

## TRSL-9115WG / TRSL-9115AWG

### 3.3V / 1310 nm / 2.5 Gbps **RoHS Compliant** SFF LC 2X10 SINGLE-MODE TRANSCEIVER

#### FEATURES

- I Duplex LC Single Mode Transceiver
- I SONET OC-48 IR / SDH STM-16 (S-16.1) Compliant
- I Compliant with Fiber Channel 2X/1X SM-LC-L FC-PI
- I Compliant with IEEE 802.3z Gigabit Ethernet
- I Multi-sourced 2X10 SFF Package Style
- I 1310 nm DFB LD Transmitter
- I 13 dB Link Power Budget At Least
- I Analog Monitor Function
  - Transmitter Laser Bias Current
  - Transmitter Laser Optical Power Monitor
  - Receiver Photo Detector Current
- I AC/AC Coupled Signal Input / Output
- I LVPECL Signal Input / Output
- I LVTTTL Signal Detection Output
- I Single +3.3 V Power Supply
- I RoHS Compliant
- I 0 to 70°C Operation: TRSL-9115WG
- I **-20 to 85°C Operation: TRSL-9115AWG**
- I Wave Solderable and Aqueous Washable
- I Class 1 Laser International Safety Standard IEC-60825 Compliant

#### DESCRIPTION

The TRSL-9115WG series single mode transceivers is small form factor, low power, high performance module for bi-directional serial optical data communications such as SONET OC-48 IR / SDH STM-16 (S-16.1), IEEE 802.3z Gigabit Ethernet and 1X/2X Fiber channel. This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a multiple quantum well 1310 nm DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC. A LVPECL logic interface simplifies interface to external circuitry.

#### LASER SAFETY

This single mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug

#### APPLICATIONS

- I ATM Switches and Routers
- I SONET / SDH Switch Infrastructure
- I XDSL Applications

#### ORDER INFORMATION

| P/No.               | Bit Rate (Mb/s) | SONET /SDH  | Distance (km) | Wavelength (nm) | Package | Temp. (°C)       | TX Power (dBm) | RX Sens. (dBm) | RoHS Compliant |
|---------------------|-----------------|-------------|---------------|-----------------|---------|------------------|----------------|----------------|----------------|
| TRSL-9115WG         | 2488            | IR-1/S-16.1 | 15            | 1310 DFB        | 2X10 LC | 0 to 70          | 0 to -5        | -18            | Yes            |
| <b>TRSL-9115AWG</b> | 2488            | IR-1/S-16.1 | 15            | 1310 DFB        | 2X10 LC | <b>-20 to 85</b> | 0 to -5        | -18            | Yes            |

| Absolute Maximum Ratings |        |      |     |       |                          |
|--------------------------|--------|------|-----|-------|--------------------------|
| Parameter                | Symbol | Min  | Max | Units | Notes                    |
| Storage Temperature      | Tstg   | -40  | 85  | °C    |                          |
| Operating Temperature    | Topr   | 0    | 70  | °C    | TRSL-9115WG              |
|                          |        | -20  | 85  |       | TRSL-9115AWG             |
| Soldering Temperature    | ---    |      | 260 | °C    | 10 seconds on leads only |
| Power Supply Voltage     | Vcc    | -0.5 | 3.6 | V     |                          |
| Input Voltage            | ---    | -0.5 | Vcc | V     |                          |
| Output Current           | Iout   | 0    | 50  | mA    |                          |

| Recommended Operating Conditions |        |      |      |      |                   |
|----------------------------------|--------|------|------|------|-------------------|
| Parameter                        | Symbol | Min  | Typ  | Max  | Units / Notes     |
| Power Supply Voltage             | Vcc    | 3.13 | 3.3  | 3.47 | V                 |
| Operating Temperature            | Topr   | 0    |      | 70   | °C / TRSL-9115WG  |
|                                  |        | -20  |      | 85   | °C / TRSL-9115AWG |
|                                  |        |      |      |      | air flow 1m/sec   |
| Data Rate                        |        | 622  | 2500 | 2700 | Mb/s              |

| Transmitter Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) |  |      |      |                 |         |                   |
|---|--|------|------|-----------------|---------|-------------------|
| Parameter   | Symbol   | Min  | Typ  | Max             | Units   | Notes             |
| <b>Optical</b>  |  |      |      |                 |         |                   |
| Optical Transmit Power  | Po   | -5   | ---  | 0               | dBm     | 1                 |
| Output Center Wavelength  | $\lambda$  | 1280 | 1310 | 1335            | nm      |                   |
| Output Spectrum Width   | $\Delta\lambda$  | ---  | ---  | 1               | nm      | -20 dB Width      |
| Side Mode Suppression Ratio   | SMSR   | 30   |      |                 | dB      |                   |
| Extinction Ratio  | ER   | 8.2  | ---  | ---             | dB      |                   |
| Output Eye  | Compliant with Bellcore GR-253-GORE and ITU-T Recommendation G.957 |      |      |                 |         |                   |
| Optical Rise Time   | tr   |      |      | 150             | ps      | 20% to 80% Values |
| Optical Fall Time   | tf   |      |      | 150             | ps      | 20% to 80% Values |
| Relative Intensity Noise  | RIN  |      |      | -120            | dB/Hz   |                   |
| <b>Electrical</b>   |  |      |      |                 |         |                   |
| Power Supply Current  | Icc  |      |      | 180             | mA      | 2                 |
| Data Input Current – Low  | IL   | -350 |      |                 | $\mu$ A |                   |
| Data Input Current – High   | I <sub>IH</sub>  |      |      | 350             | $\mu$ A |                   |
| Differential Input Voltage  | V <sub>IH</sub> - V <sub>IL</sub>                                  | 300  |      | 1600            | mV      |                   |
| Data Input Voltage – Low  | V <sub>IL</sub> - V <sub>CC</sub>                                  | -2.0 |      | -1.58           | V       | 3                 |
| Data Input Voltage -- High  | V <sub>IH</sub> - V <sub>CC</sub>                                  | -1.1 |      | -0.74           | V       | 3                 |
| TX Disable Input Voltage – Low                                      | T <sub>DIS</sub>   | 0    |      | 0.5             | V       |                   |
| TX Disable Input Voltage – High                                     | T <sub>DIS</sub>   | 2.0  |      | V <sub>CC</sub> | V       |                   |
| TX Disable Assert Time  | T <sub>ASSERT</sub>  |      |      | 10              | $\mu$ s |                   |
| TX Disable Deassert Time  | T <sub>DEASSERT</sub>  |      |      | 50              | $\mu$ s |                   |

- Notes: 1. Output power is power coupled into a 9/125  $\mu$ m single mode fiber.  
 2. Maximum current is specified at Vcc = Maximum @ maximum temperature.  
 3. These inputs are compatible with 10K, 10KH and 100K ECL and PECL inputs.

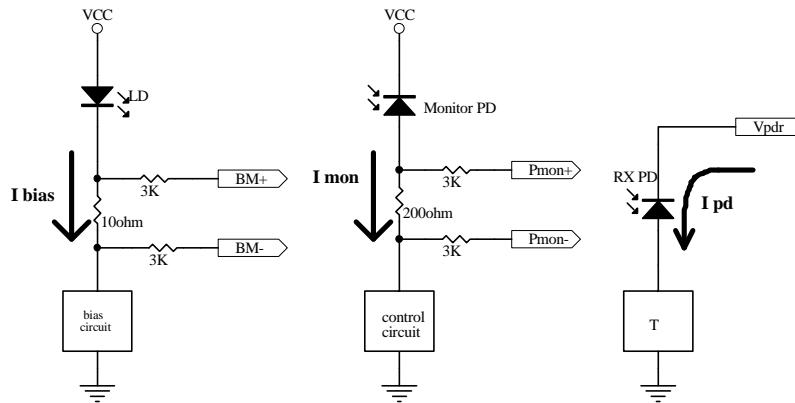
| Receiver Specifications (0°C < Topr < 70°C, 3.13V < Vcc < 3.47V) |                                   |      |     |                      |       |                         |
|--|-----------------------------------|------|-----|----------------------|-------|-------------------------|
| Parameter  | Symbol                            | Min  | Typ | Max                  | Units | Notes                   |
| <b>Optical</b>   |                                   |      |     |                      |       |                         |
| Sensitivity @ 2.488 Gbps   | Sen1                              | ---  |     | -18                  | dBm   | 1                       |
| Sensitivity @ 1.25 Gbps  | Sen2                              |      |     | -20                  | dBm   | 2                       |
| Maximum Input Power  | Pin                               | 0    |     | ---                  | dBm   |                         |
| Signal Detect -- Asserted  | Pa                                | ---  | --- | -18                  | dBm   | Transition: low to high |
| Signal Detect -- Deasserted                                      | Pd                                | -35  | --- | ---                  | dBm   | Transition: high to low |
| Signal Detect -- Hysteresis                                      |                                   | 1.0  | --- | 4.0                  | dB    |                         |
| Wavelength of Operation  |                                   | 1100 | --- | 1600                 | nm    |                         |
| <b>Electrical</b>  |                                   |      |     |                      |       |                         |
| Power Supply Current   | Icc                               |      | 110 | 140                  | mA    |                         |
| Data Output Voltage – Low  | V <sub>OL</sub> - V <sub>CC</sub> | -2.0 |     | -1.58                | V     | 3                       |
| Data Output Voltage – High                                       | V <sub>OH</sub> - V <sub>CC</sub> | -1.1 |     | -0.74                | V     | 3                       |
| Signal Detect Output Voltage -- Low                              | V <sub>SDL</sub>                  | 0    |     | 0.8                  | V     |                         |
| Signal Detect Output Voltage -- High                             | V <sub>SDH</sub>                  | 2.0  |     | V <sub>CC</sub> +0.3 | V     |                         |

- Notes: 1. Minimum sensitivity and saturation levels at BER=1E-10 for a 2<sup>23</sup>-1 PRBS.  
 2. Minimum sensitivity and saturation levels at BER=1E-12 for a 2<sup>7</sup>-1 PRBS.  
 3. These outputs are compatible with 10K, 10KH and 100K ECL and PECL inputs.

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**ANALOG DIAGNOSTICS FUNCTIONS**  
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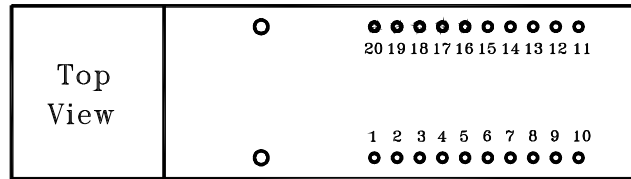
| Parameter                          | Symbol       | Min | Typ | Max | Units | Notes |
|------------------------------------|--------------|-----|-----|-----|-------|-------|
| <b>Transmitter</b>                 |              |     |     |     |       |       |
| Laser Bias Current Monitor         | Bmon+, Bmon- | 0   |     | Vcc | V     | 1     |
| Monitor Photodiode Current Monitor | Pmon+,Pmon-  | 0   |     | Vcc | V     | 2     |
| <b>Receiver</b>                    |              |     |     |     |       |       |
| Received Photocurrent              | Rpd          | 0   |     | 1   | mA    | 3     |
| Photodiode Responsivity            | R            | 0.5 | 0.9 | 1.0 | A/W   |       |
| Applied Voltage at VpdR pin        | Vpd          | 2.4 |     | Vcc | V     | 3     |

- Notes: 1. PIN 17 and 18 provide an analog voltage output proportional to the laser bias current, based on the following formula:  $I_{bias} = V (Bmon+ - Bmon-) / 10 \Omega$ . See below the equivalent circuit.
2. PIN 19 and 20 provide an analog voltage output proportional to the monitor photodiode current, based on the following formula:  $I_{mon} = V (Pmon+ - Pmon-) / 200 \Omega$ . See below the equivalent circuit.
3. PIN 1 is used to monitor the received photocurrent. It must be connected to a positive voltage within the specified above. The received power is given by the photocurrent multiplied by the photodiode responsivity.



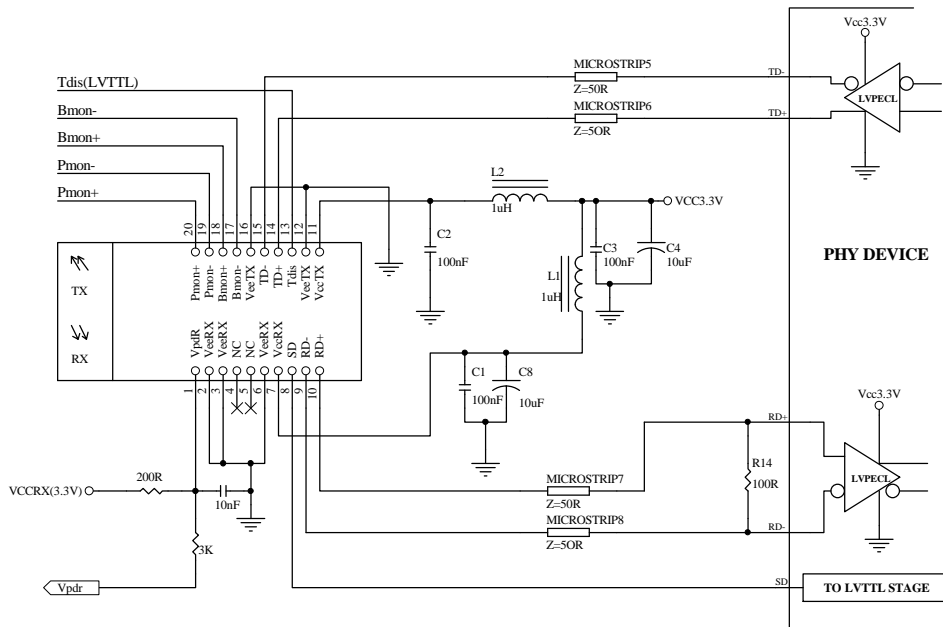
**Analog Monitoring Function Connections**

## CONNECTION DIAGRAM



| PIN | Symbol | Notes   | PIN | Symbol | Notes   |
|-----|--------|---|-----|--------|---|
| 1   | VpdR   | Receiver power monitor. This pin must be connected to a positive power supply (Vcc), preferably via a small resistor. Supplier photocurrent and maybe used to monitor receiver power. | 11  | VccT   | +3.3V dc transmitter power supply   |
| 2   | VeeR   | Receiver ground.  | 12  | VeeT   | Transmitter ground.   |
| 3   | VeeR   | Receiver ground.  | 13  | T Dis  | Transmitter Disable. Connect this pin to logic "1" to disable module. To enable module connect to logic low "0" |
| 4   | NC     | No connected  | 14  | TD +   | Transmitter Data In   |
| 5   | NC     | No connected  | 15  | TD -   | Transmitter Data In Bar   |
| 6   | VeeR   | Receiver ground.  | 16  | VeeT   | Transmitter ground.   |
| 7   | VccR   | +3.3V dc receiver power supply  | 17  | Bmon-  | Laser Bias Monitoring - Negative End  |
| 8   | SD     | Signal detect. Logic 1 indicate a normal operation.   | 18  | Bmon+  | Laser Bias Monitoring - Positive End<br>(Bmon+ - Bmon-) = 10 Ω X laser bias current                             |
| 9   | RD-    | Receiver Dataout Bar  | 19  | Pmon-  | Laser Power Monitoring -- Negative end  |
| 10  | RD+    | Receiver Dataout  | 20  | Pmon+  | Laser Power Monitoring -- Positive end<br>(Pmon+ - Pmon-) = 200 Ω X monitor photodiode current                  |
| MS  | MS     | Mounting Studs. Connect to Chassis Ground   |     |        |   |

## RECOMMENDED CIRCUIT SCHEMATIC

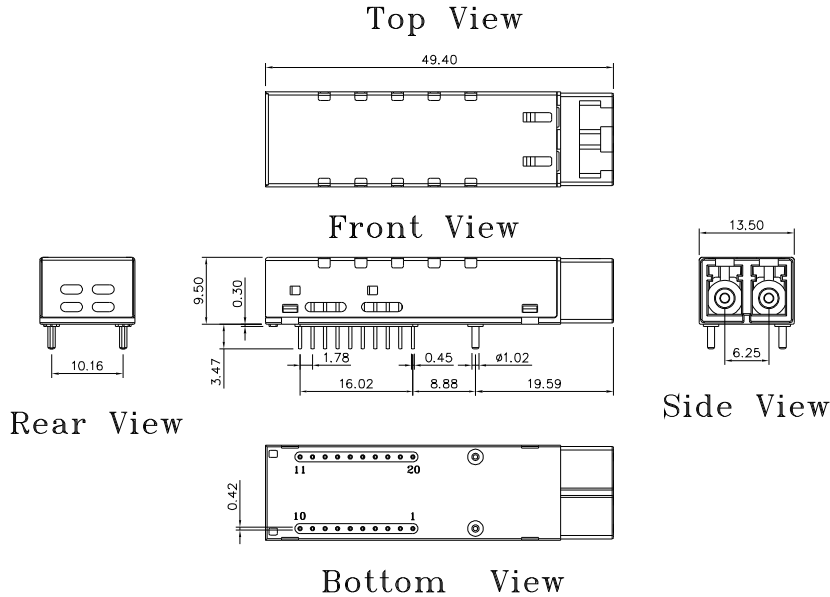


- Note: 1. TX input is terminated inside the module.  
 2. VeeR and VeeT are not internally connected to each other.  
 3. 50 Ω line pattern and component placements on TD+/TD- and RD+/RD- lines shall be symmetrical for better impedance matching.

PACKAGE DIAGRAM

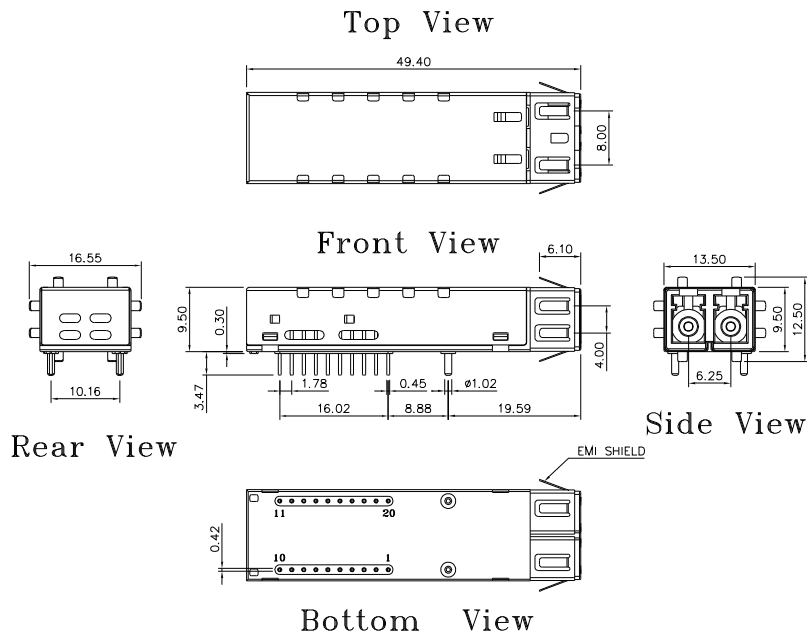
Units in mm

1) Standard Case



TRSL-9115WG / TRSL-9115AWG

2) Extended Case



TRSL-9115WEG / TRSL-9115AWEG

**Note:** Specifications subject to change without notice.