# 8 Gbps Multi-Mode SFP+ Transceiver

SFP-8GD-SX

## Highlights

- SFP+ transceiver
- Data Rates: 2.125 to 8.5 Gbps
- Protocols:
  - 2/4/8 Gbps Fibre Channel
- Multi-mode fiber (MMF)
- Dual fiber, bi-directional
- 850 nm
- Up to 500 m range on 50/125 µm (OM3) MMF
- Duplex LC connector
- Digital Diagnostics (SFF-8472)
- Hot-swap

## 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 | 2.125 to 8.5 Gbps |
| Tx Wavelength | 850 nm |
| Tx Power (Minimum) | -9 dBm |
| Tx Dispersion Penalty | 4.2 dB |
| Tx Disable | Yes |
| Rx Wavelength | 770 to 860 nm |
| Rx Sensitivity @ 8.5 Gbps (OMA) | -11.2 dBm |
| Rx Saturation | 0 dBm |
| Operating Temperature Range | -5 to 70 ºC |
| Power Consumption | 1 Watt |

## Datasheet

### Optical Specifications

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|---|---|---|---|---|---|
| **Transmitter** | | | | | |
| Output Optical Power: 50 or 62.5 MMF | $P_{OUT}$ | -9 | -2 | dBm | 1 |
| Optical Wavelength | λ | 830 | 860 | nm | - |
| Spectral Width | σ | - | 0.65 | nm | - |
| Optical Modulation Amplitude @ 2.125 Gbps | OMA | -7.1 | - | dBm | 2 |
| Optical Modulation Amplitude @ 4.25 Gbps | OMA | -6.1 | - | dBm | 2 |
| Optical Modulation Amplitude @ 8.5 Gbps | OMA | -5.2 | - | dBm | 2 |
| Optical Rise/Fall Time @ 2.125, 4.25 Gbps | $t_r$, $t_f$ | - | 90 | ps | 3 |
| Transmitter Waveform and Dispersion Penalty @ 8.5 Gbps | TWDP | - | 4.2 | dB | 4 |
| Relative Intensity Noise | RIN | - | -128 | dB/Hz | - |
| Deterministic Jitter Contribution @ 2.125 Gbps | TX Δ DJ | - | 56.5 | ps | - |
| Total Jitter Contribution @ 2.125 Gbps | TX Δ TJ | - | 119.6 | ps | 5 |
| Deterministic Jitter Contribution @ 4.25 Gbps | TX Δ DJ | - | 28.2 | ps | - |
| Total Jitter Contribution @ 4.25 Gbps | TX Δ TJ | - | 59.8 | ps | 5 |
| **Receiver** | | | | | |
| Receiver OMA Sensitivity @ 2.125 Gbps | $Rx_{SENS}$ | - | -13.1 | dBm | - |
| Receiver OMA Sensitivity @ 4.25 Gbps | $Rx_{SENS}$ | - | -12.1 | dBm | - |
| Receiver OMA Sensitivity @ 8.5 Gbps | $Rx_{SENS}$ | - | -11.2 | dBm | - |
| Maximum Average Receiver Power | $Rx_{MAX}$ | 0 | - | dBm | - |
| Optical Center Wavelength | $\lambda_C$ | 770 | 860 | nm | - |
| Optical Return Loss | - | 12 | - | dB | - |
| LOS De-Assert | $LOS_D$ | - | -18 | dBm | - |
| LOS Assert | $LOS_A$ | -30 | - | dBm | - |
| LOS Hysteresis | - | 0.5 | - | dB | - |

**Notes:**

1. Class 1 Laser Safety per FDA/CDRH, and EN (IEC) 60825 laser safety standards.
2. Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
3. Unfiltered, 20-80%. Complies with FC 1x and 2x eye mask when filtered.
4. TWDP is calculated with a 1.0 equalizer and a 6,860 MHz Gaussian filter for the fiber simulation. Jitter values at $\lambda_T$ and $\lambda_R$ are controlled by TWDP and stress receiver sensitivity.
5. If measured with TJ-free data input signal. In actual application, output TJ will be given by: $TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$

### General Specifications

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|---|---|---|---|---|---|
| Data Rate | BR | 2.125 | 8.5 | Gbps | 1 |
| Bit Error Rate | BER | - | $10^{-12}$ | - | 2 |
| Fiber Length on 62.5/125 µm160 MHz/km MMF | L | 0 | 55<br>30<br>15 | m | 3<br>4<br>5 |
| Fiber Length on 62.5/125 µm 200 MHz/km (OM1) MMF | L | 0 | 70<br>40<br>21 | m | 3<br>4<br>5 |
| Fiber Length on 50/125 µm 160 MHz/km MMF | L | 0 | 300<br>150<br>50 | m | 3<br>4<br>5 |
| Fiber Length on 50/125 µm 2000 MHz/km (OM3) MMF | L | 0 | 500<br>380<br>150 | m | 3<br>4<br>5 |

**Notes:**

1. 2x and 4x Fibre Channel compatible, per "Fibre Channel Physical Interface-4 Specification (FC-PI-4 Rev. 7.00)". American National Standard for Information Systems, September 20, 2007.
2. PRBS $2^7$-1.
3. At 2.125 Gb/s Fibre Channel data rate.
4. At 4.25 Gb/s Fibre Channel data rate.
5. At 8.5 Gb/s Fibre Channel data rate.

## Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|---|---|---|---|---|---|
| Maximum Supply Voltage | $V_{CC}$ | -0.5 | 4.0 | V | - |
| Case Operating Temperature | $T_A$ | -5 | 70 | ºC | - |
| Storage Temperature | $T_S$ | -40 | 85 | ºC | - |
| Relative Humidity (Non-Condensing) | RH | 0 | 85 | % | - |

## Electrical Specifications

| Parameter | Symbol | Minimum | Maximum | Unit | Note |
|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 3.00 | 3.60 | 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 | 90 | 800 | mV | - |
| Transmit Disable Voltage | $V_D$ | 2 | $V_{CC}$ | V | 2 |
| Transmit Enable Voltage | $V_{EN}$ | $V_{ee}$ | $V_{ee}$ + 0.8 | V | - |
| **Receiver** | | | | | |
| Single Ended Data Output Swing | V out, pp | 170 | 400 | mV | 3 |
| Data Output Rise/Fall Time @ 2.125/4.25 Gbps | $t_r$, $t_f$ | - | 120 | ps | 4 |
| Data Output Rise/Fall Time @ 8.5 Gbps | $t_r$, $t_f$ | - | 60 | ps | 4 |
| LOS Fault | $V_{LOS\ fault}$ | 2 | $V_{CC_{HOST}}$ | V | 5 |
| LOS Normal | $V_{LOS\ norm}$ | $V_{ee}$ | $V_{ee}$ + 0.8 | V | 5 |
| Power Supply Rejection | PSR | 100 | - | mVpp | 6 |
| Deterministic Jitter Contribution @ 2.125 Gbps | RX Δ DJ | - | 47.1 | ps | - |
| Total Jitter Contribution @ 2.125 Gbps | RX Δ TJ | - | 123.5 | ps | 7 |
| Deterministic Jitter Contribution @ 4.25 Gbps | RX Δ DJ | - | 23.5 | ps | - |
| Total Jitter Contribution @ 4.25 Gbps | RX Δ TJ | - | 61.8 | ps | 8 |
| Deterministic Jitter @ 8.5 Gbps | RX DJ | - | 49.4 | ps | 8 |
| Pulse Width Shrinkage @ 8.5 Gbps | RX DDPWS | - | 42.4 | ps | 8 |
| Total Jitter @ 8.5 Gbps | RX TJ | - | 83.5 | ps | 8 |

Notes:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. Unfiltered, 20 – 80 %
5. 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.
6. 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.
7. If measured with TJ-free data input signal. In actual application, output TJ will be given by:

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

8. As defined in FC-PI-4, Rev 7.0, Table 13, 800-Mx-SN-y, "Fibre Channel Physical Interface-4 Specification (FC-PI-4 Rev. 7.00)". American National Standard for Information Systems, September 20, 2007.

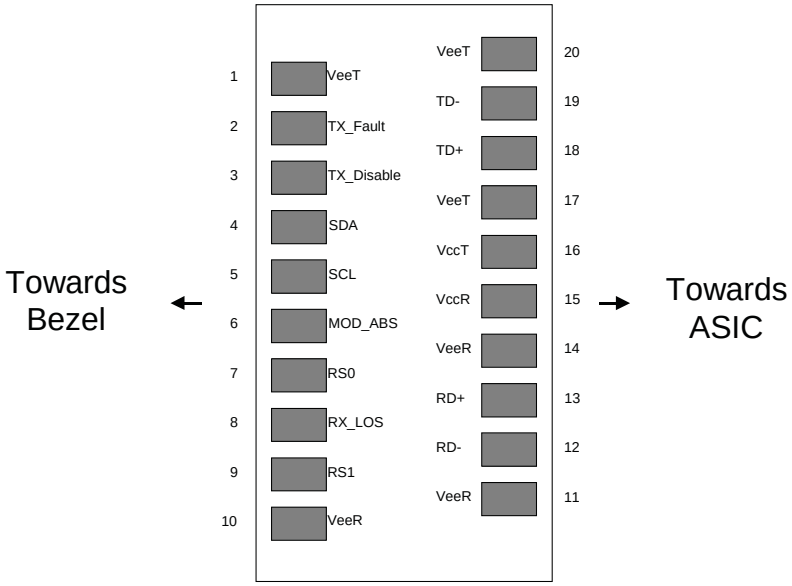
## Pin Descriptions

| Pin | Function | Name/Description | Note |
|---|---|---|---|
| 1 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | $T_{FAULT}$ | Transmitter Fault. | 2 |
| 3 | $T_{DIS}$ | Transmitter Disable. Laser Output Disabled on High or Open. | 3 |
| 4 | SDA | 2-wire Serial Interface Data Line (MOD-DEF2) | 4 |
| 5 | SCA | 2-wire Serial Interface Clock (MOD-DEF1) | 4 |
| 6 | MOD_ABS | Module Absent, connected to $V_{EET}$ or $V_{EER}$ | 4 |
| 7 | RS0 | No connection required | - |
| 8 | LOS | Loss of Signal Indication. Logic 0 Indicates Normal Operation. | 5 |
| 9 | RS1 | No connection required | - |
| 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 | $V_{EET}$ | Receiver Ground (Common with Transmitter Ground) | 1 |
| 18 | TD+ | Transmitter Non-Inverted DATA In. AC Coupled. | - |
| 19 | TD- | Transmitter Inverted DATA In. AC Coupled. | - |
| 20 | $V_{EET}$ | Receiver Ground (Common with Transmitter Ground) | 1 |

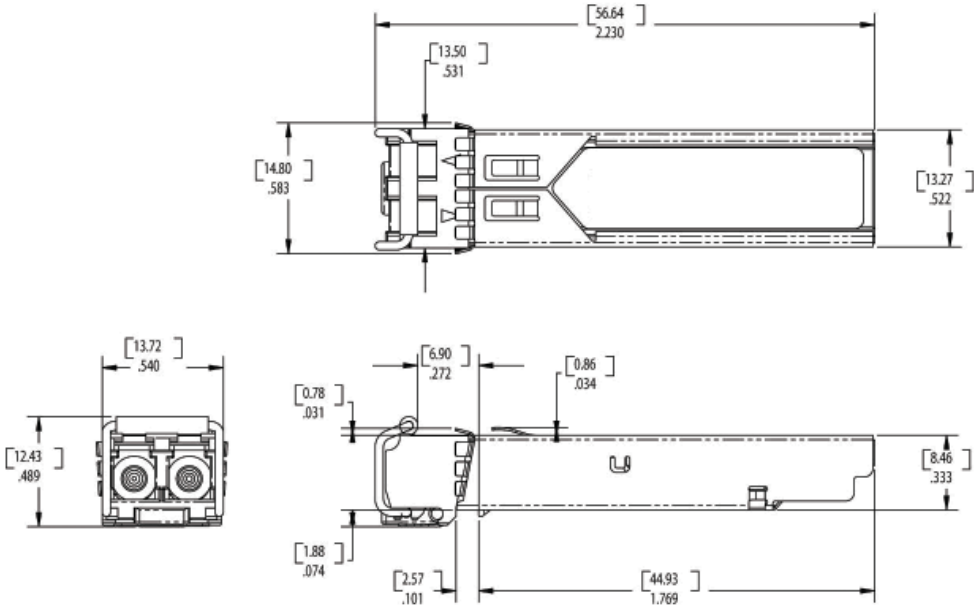
**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. $T_{FAULT}$ is an open collector/drain output, which should be pulled up with a 4.7 k – 10 kohms resistor on the host board if intended for use. Pull up voltage should be between 2.0 V to Vcc + 0.3 V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to < 0.8V.
3. Laser output disabled on $T_{DIS}$ > 2.0 V or open, enabled on $T_{DIS}$ < 0.8 V.
4. 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_ABS pulls line low to indicate module is plugged in.
5. 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




## Mechanical Dimensions



Optical Communications Systems™

# Datasheet

## Ordering Information

| Model | Description | Data Rate (Mbps) | Wavelength (nm) | Connector | Digital Diagnostics | Bail Latch Color | Max. Link Length (m) |
|---|---|---|---|---|---|---|---|
| **SFP-8GD-SX** | 2.125/4.25/8.5 Gbps SFP+ Transceiver, MM | 2125 - 8500 | 850 | Duplex LC | Yes | Black | 500 (50/125 µm OM3 MMF) |

## Regulatory and Industry Compliances

Class 1 Laser Product, complies with EN 60825-1 and 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50. dated June 24, 2007

MSA SFF-8074i; Digital Diagnostic SFF-8472

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 by QMI-SAI Global

The Environmental Management System is in compliance with ISO 14001

## Warnings

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic descharge (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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