

## SDH/SONET 155Mbps CWDM Transceiver TS1#3xx(STM-1/OC-3)



- 1470 to 1610nm CWDM Transceiver with 20nm spacing
- SDH STM-1, SONET OC-3 Data Rate of 155Mbps
- Single +3.3V Power Supply
- 2X5 or 2X10 Duplex LC Connector

### Family Model

TS1A340/80/A0 TS1B340/80/A0 TS1C340/80/A0 TS1D340/80/A0  
TS1E340/80/A0 TS1F340/80/A0 TS1G340/80/A0 TS1H340/80/A0

### Features

- Compliant with SONET OC-3 and ITU-T SDH STM-1 specifications
- Industry standard 2X5 or 2X10 package with duplex LC connector
- 1.47 $\mu$ m ~ 1.61 $\mu$ m uncooled InGaAsP SMQW distributed feed-back(DFB) LD with 20nm spacing
- 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
- Internally ac-coupled LVPECL differential data inputs and outputs
- Operating temperature ; 0 to +70 $^{\circ}$ C/-40 to +85 $^{\circ}$ C
- Complies with FDA/CDRH 21CFR 1040.10 and 1040.11 laser safety requirements
- Tested by Teradrian's Reliability and Qualification Program
- Wavelength options(8 channels with 20nm spacing)  
1470nm/1490nm/1510nm/1530nm/1550nm/1570nm/1590nm/1610nm
- Distance options  
40km/80km/100km with 9/125 $\mu$ m SMF

### Description

The TS1#3XX series transceivers are designed to meet the specifications of SONET OC-3 and ITU-T SDH rates of STM-1(155.52Mbps). 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 long wavelength(1.47 $\mu$ m ~ 1.61 $\mu$ m) InGaAsP SMQW DFB-LD in an optical subassembly(OSA) with 20nm wavelength intervals for 8 channel CWDM applications.

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 be 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.

- CWDM applications
- Intra-office and Inter-office SONET/ITU-T SDH
- Fast Ethernet
- High-speed data links
- Metropolitan Area Network

## Absolute Maximum Ratings

Parameters	Symbol	Unit	Min.	Max.	Remarks
Ambient Operating Temperature 40km, 80km	T <sub>op</sub>	°C	0	70	Indoor use
			-40	85	Outdoor use
100km			0	70	Indoor use
Storage Temperature	T <sub>stg</sub>	°C	-40	85	
Supply Voltage	V <sub>CC</sub> -V <sub>EE</sub>	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 <sub>CC</sub> -V <sub>EE</sub>	V	3.1	3.3	3.5	
DC Power Supply Current	I <sub>CC,TX</sub>	mA	35		150	
	I <sub>CC,RX</sub>	mA	60		80	
Input Data Voltage Swing (Single-ended)	V <sub>IH</sub> - V <sub>IL</sub>	mV	150		800	
Output Data Voltage Swing (Single-ended)	V <sub>OH</sub> - V <sub>OL</sub>	mV	590		800	
Transmit Disable Input Voltage	V <sub>TDIS</sub>	V	2.0		0.8	CMOS/TTL
Low						
High						
Signal Detect Output Voltage	V <sub>SD</sub>	V	-		1.82	LVPECL
Low						
High		2.14				

Eye Diagram

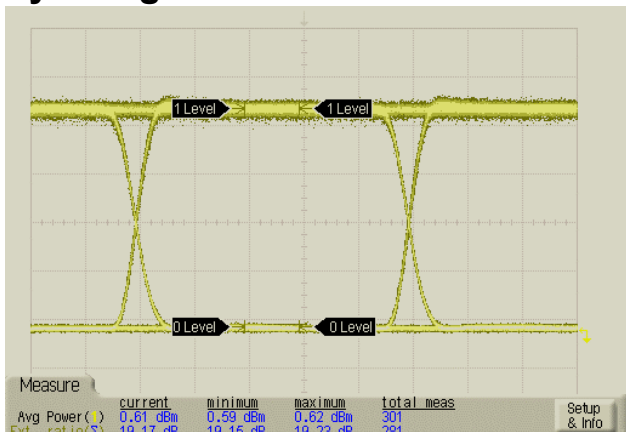


Fig. 1 Back-to-back (measured with 622Mbps filter)

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	Mbps		155.52		
Fiber Length 9µm core SMF		10 <sup>-10</sup> BER, 155Mbps	km	40		100	
<b>TRANSMITTER</b>							
Average Power Output	P <sub>OUT</sub>	I <sub>f</sub> =I <sub>BIAS</sub> + I <sub>mod</sub> /2	dBm	-6.0 -5.0 -2.0	-4.0 -3.0 0	-2.0 0 +2.0	40km 80km 100km
Extinction Ratio	ER		dB	10			
Center Wavelength	λ <sub>C</sub>	CW, @ P <sub>OUT</sub>	nm	1468 1488 1508 1528 1548 1568 1588 1608	1470 1490 1510 1530 1550 1570 1590 1610	1472 1492 1512 1532 1552 1572 1592 1612	TS1A3XX TS1B3XX TS1C3XX TS1D3XX TS1E3XX TS1F3XX TS1G3XX TS1H3XX
Spectral Width	Δλ	RMS Width Max. -20dB WD	nm			1.0	
Side Mode Suppression Ratio	SMSR		dB	30			
Optical Rise/Fall Time	t <sub>r</sub> /t <sub>f</sub>	10 - 90%	nsec			2.0	
<b>RECEIVER</b>							
Sensitivity (Average Input Power)	P <sub>IN,MIN</sub>	PRBS 2 <sup>23</sup> -1, 10 <sup>-10</sup> BER	dBm		-36 -37	-34 -36	40/80km 100km
Receiver Overload	P <sub>IN,MAX</sub>		dBm	-3.0			
Signal Detect Threshold Decreasing light input Increasing light input	P <sub>D</sub> P <sub>A</sub>		dBm dBm	-46		-38	
Signal Detect Hysteresis	P <sub>A</sub> - P <sub>D</sub>		dB	0.5	1.0		

## 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)	LVPECL
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.

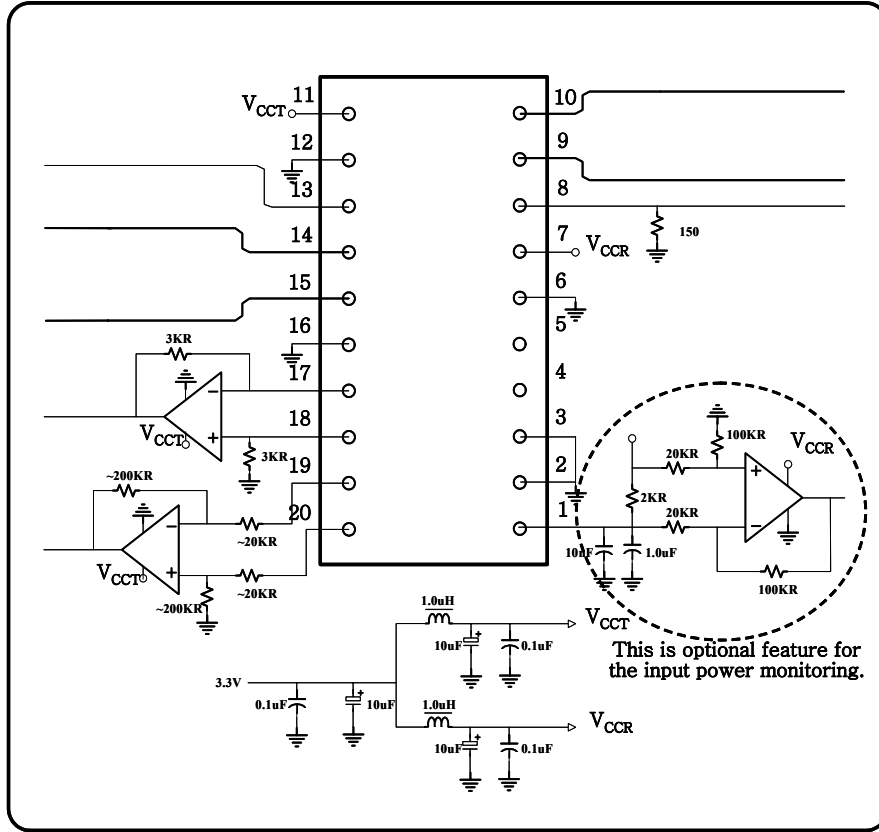


Fig. 2 DC-Coupled PECL Interface

Outline Diagram(2X5 or 2X10pin)

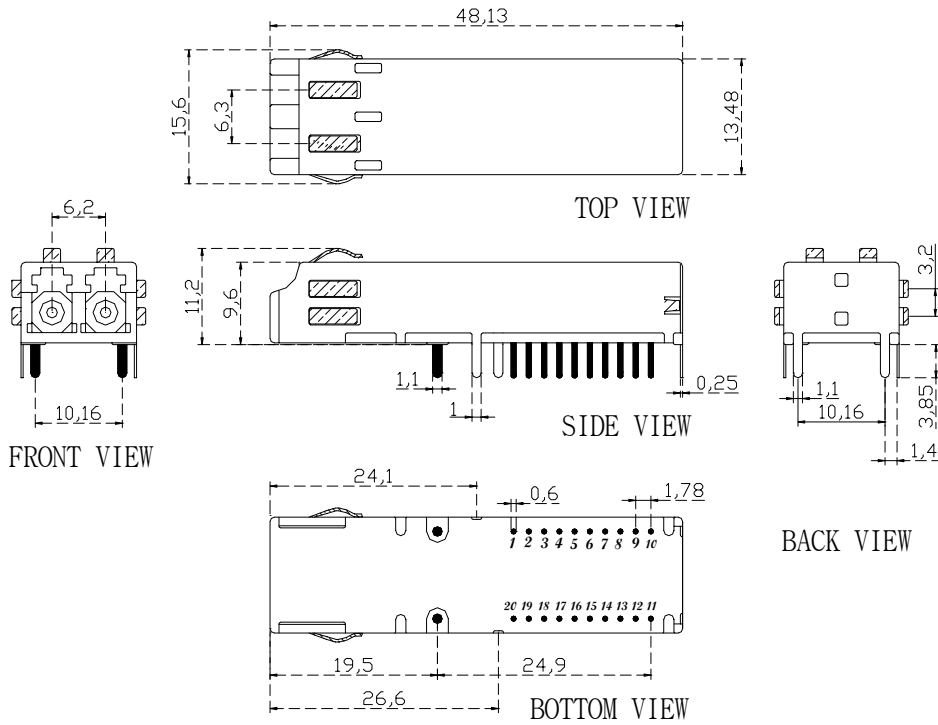
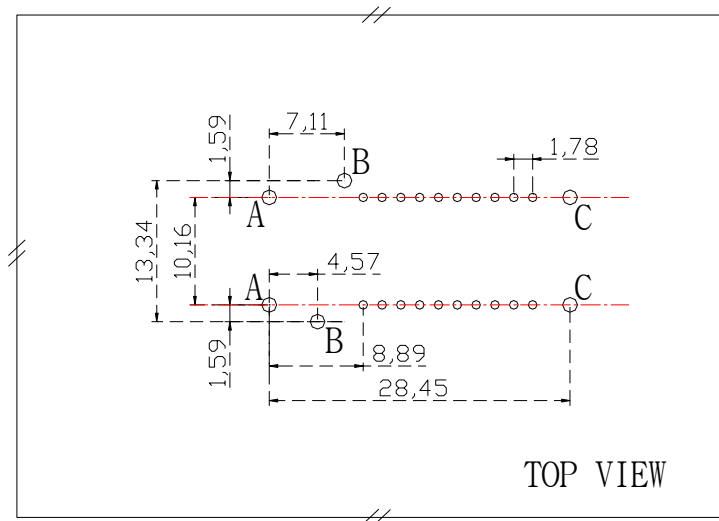


Fig.3 SFF Transceiver Package Dimensions [unit: mm]



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]

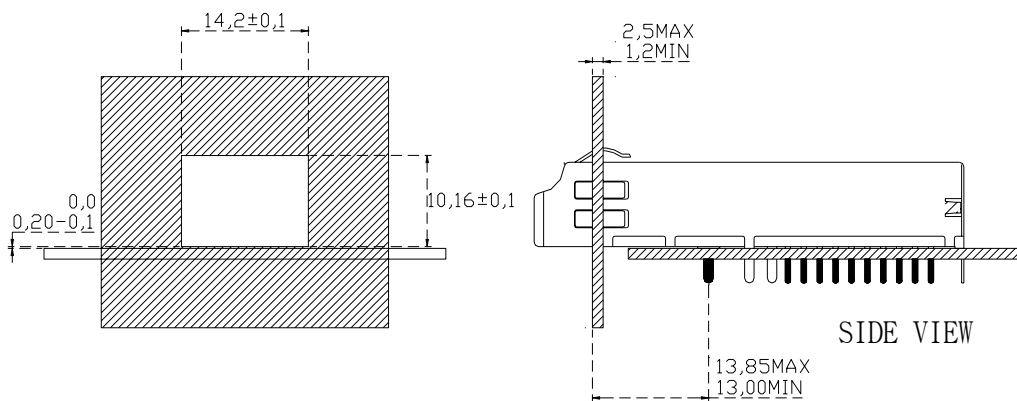


Fig.5 Bezel Opening Dimensions [unit: mm]

## ! 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 : CWDM(1470~1610nm, Model : TS1A3A0, TS1D3A0, TS1H3A0)

Modulation Frequency : 155Mbps (duty cycle : 50 percent)

Measured output power(Aperture Size 7mm) : 0.11mW

Limit power : 0.79mW

## ! Caution

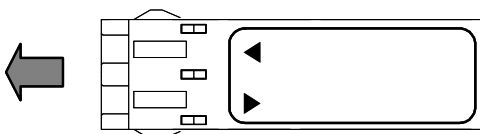
- All adjustments are made at the factory before shipment to our customers. No maintenance and alteration to device is required.
- Tampering with or modifying the performance of the modules will result in voided product warranty. It may also result in improper operation of the circuitry, and possible 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

Indication of  
laser aperture and beam



## Ordering Information

Com pany	Func- tion	Data Rate	Wavelength	Supply Voltage	Distance	Pin	Temp. Range	Shielding
<b>T</b>	<b>S</b>	<b>1</b>	<b>C</b>	<b>3</b>	<b>40</b>	<b>1</b>	<b>I</b>	<b>N</b>
Terad- ian	<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> ;1.3μm <b>5</b> ;1.55μm <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℃) <b>O</b> ;Outdoor Use (-40~85℃)	<b>N</b> ;No Shield

\*Note 1 ;

- 220m with 62.5/125μm MMF @1.25Gbps
- 500m with 50/125μm MMF @1.25Gbps
- 200m with 62.5/125μm 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

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