

## SDH/SONET 2.5Gpbs Transceiver TSGx3xx(STM-16/OC-48)



- 1.3 $\mu$ m or 1.55 $\mu$ m SMF Transceiver
- SDH STM-16, SONET OC-48  
Data Rate of 2.488Gbps
- Single +3.3V Power Supply
- 2X5 or 2X10 Duplex LC Connector

### Family Model

TSG3302 TSG3315

### Features

- Compliant with SONET OC-48 and ITU-T SDH STM-16 specifications
- Industry standard 2X5 or 2X10 package with duplex LC connector
- 1.3 $\mu$ m uncooled InGaAsP SMQW Fabry-Perot(FP) LD or 1.3 $\mu$ m/1.55 $\mu$ m distributed feed-back(DFB) LD with APC for constant output power
- High sensitive InGaAs PIN photodiode used at wavelengths from 1.1 $\mu$ m to 1.6 $\mu$ m
- Single +3.3V power supply and LVPECL interface
- LVPECL differential data inputs and outputs
- Operating temperature ; 0 to +70 $^{\circ}$ C/-40 to +85 $^{\circ}$ C
- Tested by Teradian's Reliability and Qualification Program
- Distance options  
2km/15km/40km with 9/125 $\mu$ m SMF

### Description

The TSGX3XX series transceivers are designed to meet the specifications of SONET OC-48 and ITU-T SDH rates of STM-16(2.5Gbps). The transceivers are manufactured in 2x5 pin or 2X10 pin package with duplex LC connector interface and made of metallized housing to obtain excellent EMI shielding.

The transmitter consists of a long wavelength(1.3 $\mu$ m or 1.55 $\mu$ m) InGaAsP SMQW laser diode (FP- LD or DFB-LD) in an optical subassembly(OSA).

The OSA is driven by a custom IC which converts differential LVPECL logic signals into a laser diode drive current. The receiver includes a planar InGaAs PIN photodiode mounted with a transimpedance preamplifier IC in an OSA. The OSA is mated to a custom limiting-amplifier which provides post-amplification and signal detect function(active high).

The transceivers are designed to used in a single power supply(+3.3V) and an operating

temperature range of 0°C to +70°C or -40°C to +85°C.

## Applications

Used in telecommunication and data communication systems, from medium to high speed for intra-office, short-haul inter-office and long-haul inter-office applications.

- Intra-office and Inter-office SONET/ITU-T SDH
- Fiber in the loop(FTTO, FTTC, FTTH etc.)
- High-speed data links, Single-mode FDDI
- Private optical networks
- ATM

## Absolute Maximum Ratings

Parameters	Symbol	Unit	Min.	Max.	Remarks
Ambient Operating Temperature	$T_{op}$	°C	0	70	Indoor use
			-40	85	Outdoor use
Storage Temperature	$T_{stg}$	°C	-40	85	
Supply Voltage	$V_{CC}-V_{EE}$	V	-0.5	6.0	
Lead Soldering Temperature/Time		°C/sec		260/10	
Relative Humidity	RH	%	-	95	

## Electrical Characteristics

Parameters	Symbol	Unit	Min.	Typ.	Max.	Remarks
DC Power Supply Voltage	$V_{CC}-V_{EE}$	V	3.1	3.3	3.5	
DC Power Supply Current	$I_{CC,TX}$	mA	50		170	
	$I_{CC,RX}$	mA	60		90	
Input Data Voltage Swing (Single-ended)	$V_{IH}-V_{IL}$	mV	150		930	
Output Data Voltage Swing (Single-ended)	$V_{OH}-V_{OL}$	mV	590		900	
Transmit Disable Input Voltage	$V_{TDIS}$	V			0.8	CMOS/TTL
Low High			2.0			
Signal Detect Output Voltage	$V_{SD}$	V	-		0.4	TTL
			2.4		-	

### Eye Diagram

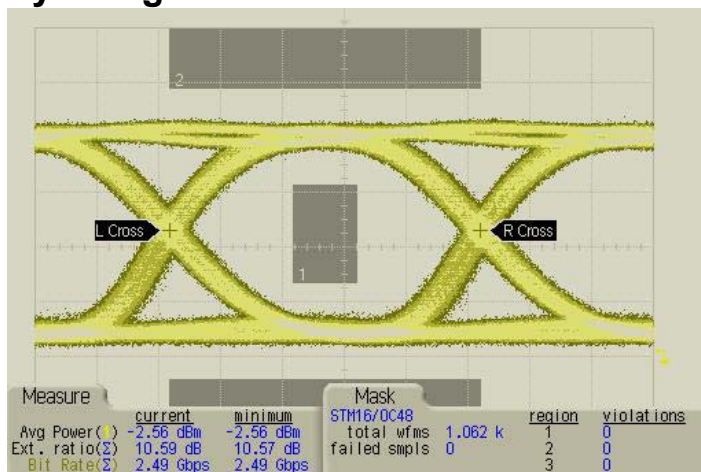


Fig. 1 Back-to-back

### Optical Characteristics

(T<sub>op</sub> = 25°C)

Parameters	Symbol	Condition	Unit	Min.	Typ.	Max.	Remark
Data Bit Rate		PRBS 2 <sup>23</sup> -1,NRZ	Gbps		2.488		
Fiber Length 9µm core SMF		10 <sup>-10</sup> BER, 2.488Gbps	km	2 15			@1.3 µm @1.3 µm
<b>TRANSMITTER</b>							
Average Power Output	P <sub>OUT</sub>	I <sub>f</sub> =I <sub>BIAS</sub> + I <sub>mod</sub> /2	dBm	-3.0 -5.0	-6.0 -3.0	-10.0 0	2km 15km
Extinction Ratio	ER		dB	8.2			
Center Wavelength	λ <sub>C</sub>	CW, @ P <sub>OUT</sub>	nm	1266 1260	1310 1310	1360 1360	2km 15km
Spectral Width	Δλ	RMS Width Max. -20dB WD	nm		2.5	4.0 1.0	FP-LD DFB-LD
Side Mode Suppression Ratio	SMSR		dB	30			DFB-LD
Optical Rise/Fall Time	t <sub>r</sub> /t <sub>f</sub>	20 – 80%	nsec			0.17	
<b>RECEIVER</b>							
Sensitivity (Average Input Power)	P <sub>IN,MIN</sub>	PRBS 2 <sup>23</sup> -1, 10 <sup>-10</sup> BER	dBm		-21.0	-18.0	
Receiver Overload	P <sub>IN,MAX</sub>		dBm	0			
Signal Detect Threshold Decreasing light input Increasing light input	P <sub>D</sub> P <sub>A</sub>		dBm dBm	-30		-20	
Signal Detect Hysteresis	P <sub>A</sub> - P <sub>D</sub>		dB	0.5			
Receiver Reflectance	R		dB			-27	

## Pin Descriptions

Pin (2×10)	Pin (2×5)	Symbol	Function	Logic Family
1		V <sub>PD</sub>	Photodetector(PD) Bias; optional feature If not use the input power monitoring function, connect this pin to power supply.	
2		V <sub>EE,RX</sub>	Receiver(RX) Signal Ground	
3		V <sub>EE,RX</sub>	Receiver Signal Ground	
4		N/C		
5		N/C		
6	1	V <sub>EE,RX</sub>	Receiver Signal Ground	
7	2	V <sub>CC,RX</sub>	Receiver Power Supply	
8	3	SD	Signal Detect. (Logic HIGH for normal operation)	TTL
9	4	RD-	Received Data Out Bar	LVPECL
10	5	RD+	Received Data Out	LVPECL
11	6	V <sub>CC,TX</sub>	Transmitter(TX) Power Supply	
12	7	V <sub>EE,TX</sub>	Transmitter Signal Ground	
13	8	TDis	Transmitter Disable (Logic LOW for normal operation)	TTL
14	9	TD+	Transmitter Data In	LVPECL
15	10	TD-	Transmitter Data In Bar	LVPECL
16		V <sub>EE,TX</sub>	Transmitter Signal Ground	
17		Bmon(-)	Laser Diode Bias Current Monitor – Negative End	Analog
18		Bmon(+)	Laser Diode Bias Current Monitor – Positive End	Analog
19		Pmon(-)	Laser Diode Optical Power Monitor – Negative End	Analog
20		Pmon(+)	Laser Diode Optical Power Monitor – Positive End	Analog

## Recommended Interface Circuit

The transceiver can operate with LVPECL logic level. The interface circuit with DC-coupled PECL interface is recommended as shown in Figure. The power supply filters are required for good EMI performance and should be as close to the transceiver as possible.

The Signal Detect circuit monitors the incoming optical signal and generates a logic LOW signal when the optical signal is lower than a predefined level. The transmitter is normally enabled except when the TX DISABLE control input is level HIGH. The transmitter offers the functions of monitoring the laser diode bias current and the laser diode optical power. The voltage measured between pins 17 and 18 is proportional to the bias current through an internal 10Ω resistor. Similarly voltage between pins 19 and 20 is measured across an internal 200Ω resistor, which is proportional to the laser diode optical power.

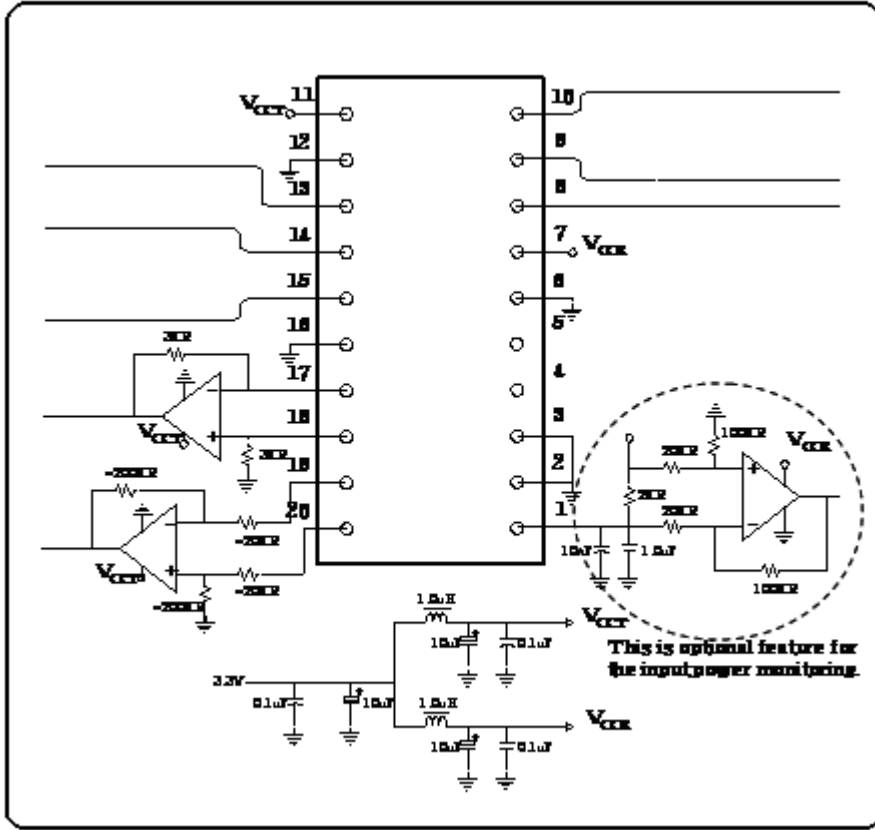


Fig. 2 DC-Coupled PECL Interface

Outline Diagram (2X5 or 2X10 pin)

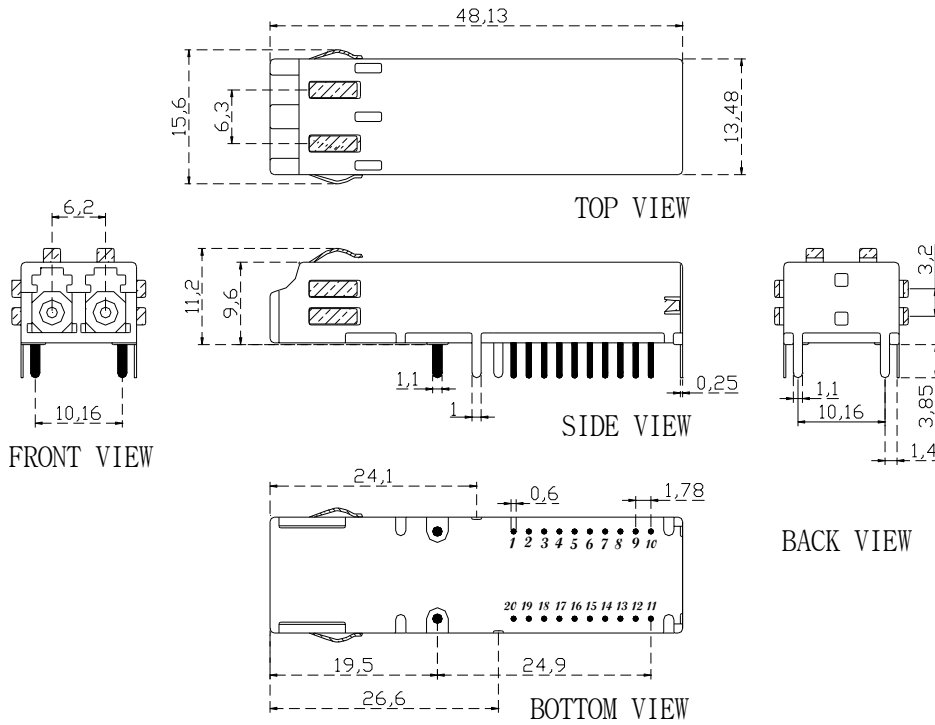
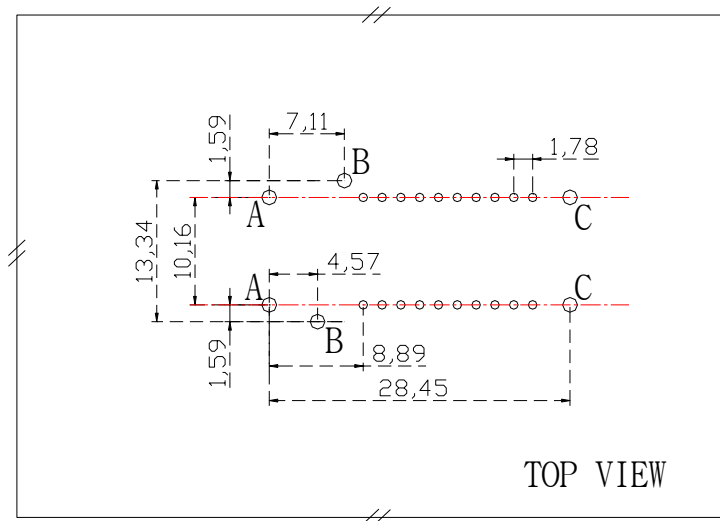


Fig.3 SFF Transceiver Package Dimensions [unit: mm]



Symbol	QTY	Diameter(mm)
A	2	1.40±0.1
B	4	1.40±0.1
C	10	0.78±0.1

Fig.4 Recommended PCB Layout & Hole size [unit : mm]

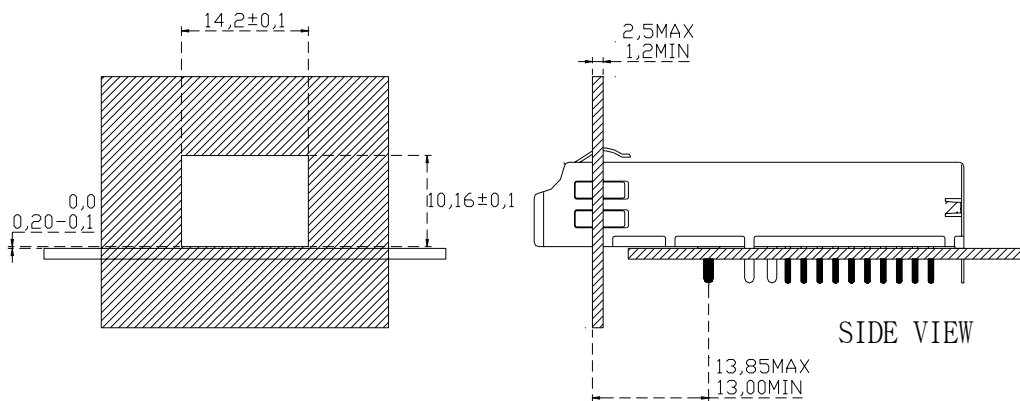


Fig.5 Bezel Opening Dimensions [unit: mm]

### ! Handling Caution

The transceiver can be damaged by overvoltage and current surges. Precautions should be taken for transient power supply.

This device is susceptible to damage as a result of electrostatic discharge(ESD). Take proper precautions during both handling and testing

### Laser Eye Safety

These transceivers have laser semiconductor product and are classified as AEL Class I per U.S. FDA/CDRH 21CFR 1040 and class 1 per EN60825-1. These products comply with 21CFR, Chapter 1, Subchapter J( 21CFR 1040.10 and 1040.11 laser safety requirements).

### Laser Data

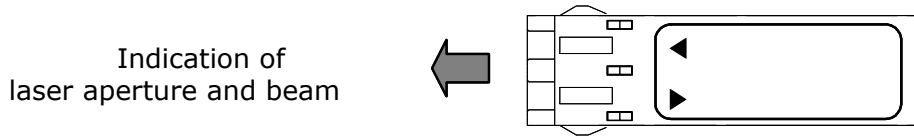
Wavelength :            nm (model            )  
 Modulation Frequency : 2.5Gbps (duty cycle : 50 percent)  
 Measured output power(Aperture Size 7mm) :            mW(            nm)  
 Limit power :            mW(            nm)

### ! Caution

- All adjustments are made at the factory before shipment to our customers. No maintenance and alteration to device is required.
- Tampering with or modifying the performance of the modules will result in voided product warranty. It may also result in improper operation of the circuitry, and possible overstress of the semiconductor components. Device degradation or product failure may result.
- Use of controls or adjustments or procedures other than those specified herein (ex : Connection of the modules to a non-approved optical source, operating above the recommended absolute maximum conditions, operating in a manner inconsistent with unit design and function) may result in hazardous radiation exposure and may be considered an act of modifying or manufacturing a laser product. The person(s) performing such an act is required by law to recertify the laser product under the provisions of US 21CFR (Subchapter J).
- The use of optical instruments with this product will increase eye hazard.

**Notice**  
**On operation, If optical connectors are unterminated, modules can emit invisible laser radiation. Avoided eye exposure to direct or indirect radiation**

### Laser Emission



## Ordering Information

Com pany	Func- tion	Data Rate	Wavelength	Supply Voltage	Distance	Pin	Temp. Range	Shielding	
<b>T</b>	<b>S</b>	<b>G</b>	<b>3</b>	<b>3</b>	<b>15</b>	<b>-</b>	<b>1</b>	<b>I</b>	<b>N</b>
Ter- dian	<b>V</b> ;TRV <b>S</b> ;SFF <b>F</b> ;SFP  <b>B</b> ;Bi-Di TRV. (Recep- tacle)  <b>D</b> ;Bi-Di TRV. (Pig- tailed)	<b>1</b> ;155Mbps <b>4</b> ;622Mbps <b>F</b> ;1.06Gbps <b>8</b> ;1.25Gbps <b>S</b> ;2.12Gbps <b>G</b> ;2.5Gbps  <b>A</b> ;Asy. Bi-Di 622M/155M <b>E</b> ;Asy. Bi-Di 1.25G/155M  <b>O</b> ;Order- made	<b>3</b> ;1.3 $\mu$ m <b>5</b> ;1.55 $\mu$ m <b>6</b> ;Bi-Di T1.3/R1.5 <b>7</b> ;Bi-Di T1.5/R1.3 <b>8</b> ;850nm <b>A</b> ;1470nm <b>B</b> ;1490nm <b>C</b> ;1510nm <b>D</b> ;1530nm <b>E</b> ;1550nm <b>F</b> ;1570nm <b>G</b> ;1590nm <b>H</b> ;1610nm  <b>M</b> ;1270nm <b>N</b> ;1290nm <b>O</b> ;1310nm <b>P</b> ;1330nm <b>Q</b> ;1350nm <b>R</b> ;1370nm <b>S</b> ;1390nm <b>T</b> ;1410nm <b>U</b> ;1430nm <b>W</b> ;1450nm	<b>3</b> ;3.3V	<b>SX</b> ;Note1 <b>02</b> ;2km <b>LX</b> ;5km <b>10</b> ;10km <b>15</b> ;15km <b>20</b> ;20km <b>30</b> ;30km <b>40</b> ;40km <b>60</b> ;60km <b>80</b> ;80km <b>A0</b> ;100km <b>C0</b> ;120km	<b>1</b> ;2X5 (10 pin) <b>2</b> ;2X10 (20 pin) <b>9</b> ;1X9 (9 pin)	<b>I</b> ;Indoor Use (0~70 $^{\circ}$ C) <b>O</b> ;Outdoor Use (-40~85 $^{\circ}$ C)	<b>N</b> ;No Shield	

\*Note 1 ;

- 220m with 62.5/125 $\mu$ m MMF @1.25Gbps
- 500m with 50/125 $\mu$ m MMF @1.25Gbps
- 200m with 62.5/125 $\mu$ m MMF @2.125Gbps

\*Note 2 ; additional order information

- Connector type default is SC/PC and the default length of fiber is 1m
- In case of ordering pigtailed Bi-Di Transceiver, please specify specs. clearly if not default.

## More Information

## Teradian Inc.

Address 946, Dunsan-dong, Seo-gu, Daejeon, 302-120, Korea  
 Tel +82-42-476-4800, 4803(Oversea Sales Team)  
 Fax +82-42-476-4805  
 Homepage <http://www.teradian.com>  
 e-mail [sales@teradian.com](mailto:sales@teradian.com)