

Datasheet

Multi-Rate (4 Gbps) Multi-Mode SFP Transceiver

SFP-TGD-SX



Features

- SFP transceiver
- Data Rates: 1062 - 4250 Mbps
- Protocols:
 - OC-48 and OC48 with FEC
 - Gigabit Ethernet
 - 1 Gbps Fibre Channel
 - 2 Gbps Fibre Channel
 - 4 Gbps Fibre Channel
- Multi-mode fiber
- 850 nm (Tx)
- 0 - 550 m on 50/125 µm MMF
- 0 - 300 m on 62.5/125 µm MMF
- Duplex LC connector
- Digital Diagnostics (SFF-8472)
- Hot-swap
- Extended operating temperature range
- Compliances (see last page for details)

Overview

Small Form-Factor Pluggable (SFP) interfaces from MRV Communications provide flexible high speed links in a small industry standard package. They deliver the deployment options and inventory control that network administrators demand for growing networks.

SFPs are designed to Multi-Source Agreement (MSA) standards to ensure network equipment compatibility. They are a perfect addition to MRV’s extensive lines of networking equipment.

Visit the MRV website at www.mrv.com or contact your nearest authorized MRV Communications dealer for more information.

Specifications Overview

| | |
|------------------------------|------------------|
| Data Rate | 1062 - 4250 Mbps |
| Tx Wavelength | 850 nm |
| Tx Power (Minimum) | -9 dBm |
| Tx Disable | Yes |
| Rx Wavelength | 770 - 860 nm |
| Rx Sensitivity @ 1.0625 Gbps | -20 dBm |
| Rx Sensitivity @ 1.25 Gbps | -20 dBm |
| Rx Sensitivity @ 2.125 Gbps | -18 dBm |
| Rx Sensitivity @ 4.25 Gbps | -15 dBm |
| Rx Saturation | 0 dBm |
| Operating Temperature Range | -20 to 85 °C |
| Power Consumption | 0.86 Watt |

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| Optical Specifications | | | | | |
|--|---------------------------------|---------|---------|-------|------|
| Parameter | Symbol | Minimum | Maximum | Unit | Note |
| Transmitter | | | | | |
| Output Optical Power: 50 or 62.5 MMF | P _{OUT} | -9 | -2.5 | dBm | 1 |
| Optical Wavelength | λ | 830 | 860 | nm | - |
| Spectral Width | σ | - | 0.85 | nm | - |
| Optical Modulation Amplitude @ 4.25 Gbps | OMA | 247 | - | μW | 2 |
| Optical Modulation Amplitude @ 2.125 Gbps | OMA | 196 | - | μW | 2 |
| Optical Modulation Amplitude @ 1.0625 Gbps | OMA | 156 | - | μW | 2 |
| Optical Rise/Fall Time | t _r , t _f | - | 90 | ps | 3 |
| Relative Intensity Noise | RIN | - | -118 | dB/Hz | - |
| Deterministic Jitter Contribution @ 2.125 Gbps | TX Δ DJ | - | 56.5 | ps | 4 |
| Total Jitter Contribution @ 2.125 Gbps | TX Δ TJ | - | 119 | ps | 5 |
| Deterministic Jitter Contribution @ 4.25 Gbps | TX Δ DJ | - | 28.2 | ps | 4 |
| Total Jitter Contribution @ 4.25 Gbps | TX Δ TJ | - | 56.5 | ps | 5 |
| Optical Extinction Ratio @ 1.25 Gbps | ER | 9 | - | dB | 6 |
| Mask Margin | - | 0 | - | % | - |
| Receiver | | | | | |
| Receiver Sensitivity @ 1.0625 Gbps | RX _{SENS} | - | -20 | dBm | 7 |
| Receiver Sensitivity @ 2.125 Gbps | RX _{SENS} | - | -18 | dBm | 7 |
| Receiver Sensitivity @ 4.25 Gbps | RX _{SENS} | - | -15 | dBm | 7 |
| Receiver Sensitivity @ 1.25 Gbps | RX _{SENS} | - | -20 | dBm | 8 |
| Receiver Power | RX _{MAX} | - | 0 | dBm | - |
| Receiver Electrical 3 dB cutoff frequency | - | - | 1500 | MHz | 9 |
| Receiver Electrical 3 dB cutoff frequency | - | - | 2500 | MHz | 10 |
| Optical Center Wavelength | λ _C | 770 | 860 | nm | - |
| Optical Return Loss | - | 12 | - | dB | - |
| LOS De-Assert | LOS _D | - | -20 | dBm | - |
| LOS Assert | LOS _A | -30 | - | dBm | - |
| LOS Hysteresis | - | 0.5 | - | dB | - |

- Notes:**
- Class 1 Laser Safety per FDA/CDRH, and EN (IEC) 60825 laser safety standards.
 - Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
 - Unfiltered, 20-80%. Complies with FC 1G and 2G eye mask when filtered.
 - Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and ΔDJ.
 - If measured with TJ-free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

- Applicable for Rate Selectable version only in low bandwidth mode.
- Specifications are for 50 micro-meter or 62.5 micro-meter fiber.
- As measured with 9 dB extinction ratio.
- Rate Selectable version in low bandwidth mode.
- Rate Selectable version in high bandwidth mode.

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| Digital Diagnostics Specifications | | | | | |
|--|---------------------------|---------|---------|------|------|
| Parameter | Symbol | Minimum | Maximum | Unit | Note |
| Accuracy | | | | | |
| Internally Measured Transceiver Temperature | DD _{Temperature} | - | 3 | °C | - |
| Internally Measured Transceiver Supply Voltage | DD _{Voltage} | - | 100 | mV | - |
| Measured TX Bias Current | DD _{Bias} | - | 10 | % | 1 |
| Measured TX Output Power | DD _{Tx-Power} | - | 2 | dB | - |
| Measured RX Received Average Optical Power | DD _{Rx-Power} | - | 2 | dB | - |
| Dynamic Range for Rated Accuracy | | | | | |
| Internally Measured Transceiver Temperature | DD _{Temperature} | -20 | 85 | °C | - |
| Internally Measured Transceiver Supply Voltage | DD _{Voltage} | 3.0 | 3.6 | V | - |
| Measured TX Bias Current | DD _{Bias} | 0 | 20 | mA | - |
| Measured TX Output Power | DD _{Tx-Power} | -9 | -2.5 | dBm | - |
| Measured RX Received Average Optical Power | DD _{Rx-Power} | -20 | 0 | dBm | - |
| Max Reporting Range | | | | | |
| Internally Measured Transceiver Temperature | DD _{Temperature} | -40 | 125 | °C | - |
| Internally Measured Transceiver Supply Voltage | DD _{Voltage} | 2.8 | 4.0 | V | - |
| Measured TX Bias Current | DD _{Bias} | 0 | 20 | mA | - |
| Measured TX Output Power | DD _{Tx-Power} | -10 | -3 | dBm | - |
| Measured RX Received Average Optical Power | DD _{Rx-Power} | -22 | 0 | dBm | - |

Notes: 1. Accuracy of Measured Tx Bias Current is 10% of the actual Bias Current from the laser driver to the laser.

| General Specifications | | | | | |
|---------------------------------|--------|---------|-------------------|------|------|
| Parameter | Symbol | Minimum | Maximum | Unit | Note |
| Data Rate | BR | 1062 | 4250 | Mbps | 1 |
| Bit Error Rate | BER | - | 10 ⁻¹² | - | 5 |
| Fiber Length on 50/125 µm MMF | L | - | 550 | m | 2 |
| | | | 300 | | 3 |
| | | | 150 | | 4 |
| Fiber Length on 62.5/125 µm MMF | L | - | 300 | m | 2 |
| | | | 150 | | 3 |
| | | | 70 | | 4 |

Notes: 1. 1G, 2G, 4G Fibre Channel compatible, per FC-PI-2 Rev. 7.0. Rate selectable version is also Gigabit Ethernet compatible per IEEE 802.3.
 2. At 1.0625 Gbps Fibre Channel data rate and, for rate selectable version, at 1.25 Gbps Gigabit Ethernet data rate.
 3. At 2.125 Gbps Fibre Channel data rate.
 4. At 4.25 Gbps Fibre Channel data rate
 5. 4.25Gbps with PRBS 2⁷-1.

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Absolute Maximum Ratings*

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|------------------------------------|-----------------|---------|---------|------|------|
| Maximum Supply Voltage | V _{CC} | -0.5 | 4.0 | V | - |
| Case Operating Temperature | T _A | -20 | 85 | °C | - |
| Storage Temperature | T _S | -40 | 85 | °C | - |
| Relative Humidity (Non-Condensing) | RH | 0 | 85 | % | - |

*Exceeding the limits listed in the table may damage the transceiver module permanently

Electrical Specifications

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|--|---------------------------------|-----------------------|-----------------------|------|------|
| Supply Voltage | V _{CC} | 3.0 | 3.6 | V | - |
| Supply Current | I _{CC} | - | 240 | mA | - |
| Transmitter | | | | | |
| Input Differential Impedance | R _{in} | 80 | 120 | Ω | 1 |
| Single Ended Data Input Swing | V _{in} , pp | 250 | 1200 | mV | 2 |
| Transmit Disable Voltage | V _D | V _{CC} - 1.3 | V _{CC} | V | 3 |
| Transmit Enable Voltage | V _{EN} | V _{EE} | V _{EE} + 0.8 | V | - |
| Receiver | | | | | |
| Single Ended Data Output Swing | V _{out} , pp | 285 | 800 | mV | 4 |
| Data Output Rise Time | t _r , t _f | - | 175 | ps | 5 |
| Data Output Fall Time | t _r , t _f | - | 120 | ps | 5 |
| LOS Fault | V _{LOS fault} | 2 | V _{CCHOST} | V | 6 |
| LOS Normal | V _{LOS norm} | V _{EE} | V _{EE} + 0.8 | V | 6 |
| Power Supply Rejection | PSR | 100 | - | mVpp | 7 |
| Deterministic Jitter Contribution @ 2.125 Gbps | RX ΔDJ | - | 51.7 | ps | 8 |
| Total Jitter Contribution @ 2.125 Gbps | RX ΔTJ | - | 23.5 | ps | 8 |
| Deterministic Jitter Contribution @ 4.25 Gbps | RX ΔDJ | - | 122 | ps | 9 |
| Total Jitter Contribution @ 4.25 Gbps | RX ΔTJ | - | 61 | ps | 9 |

Notes:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. We recommend < 600 mV for best EMI performance.
3. Or open circuit.
4. Into 100 ohms differential termination.
5. Unfiltered, 20 – 80 %
6. LOS is an open collector output. Should be pulled up with 4.7 k – 10 kohms on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5 V.
7. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.
8. Typical peak-to-peak jitter (=6*RMS width of Jitter).
9. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and ΔDJ. If measured with TJ free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

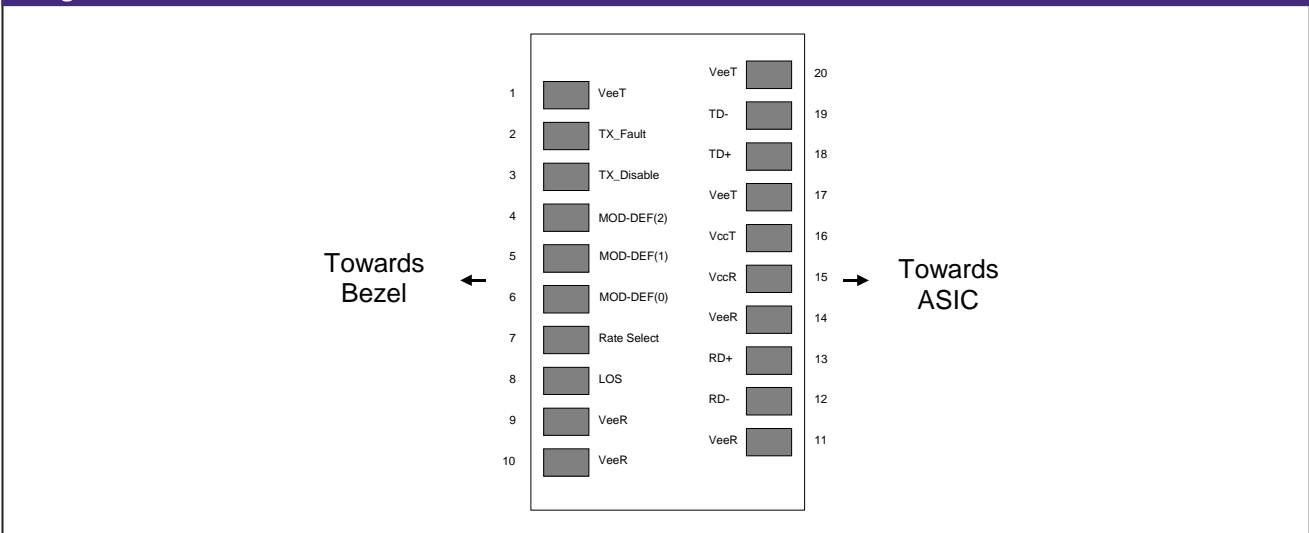
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Pin Descriptions

| Pin | Function | Name/Description | Note |
|-----|--------------------|---|------|
| 1 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | T _{FAULT} | Transmitter Fault. Not Supported. | - |
| 3 | T _{DIS} | Transmitter Disable. Laser Output Disabled on High or Open. | 2 |
| 4 | MOD_DEF(2) | Module Definition 2. Data Line for Serial ID. | 3 |
| 5 | MOD_DEF(1) | Module Definition 1. Data Line for Serial ID. | 3 |
| 6 | MOD_DEF(0) | Module Definition 0. Grounded Within the Module. | 3 |
| 7 | Rate Select | Open or Low = 1.063 Gbps or 2.125 Gbps Fibre Channel, 1.25 Gbps Gigabit Ethernet (Low Bandwidth) High = 2.125 or 4.25 Gbps Fibre Channel (High Bandwidth) | 4 |
| 8 | LOS | Loss of Signal Indication. Logic 0 Indicates Normal Operation. | 5 |
| 9 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 10 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 11 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 12 | RD- | Receiver Inverted DATA Out. AC Coupled. | |
| 13 | RD+ | Receiver Non-Inverted DATA Out. AC Coupled. | |
| 14 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 15 | V _{CCR} | Receiver Power Supply | |
| 16 | V _{CCT} | Transmitter Power Supply | |
| 17 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |
| 18 | TD+ | Transmitter Non-Inverted DATA In. AC Coupled. | |
| 19 | TD- | Transmitter Inverted DATA In. AC Coupled. | |
| 20 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |

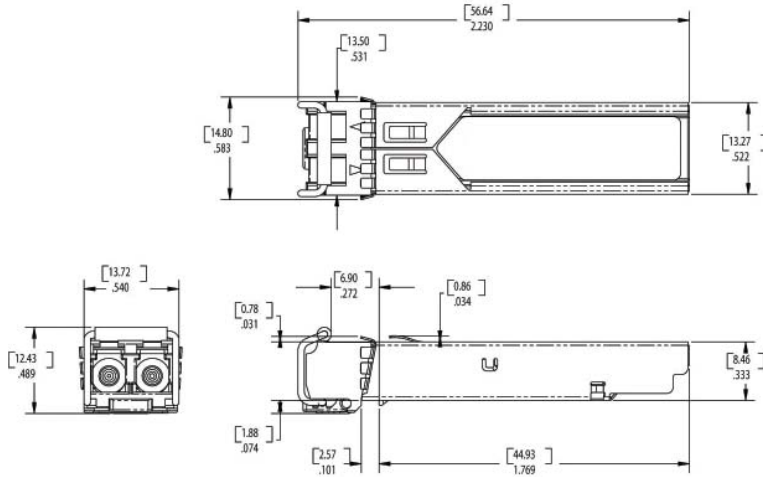
- Notes:**
- Circuit ground is internally isolated from chassis ground.
 - Laser output disabled on T_{DIS} > 2.0 V or open, enabled on T_{DIS} < 0.8 V.
 - Should be pulled up with 4.7 k - 10 kohms on host board to a voltage between 2.0 V and 3.6 V. MOD_DEF(0) pulls line low to indicate module is plugged in.
 - For Rate Selectable Version Only:** In accordance with SFF Committee SFF-8079 Draft, Rev.1.6, Table 3. Note that rate select can also be set through 2-wire bus in accordance with SFF-8472 at Bit 3, Byte 110, Address A2h (note: writing '1' selects full bandwidth operation). Rate select is the logic OR of the input state of Rate Select Pin and 2-wire bus. Non Rate Selectable version can operate at 1G, 2G, 4G Fibre Channel independent of rate select pin setting.
 - LOS is open collector output. Should be pulled up with 4.7 k - 10 kohms on host board to a voltage between 2.0 V and 3.6 V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

Diagram of Host Board Connector Block Pin Numbers and Names



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Mechanical Dimensions



Ordering Information

| Model | Description | Data Rate (Mbps) | Wavelength (nm) | Connector | Bail Latch Color | Max. Link Length (m) |
|------------|---|------------------------|-----------------|-----------|------------------|----------------------|
| SFP-TGD-SX | Multi-Rate Short-Wavelength SFP Transceiver | 1063, 1250, 2125, 4250 | 850 | Duplex LC | Black | 0-550 |

Regulatory and Industry Compliances

Class 1 Laser Product, Complies with 21CFR 1040.10, 1040.11 and EN 60825;
 Certified by one or more of the following agencies: TÜV, UL, CSA;
 RoHS Directive; China RoHS; California RoHS Law, REACH Directive SVHC; WEEE Directive
 The Quality Management System is certified to ISO 9001:2000 by QMI-SAI Global
 The Environmental Management System is in compliance with ISO 14001:2004

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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