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TRBUG1CxBx000E2G
Multi-rate Gigabit & Fast Ethernet Transceivers
Bi-Directional SFP 1000BASE 10KM LC Receptacle

OPLINK
a **molex** company

Spec Outline			
	OPLINK	**Customer**	**Notes**
Spec. Number	S0489	NA	**-**
Spec. Revision	01	NA	**-**
Part Number	TRBUG1CFBI000E2G	NA	**-**
	TRBUG1CBBI000E2G	NA	
	TRBUG1CUBI000E2G	NA	
	TRBUG1CDBI000E2G	NA	
	TRBUG1CFBC000E2G	NA	
	TRBUG1CBBC000E2G	NA	
	TRBUG1CUBC000E2G	NA	
	TRBUG1CDBC000E2G	NA	
Initiate Date	Feb 27th, 2015	NA	**-**
Document History			
Date	**Status**	**Author**	**Remarks**
2015/2/27	Version 01	Bin Xiao	Preliminary Specifications

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Features

☑ Lead Free Design & RoHS Compliant
☑ Compatible with SFP MSA
☑ Compliant with IEEE 802.3ah Gigabit Ethernet Standard
☑ 1310nm, 1490nm and 1550nm Wavelengths
☑ Distances up to 10km over Single Mode Fiber
☑ Digital Diagnostics through Serial Interface
☑ Eye Safe (Class 1 Laser Safety)
☑ Simplex LC Optical Interface
☑ -40℃ to +85℃ Operating Temperature option
☑ Hot-pluggable
☑ TX Fault & Loss of Signal Outputs
☑ TX Disable Input
☑ Single +3.3V Power Supply
☑ Option of Digital Diagnostics function

Description

The TRBUG1CxBx000E2G modules are single fiber, bi-directional SFP transceivers that provide a quick and reliable interface for 1000BASE-BX-D/U Gigabit Ethernet applications.

Three types of modules are available: the 1310nm FP laser-based transceiver (BX-U), the 1490nm DFB laser-based transceiver (BX-D) and the 1550nm 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 I2C serial interface as described per the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.4).

All modules meet Class 1 Laser Safety requirements in accordance with the U.S. and international standards as described in the FDA/CDRH and IEC-60825 documents, respectively.

The TRBUG1CxBx000E2G 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 -40°C to +85°C. The package is made of metal for EMI immunity.

Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Units
Storage Temperature		T_{stg}	-40	+85	°C
Operating Case Temperature [1]	Commercial	T_{OP}	-5	+70	°C
	Industrial		-40	+85	
Supply Voltage		V_{CC}	0	+4.5	V
Input Voltage		V_{IN}	0	V_{CC}	V
[1] Measured on top side of SFP module at the front center vent hole of the cage，					

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Transmitter Performance Characteristics (Over Operating Case Temperature, V_{CC}= 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter			Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate			B	125	-	1250	Mb/s
Optical Output Power[1]			P_o	-9	-	-3	dBm
Center Wavelength	BX10-U	1310nm FP	λ_c	1260	1310	1360	nm
	BX10-D	1490nm DFB		1480	1490	1500	
	BX10-D	1550nm DFB		1530	1550	1570	
Spectral Width (RMS)	BX10–U	1281 - 1360nm	$\Delta\lambda RMSc$	-	-	2.58	nm
Spectral Width (-20dB)	BX10-D	1480 - 1500nm	$\Delta\lambda_{20}$	-	-	1	
		1530- 1570nm		-	-	1	
Extinction Ratio			P_{hi}/P_{lo}	6	-	-	dB
Transmitter OFF Output Power			-	-	-	- 45	dBm
Relative Intensity Noise			$RIN_{12}OMA$	-	-	- 113	dB/Hz
Optical Return Loss Tolerance			$ORLT$	-	-	12	dB
Transmitter Reflectance			TR	-	-	-12	dB
Total Jitter			TJ	-	-	227	ps
Transmitter Output Eye			Compliant with Eye Mask Defined in IEEE 802.3-2005 Standard				
[1].Measured average power coupled into single mode fiber							

Receiver Performance Characteristics (Over Operating Case Temperature, V_{CC} = 3.13 to 3.47V)

All parameters guaranteed only at typical data rate

Parameter			Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate			B	125	-	1250	Mb/s
Minimum Input Optical Power (10^{-12} BER)[1]			P_{min}	- 20.0	-	-	dBm
Maximum Input Optical Power (10^{-12} BER)[1]			P_{max}	-3.0	-	-	dBm
LOS Thresholds	Increasing Light Input		Pl_{os+}	-	-	- 20.0	dBm
	Decreasing Light Input		P_{los-}	- 35.0	-	-	
LOS Hysteresis[1]			-	0.5	-	-	dB
Total Jitter			T_J	-	-	266	ps
Wavelength of Operation	BX10-U	1490nm	λ	1480	-	1500	nm
		1550nm		1530	-	1570	
	BX10-D	1310nm		1260	-	1360	
Receiver Reflectance			-	-	-	- 12	dB
[1]Measured at 1250Mb/s with 2^7-1 PRBS and 1310nm, 1490nm & 1550nm wavelengths.							

Laser Safety:

All transceivers are Class 1 Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.

Type Approved
Safety
Regular Production
Surveillance
TÜVRheinland®
CERTIFIED
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ID 2000000000

c **UL**® US

> **Oplink Communications, LLC.**
>
> This product complies with
> 21 CFR 1040.10 and 1040.11
> **Meets Class 1 Laser Safety Requirements**

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Transmitter Electrical Interface (over Operating Case Temperature, VCC = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-)[1]	V_{PP-DIF}	0.5	-	2.4	V
Input HIGH Voltage (TX Disable)[2]	V_{IH}	2.0	-	Vcc	V
Input LOW Voltage (TX Disable)[2]	V_{IL}	0	-	0.8	V
Output HIGH Voltage (TX Fault)[3]	V_{OH}	2.0	-	Vcc + 0.3	V
Output LOW Voltage (TX Fault)[3]	V_{OL}	0	-	0.8	V

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

Receiver Electrical Interface (over Operating Case Temperature, VCC = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (RD+ & RD)[1]	V_{PP-DIF}	0.6	-	2	V
Output HIGH Voltage (LOS)[2]	V_{OH}	2.0	-	Vcc + 0.3	V
Output LOW Voltage (LOS)[2]	V_{OL}	0	-	0.5	V

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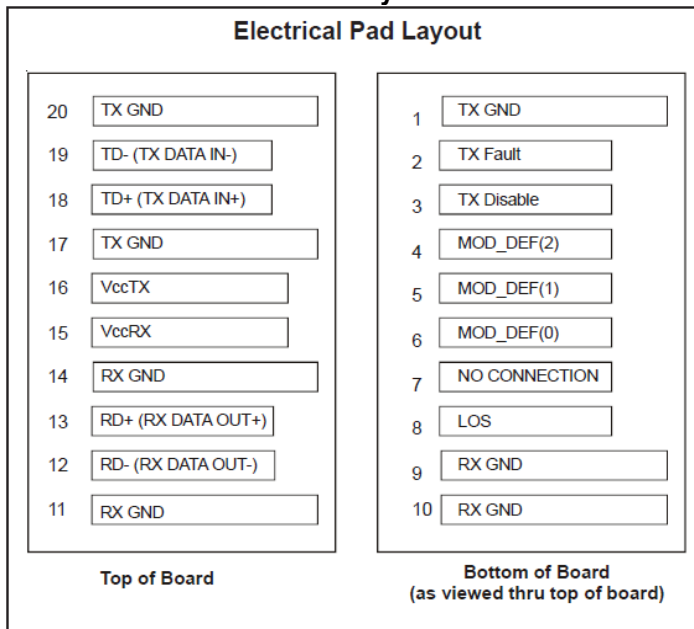[2]Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc..

Electrical Power Supply Characteristics (over Operating Case Temperature, VCC = 3.13 to 3.47V)

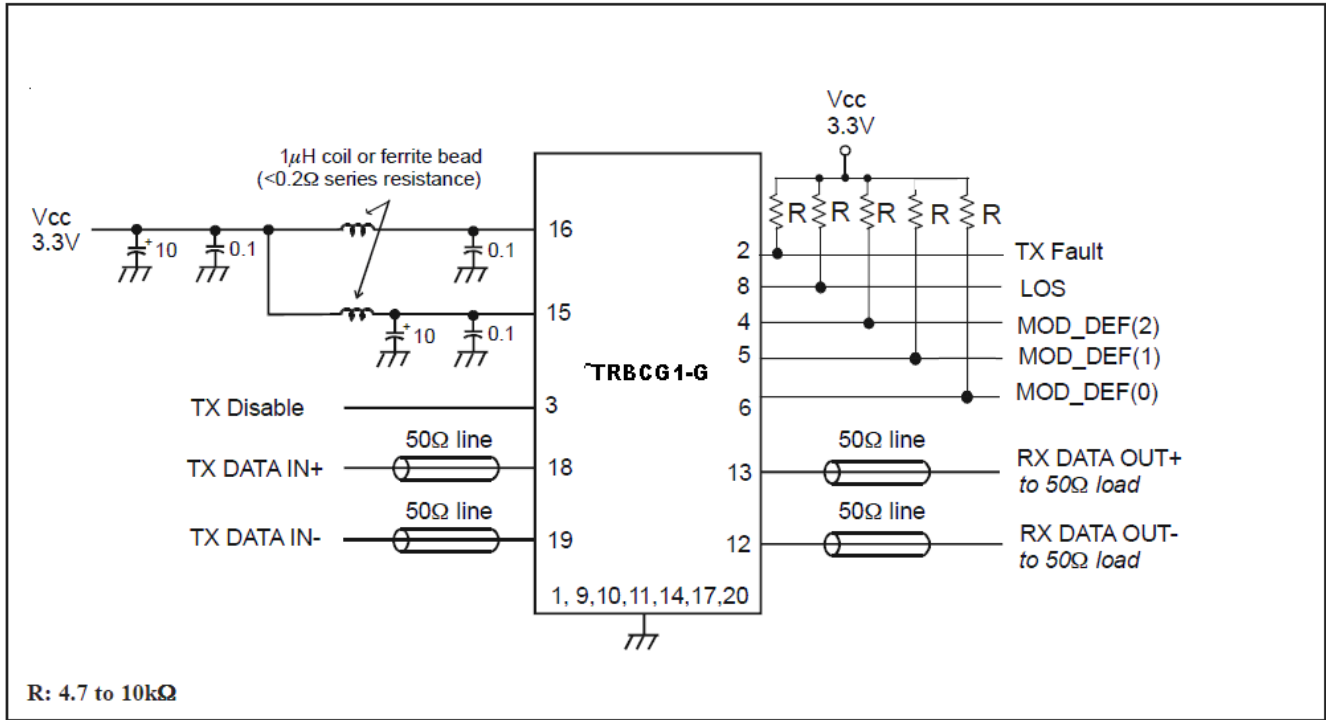| Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	Vcc	3.13	3.3	3.47	V
Supply Current	Icc	-	-	300	mA

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

Electric Pad Layout

Host Board Connector Pad Layout
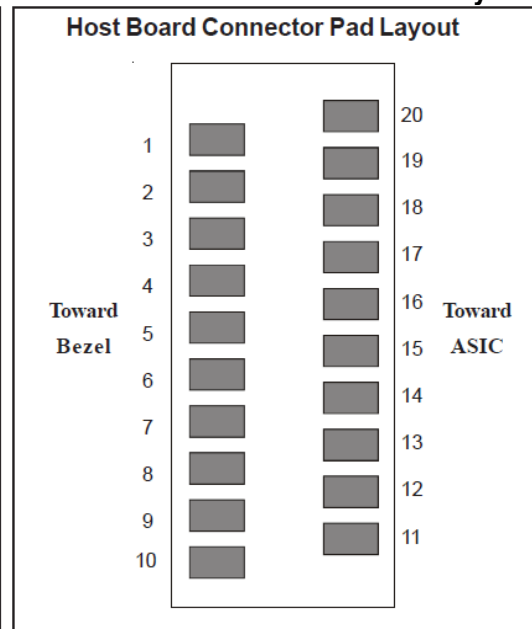
Electrical Pad Layout

	Top of Board		Bottom of Board (as viewed thru top of board)	
20	TX GND	1	TX GND	
19	TD- (TX DATA IN-)	2	TX Fault	
18	TD+ (TX DATA IN+)	3	TX Disable	
17	TX GND	4	MOD_DEF(2)	
16	VccTX	5	MOD_DEF(1)	
15	VccRX	6	MOD_DEF(0)	
14	RX GND	7	NO CONNECTION	
13	RD+ (RX DATA OUT+)	8	LOS	
12	RD- (RX DATA OUT-)	9	RX GND	
11	RX GND	10	RX GND	

Host Board Connector Pad Layout

Toward Bezel — Toward ASIC

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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 1µF 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 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: 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 I2C 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 0.1µF power supply bypass capacitors should be as close to the transceiver module as possible.

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Package Outline

NOTE: (UNLESS OTHERWISE SPECIFIED)

1. Dimensions in mm [Inches]
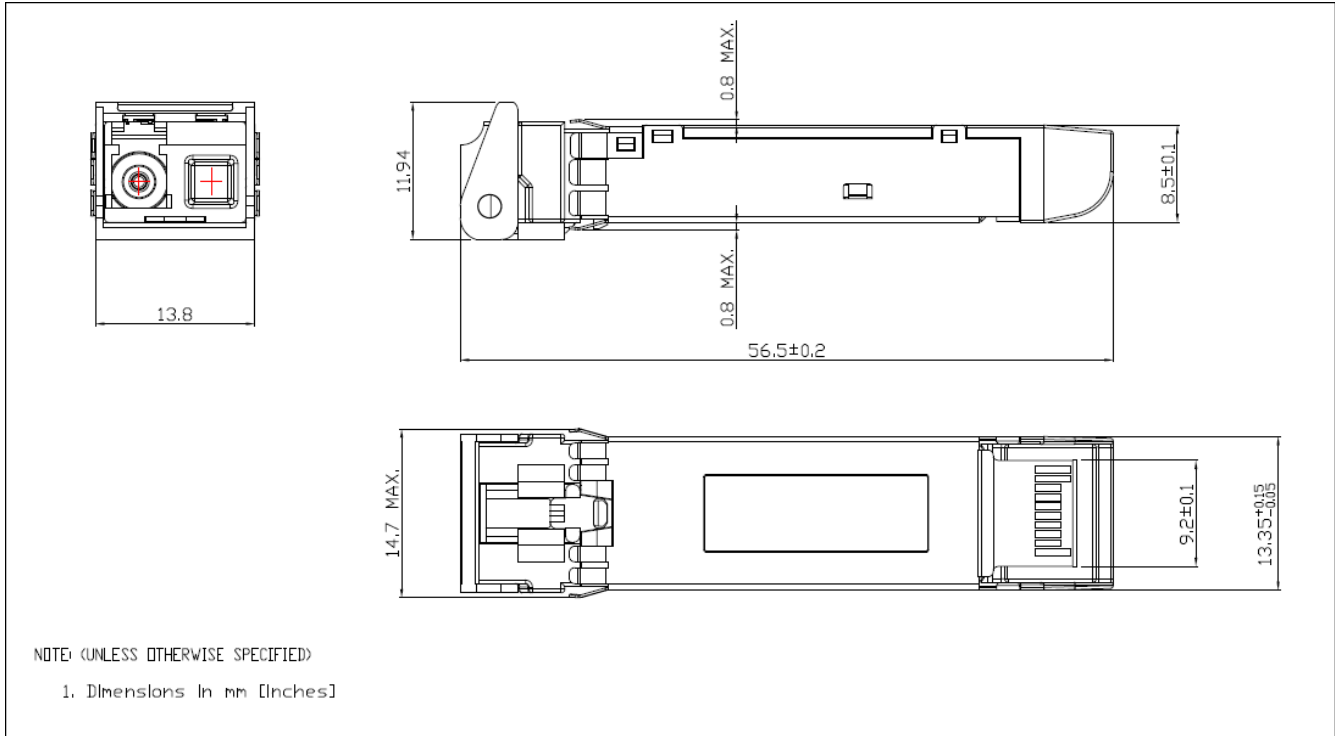
Ordering information

Part Number	DDM	Operating Temperature range	Latch Color	Nominal Wavelength		Optical Link Power Budget	Distance[1]
				Tx	Rx		
TRBUG1CFBI000E2G	YES	-40~85 °C	Blue	1310nm	1490nm	11dB	10km
TRBUG1CBBI000E2G	YES	-40~85 °C	Violet	1490nm	1310nm	11dB	10km
TRBUG1CUBI000E2G	YES	-40~85 °C	Blue	1310nm	1550nm	11dB	10km
TRBUG1CDBI000E2G	YES	-40~85 °C	Yellow	1550nm	1310nm	11dB	10km
TRBUG1CFBC000E2G	YES	-5~70 °C	Blue	1310nm	1490nm	11dB	10km
TRBUG1CBBC000E2G	YES	-5~70 °C	Violet	1490nm	1310nm	11dB	10km
TRBUG1CUBC000E2G	YES	-5~70 °C	Blue	1310nm	1550nm	11dB	10km
TRBUG1CDBC000E2G	YES	-5~70 °C	Yellow	1550nm	1310nm	11dB	10km

[1] The indicated transmission distance is for guidelines only, not guaranteed. The exact distance is dependent on the fiber loss, connector and splice loss, and allocated system penalty. Longer distances can be supported if the optical link power budget is satisfied.