE:	
	This product complies with 21 CFR 1040.10 and 1040.11 <b>Meets Class I Laser Safety Requirements</b>	

**Transmitter Electrical Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) <sup>[1]</sup>	$V_{PP-DIF}$	0.5	-	2.0	V
Input HIGH Voltage (TX Disable) <sup>[2]</sup>	$V_{IH}$	2.0	-	$V_{CC}$	V
Input LOW Voltage (TX Disable) <sup>[2]</sup>	$V_{IL}$	0	-	0.8	V
Output HIGH Voltage (TX Fault) <sup>[3]</sup>	$V_{OH}$	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (TX Fault) <sup>[3]</sup>	$V_{OL}$	0	-	0.8	V

<sup>[1]</sup> Differential peak-to-peak voltage.  
<sup>[2]</sup> There is an internal 4.7 to 10kΩ pull-up resistor to Vcc.  
<sup>[3]</sup> Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc.

**Receiver Electrical Interface** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (RD+ & RD-) <sup>[1]</sup>	$V_{PP-DIF}$	0.37	-	2	V
Output HIGH Voltage (LOS) <sup>[2]</sup>	$V_{OH}$	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) <sup>[2]</sup>	$V_{OL}$	0	-	0.5	V

<sup>[1]</sup> Differential peak-to-peak voltage across external 100Ω load.  
<sup>[2]</sup> Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc.

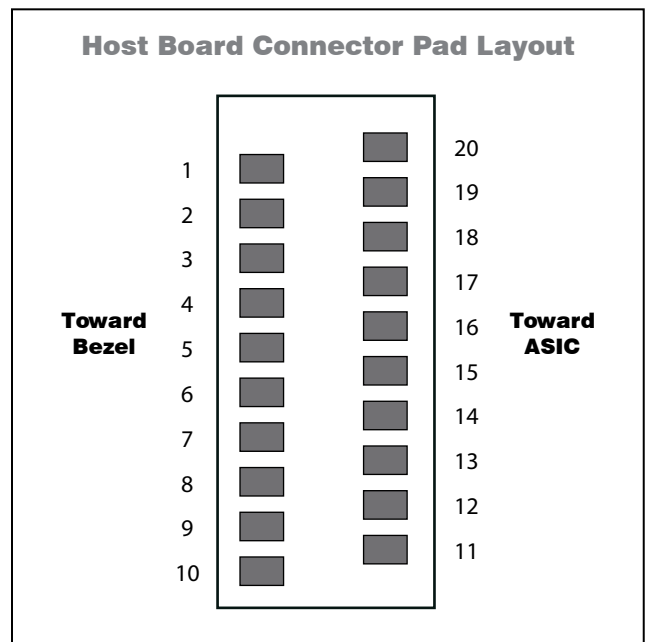
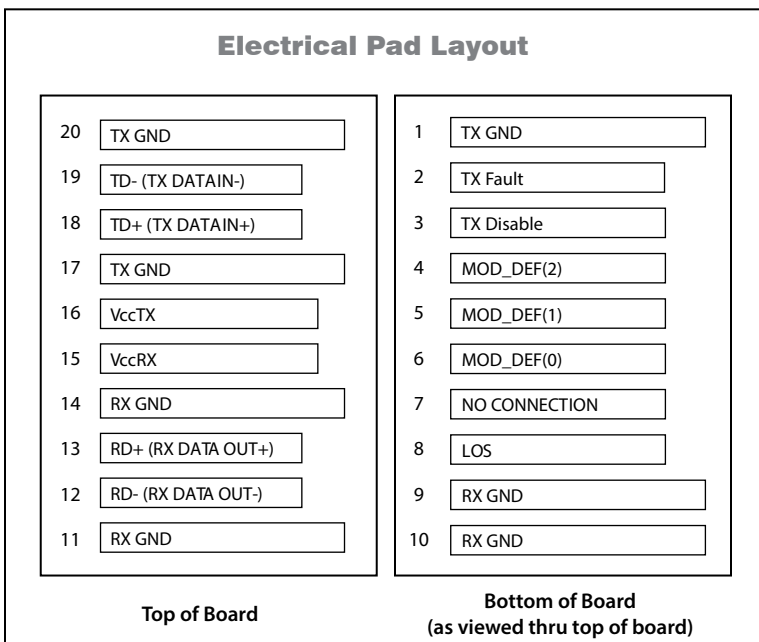
**Electrical Power Supply Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{CC}$	3.13	3.3	3.47	V
Power Consumption <sup>[1]</sup>	$P_W$	-	-	1	V
Power Consumption <sup>[2]</sup>	$P_W$	-	-	1.2	mA

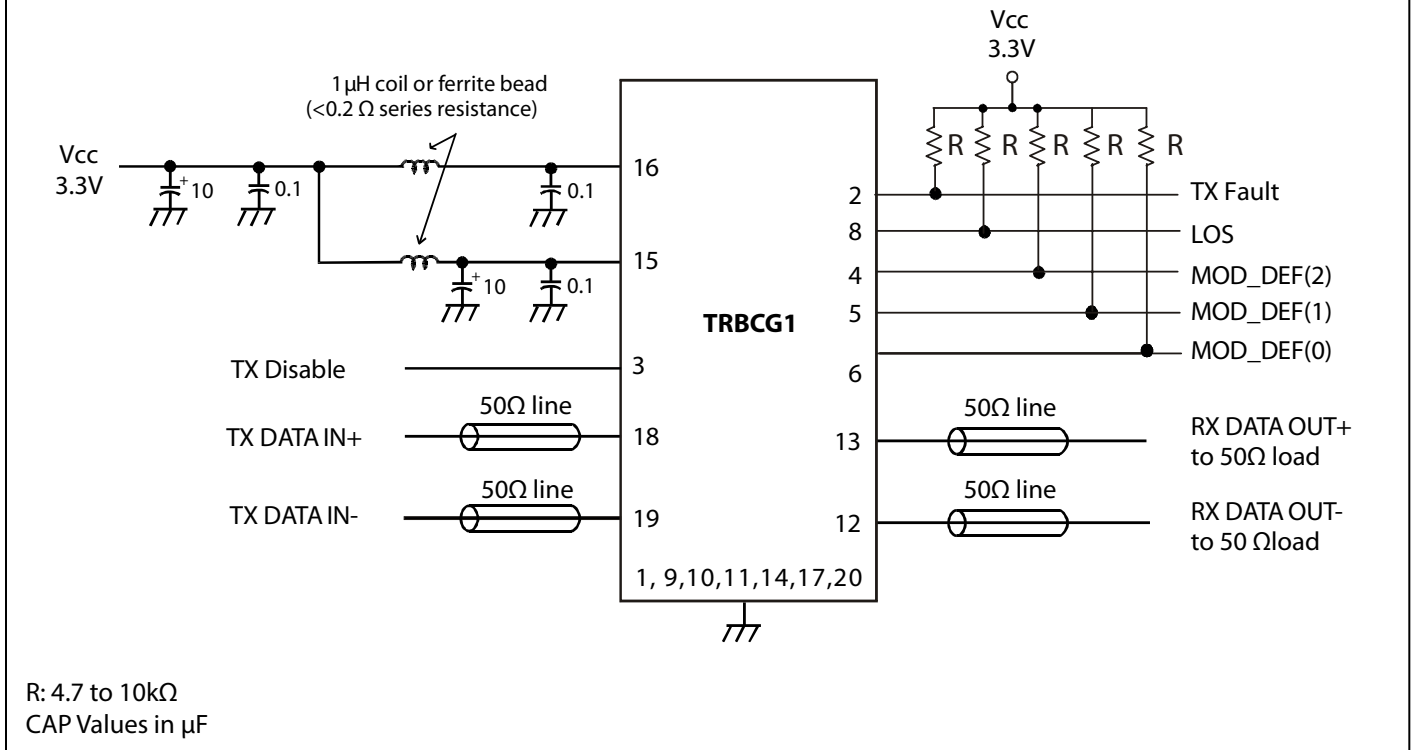
<sup>[1]</sup> Power consumption is 1W for the TRx about 1490nm Tx (I temp, E temp & C temp) and 1570nm Tx (C temp).  
<sup>[2]</sup> Power consumption is 1.2W for the TRx about 1570nm Tx (E temp & I temp).

**Module Definition**

MOD_DEF(0) pin 6	MOD_DEF(1) pin 5	MOD_DEF(2) pin 4	Interpretation by Host
TTL LOW	SCL	SDA	Serial module definition protocol



### Example of SFP host board schematic



### Application Notes

**Electrical Interface:** All signal interfaces are compliant with the SFP MSA specification. The high speed DATA interface is differential AC-coupled internally with  $1\mu\text{F}$  and can be directly connected to a 3.3V SERDES IC. All low speed control and sense output signals are open collector TTL compatible and should be pulled up with a 4.7 - 10kΩ resistor on the host board.

**Loss of Signal (LOS):** The Loss of Signal circuit monitors the level of the incoming optical signal and generates a logic HIGH when an insufficient photocurrent is produced.

**TX\_Fault:** The output indicates LOW when the transmitter is operating normally and HIGH with a laser fault including laser end-of-life. TX Fault is an open collector/drain output and should be pulled up with a 4.7 - 10kΩ resistor on the host board. TX Fault is non-latching (automatically de-asserts when fault goes away).

**TX\_Disable:** When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled (less than -45dBm).

**Serial Identification and Monitoring:** The module definition of SFP is indicated by the three module definition pins, MOD\_DEF(0), MOD\_DEF(1) and MOD\_DEF(2). Upon power

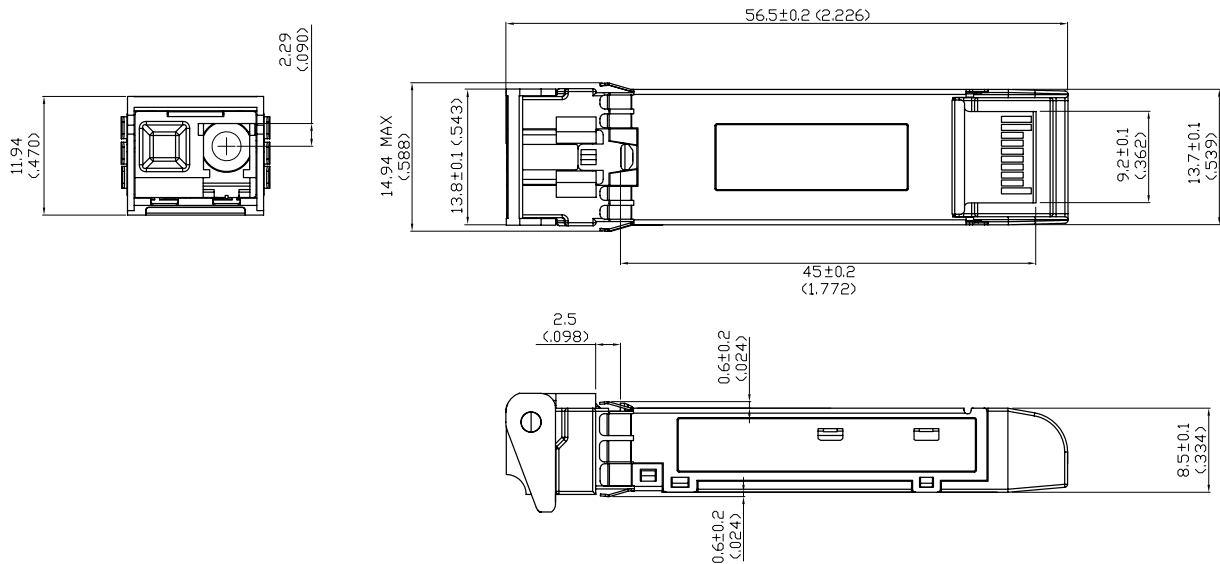
up, MOD\_DEF(1:2) appear as NC (no connection),

and MOD\_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I<sup>2</sup>C serial interface) and generates the serial clock signal (SCL). The negative edge clocks data from the SFP EEPROM.

The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in the SFP MSA. EEPROM ID is per SFF-8472, Rev. 9.4.

**Power Supply and Grounding:** The power supply line should be well-filtered. All  $0.1\mu\text{F}$  power supply bypass capacitors should be as close to the transceiver module as possible.

**Package Outline**


Notes: (UNLESS OTHERWISE SPECIFIED)  
 Dimensions in [inches] mm  
 [Default tolerances : .xxx=±.005", .xx= ±.01"]

**Ordering Information**

Part Number	DDM	Operation Temperature Range	Latch Color	Nominal Wavelength		Optical Link Power Budget	Distance
				Tx	Rx		
TRBCG1HKZI000E1G	YES	-40°C to +85°C	Violet	1490nm	1570nm	24dB	80km
TRBCG1HMZI000E1G	YES	-40°C to +85°C	Orange	1570nm	1490nm	24dB	80km
TRBCG1HKZC000E1G	YES	-5°C to +70°C	Violet	1490nm	1570nm	24dB	80km
TRBCG1HMZC000E1G	YES	-5°C to +70°C	Orange	1570nm	1490nm	24dB	80km

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