

Datasheet

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

SFP-TGD-SX



Highlights

- SFP transceiver
- Data Rates: 1.0625 - 4.25 Gbps
- Protocols:
 - OC-48 and OC48 with FEC
 - 1 Gbps 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

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	1.0625 - 4.25 Gbps
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

Datasheet

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.

Datasheet

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	1.0625	4.25	Gbps	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:

- 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.
- At 1.0625 Gbps Fibre Channel data rate and, for rate selectable version, at 1.25 Gbps Gigabit Ethernet data rate.
- At 2.125 Gbps Fibre Channel data rate.
- At 4.25 Gbps Fibre Channel data rate
- 4.25Gbps with PRBS 2⁷-1.

Datasheet

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 Δ DJ	-	51.7	ps	8
Total Jitter Contribution @ 2.125 Gbps	RX Δ TJ	-	23.5	ps	8
Deterministic Jitter Contribution @ 4.25 Gbps	RX Δ DJ	-	122	ps	9
Total Jitter Contribution @ 4.25 Gbps	RX Δ TJ	-	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:

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

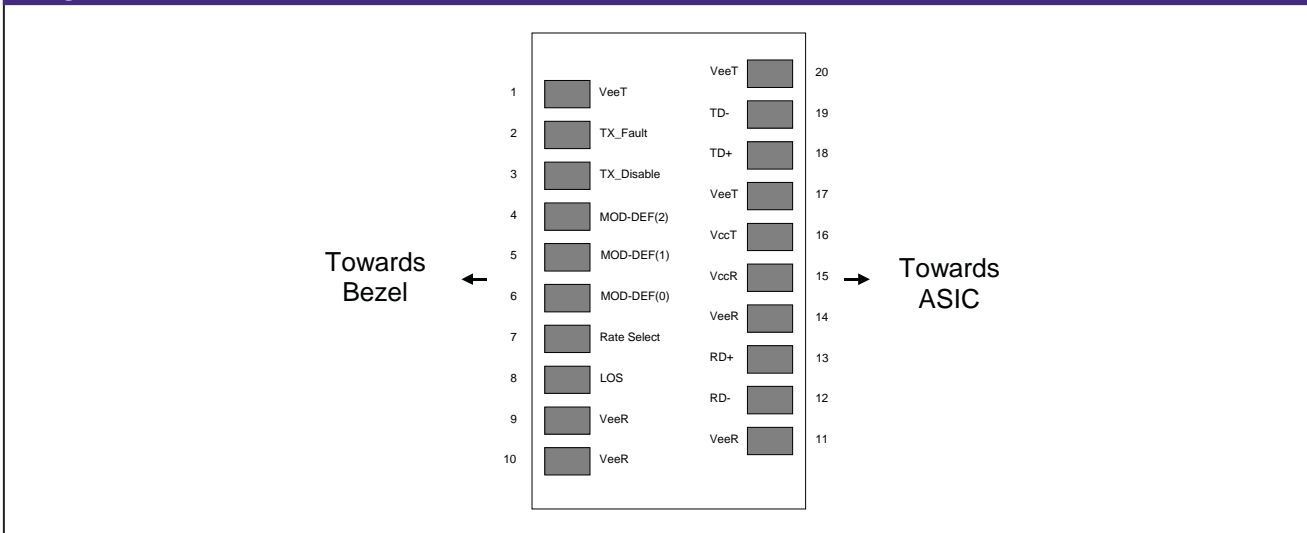
Datasheet

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

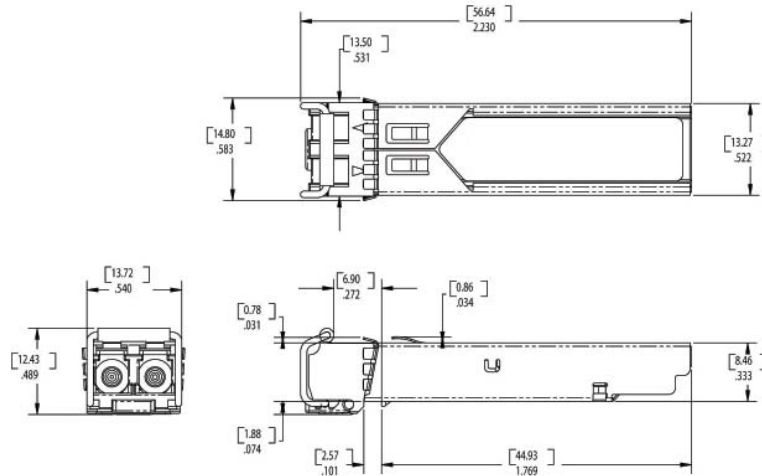
- Notes:**
- Circuit ground is internally isolated from chassis ground.
 - Laser output disabled on T_{DIS} > 2.0 V or open, enabled on T_{DIS} < 0.8 V.
 - Should be pulled up with 4.7 k - 10 kohms on host board to a voltage between 2.0 V and 3.6 V. MOD_DEF(0) pulls line low to indicate module is plugged 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



Datasheet

Mechanical Dimensions



Ordering Information

Model	Description	Data Rate (Gbps)	Wavelength (nm)	Connector	Bail Latch Color	Max. Link Length (m)
SFP-TGD-SX	1G Ethernet and 1/2G Fibre Channel SFP Transceiver	1.0625 - 4.25	850	Duplex LC	Black	0-550

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 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.

MRV has more than 50 offices throughout the world. Addresses, phone numbers and fax numbers are listed at www.mrv.com. Please e-mail us at info@mrv.com or call us for assistance.

MRV Los Angeles
 20415 Nordhoff Street
 Chatsworth, CA 91311
 800-338-5316
 818-773-0900

MRV Boston
 300 Apollo Drive
 Chelmsford, MA 01824
 800-338-5316
 978-674-6800

MRV International
 Business Park Moerfelden
 Waldeckerstrasse 13
 64546 Moerfelden-Walldorf
 Germany
 Tel. (49) 6105/2070
 Fax (49) 6105/207-100

All statements, technical information, and recommendations related to the products herein are based upon information believed to be reliable or accurate. However, the accuracy or completeness thereof is not guaranteed, and no responsibility is assumed for any inaccuracies. Please contact MRV Communications for more information. MRV Communications and the MRV Communications logo are trademarks of MRV Communications, Inc. Other trademarks are the property of their respective holders.