

1.25G ETHERNET MULTI-RATE 10/100/1000BASE-T COPPER SFP TRANSCEIVER

TRPRG1VAxx000E2G

Product Description

TRPRG1VAxx000E2G Copper Small Form Pluggable (SFP) transceivers are high performance, cost effective and compliant with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE 802.3-2002 and IEEE 802.3ab.

The module has two interfaces: the host interface and the MDI interface. The MDI interface provides 1000Base-T connectivity over the Category-5 cable. The host interface provides the data transfer over the 1.25 GHz PECL differential interface to the host board and control and configuration functions through the serial management interface. The module supports 1000Mbps full duplex with 5-level Pulse Amplitude Modulation (PAM) signals. The default mode of operation after power-up is 1000Base-T, full duplex, over SERDES Interface. All four pairs in the cable are used with symbol rate at 250Mbps on each pair. The module provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the 2-wire serial bus interface. The physical IC can also be accessed via 2-wire serial bus at address ACh.

The transceivers operate from a single +3.3V power supply over an operating case temperature range of 0°C to +70°C (Commercial) , -40°C to +85°C (Industrial) or -5°C to +85°C (Extended). The housing is made of metal for EMI immunity.



Features

- Compatible with IEEE 802.3z, IEEE 802.3u, IEEE 802.3ab
- Hot-pluggable SFP footprint
- RJ-45 connector assembly
- Access to physical layer IC via 2-wire serial bus
- TX Disable support
- Auto MDI/MDIX
- TDR functionality support
- 1000Base-T, full duplex default operating mode over SERDES interface
- 10/100/1000Base-T operation on platforms supporting SGMII
- Metallic enclosure for low EMI
- Unshielded cable support
- FCC Class B compliant
- RoHS-6 Compliant

Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Units |
|---|------------|---------|---------|-------|
| Storage Temperature | T_{ST} | - 40 | + 85 | °C |
| Case Operating Temperature ¹ | Commercial | 0 | + 70 | °C |
| | Extended | - 5 | + 85 | |
| | Industrial | - 40 | + 85 | |

¹ Measured on top side of SFP module at the front center vent hole of the cage

General Specifications

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|---------------------------|--------|---------|---------|---------|-------|
| Operating Data Rate | B | 10 | - | 1000 | Mb/s |
| Cable Length ¹ | L | - | - | 100 | m |

¹ Category 5 UTP

Electrical Power Supply Characteristics

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|-----------------------------|---------------|---------|---------|---------|-------|
| Input Voltage | V_{CC} | 3.13 | 3.3 | 3.47 | V |
| Supply Current | I_{CC} | - | - | 375 | mA |
| Power Consumption | P_W | - | - | 1.2 | W |
| Inrush Current ¹ | $I_{in-rush}$ | - | - | 30 | mA |

¹ The maximum inrush current during the hot plugging shall not exceed 30 mA.

Input Characteristics

| Parameter | Symbol | Minimum | Typical | Maximum | Units | |
|-------------------------------|--------------|-------------|----------|---------|----------------|---|
| Input differential impedance | R_{IN} | 90 | 100 | 110 | ohm | |
| Single ended data input swing | $V_{in, pp}$ | 250 | - | 1200 | mV | |
| TX Disable | Disable | V_{IH} | 2.0 | - | V_{CC} | V |
| | Enable | V_{IL} | V_{EE} | - | $V_{EE} + 0.8$ | V |
| MOD_DEF1 | High | V_{ihmin} | 2 | - | V_{CC} | V |
| | Low | V_{ilmax} | V_{EE} | - | $V_{EE} + 0.8$ | V |
| MOD_DEF2 (when host drives) | High | V_{ihmin} | 2 | - | V_{CC} | V |
| | Low | V_{ilmax} | V_{EE} | - | $V_{EE} + 0.8$ | V |

Output Characteristics

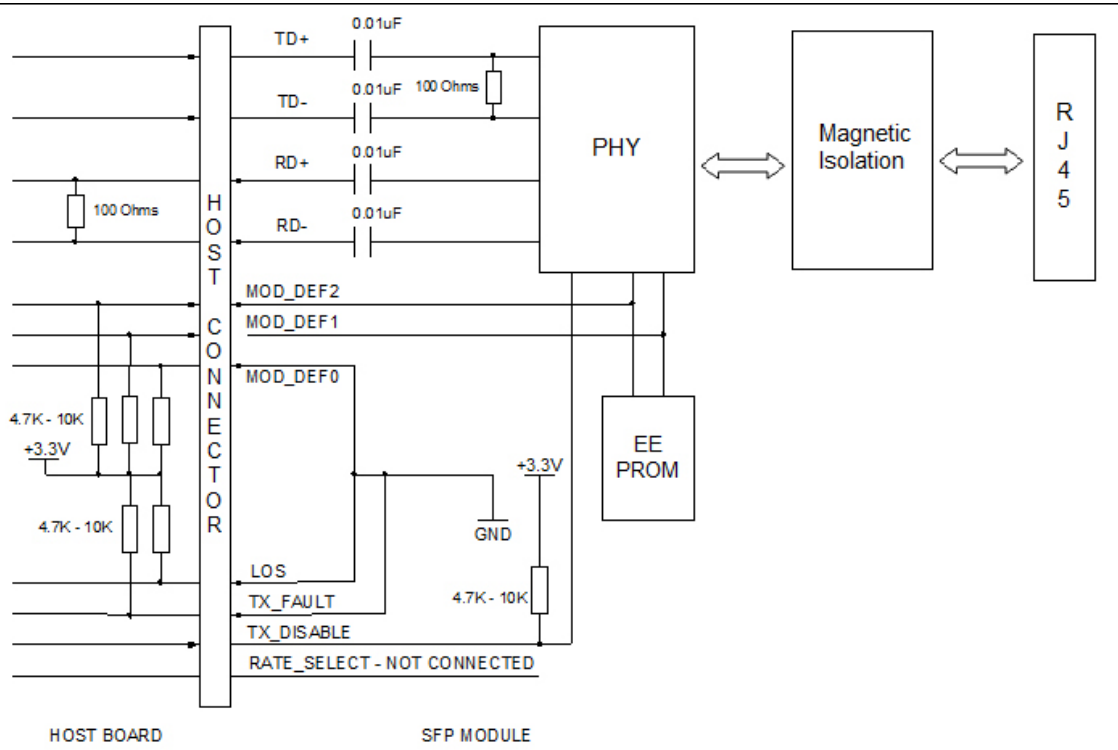
| Parameter | Symbol | Minimum | Typical | Maximum | Units | |
|---|---------------|-----------------|----------|---------|----------------|---|
| Single ended data output swing ^{1,2} | $V_{out, pp}$ | 185 | - | 600 | mV | |
| Data output rise time (20%-80%) | T_R | - | - | 300 | ps | |
| Data output fall time (20%-80%) | T_F | - | - | 300 | ps | |
| TX Fault ³ | Fault | V_{Fault} | N/A | - | N/A | V |
| | Normal | V_{Normal} | V_{EE} | - | $V_{EE} + 0.5$ | V |
| LOS ³ | Fault | $V_{losFault}$ | N/A | - | N/A | V |
| | Normal | $V_{losNormal}$ | V_{EE} | - | $V_{EE} + 0.5$ | V |
| MOD_DEF0 ³ | High | V_{ihmin} | N/A | - | N/A | V |
| | Low | V_{ilmax} | V_{EE} | - | $V_{EE} + 0.5$ | V |
| MOD_DEF2 (when SFP drives) | High | V_{ihmin} | 2.3 | - | V_{CC} | V |
| | Low | V_{ilmax} | V_{EE} | - | $V_{EE} + 0.5$ | V |

¹ Measured with 100 Ohms differential termination.

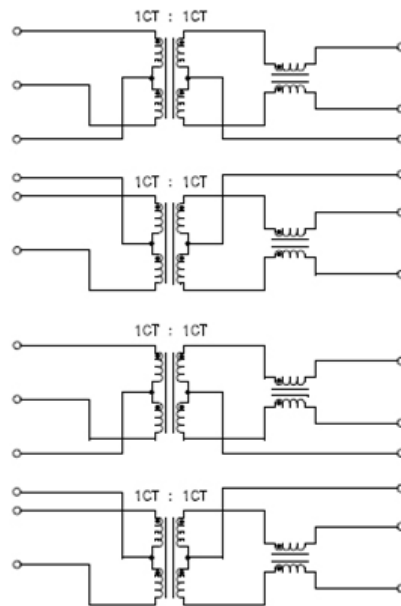
² Old requirement were 350/800 mV. Changed to be compliant with SFF-8431 standard for 10G port EDC applications (1G support in 10G capable SFP+ ports).

³ The signal is grounded on the SFP module.

Block Diagram



Magnetic Isolation Schematic



Host Board Interface

| Signal Name | Function | I/O | Connector Pin # |
|-------------|--|--------|--------------------------|
| Vee | Ground | | 1, 9, 10, 11, 14, 17, 20 |
| Vcc | +3.3V | Input | 15, 16 |
| RX- | Receive Data, Differential | Output | 12 |
| RX+ | Receive Data, Differential | Output | 13 |
| LOS | Grounded on the SFP | Output | 8 |
| TX+ | Transmit Data, Differential | Input | 18 |
| TX- | Transmit Data, Differential | Input | 19 |
| TX_DISABLE | Transmitter Disable, Active High (on 1000Base-T SFP module used as reset) | Input | 3 |
| TX_FAULT | Grounded on the SFP Module | Output | 2 |
| MOD_DEF(0) | Grounded on the SFP Module | Output | 6 |
| MOD_DEF(1) | Serial Clock | Input | 5 |
| MOD_DEF(2) | Serial Data | BiDir | 4 |
| RATE SELECT | Unused | NC | 7 |

Application Notes

Loss of Signal (LOS): LVTTTL compatible with a maximum voltage of 2.5V. LOS pin can enabled or disabled (Refer to Ordering information).

TX_Fault: TX_Fault pin is not supported, and is always connected to ground.

TX_Disable: It is an input used to reset the transceiver module. This pin is pulled up within the module with a 4.7 K Ω resistor. Low (0 – 0.8 V): Transceiver on; Between 0.8 V and 2.0 V: Undefined; High (2.0 - 3.465 V): Transceiver in reset state; Open: Transceiver in reset state.

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).

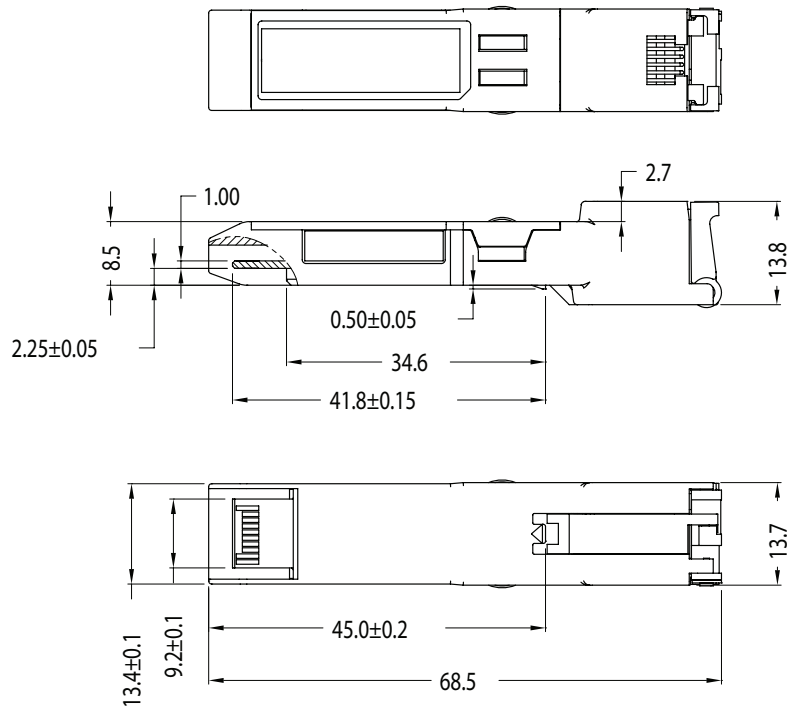
They should be pulled up with a 4.7K~10K resistor on the host board. The pull-up voltage shall be VccT or VccR. MOD_DEF(0)

is grounded by the module to indicate that the module is present. MOD_DEF(1) is the clock line of two wire serial interface for serial ID. MOD_DEF(2) is the data line of two wire serial interface for serial ID.

RD-/+: These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES.

TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential terminations inside the module.

Package Outline



Dimensions in millimeters (mm)

Ordering Information

| Part Number | Speed Mode | Link Indicator on RX_LOS Pin | 1000BASE-X Auto-negotiation | Operating Temperature |
|------------------|-----------------|------------------------------|-----------------------------|-----------------------|
| TRPRG1VA1C000E2G | 10/100/1000Mbps | No | No | 0°C to +70°C |
| TRPRG1VA1E000E2G | 10/100/1000Mbps | No | No | -5°C to +85°C |
| TRPRG1VA1I000E2G | 10/100/1000Mbps | No | No | -40°C to +85°C |
| TRPRG1VA2C000E2G | 10/100/1000Mbps | Yes | No | 0°C to +70°C |
| TRPRG1VA2E000E2G | 10/100/1000Mbps | Yes | No | -5°C to +85°C |
| TRPRG1VA2I000E2G | 10/100/1000Mbps | Yes | No | -40°C to +85°C |
| TRPRG1VA3C000E2G | 10/100/1000Mbps | No | Yes | 0°C to +70°C |
| TRPRG1VA3E000E2G | 10/100/1000Mbps | No | Yes | -5°C to +85°C |
| TRPRG1VA3I000E2G | 10/100/1000Mbps | No | Yes | -40°C to +85°C |
| TRPRG1VA4C000E2G | 10/100/1000Mbps | Yes | Yes | 0°C to +70°C |
| TRPRG1VA4E000E2G | 10/100/1000Mbps | Yes | Yes | -5°C to +85°C |
| TRPRG1VA4I000E2G | 10/100/1000Mbps | Yes | Yes | -40°C to +85°C |

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