Datasheet

8 Gbps Bi-Directional SFP+ Transceiver

SFP-8GD-LR

Features

- Designed for SFF-8472 compliance (SFP)
- Up to 8.5 Gbps data rates
  - 2.125/4.25/8.5 Gbps Fibre Channel
- Single-mode optics (Duplex LC)
- Dual-fiber, bi-directional
- Class 1 laser (Tx): 1310 nm
- Up to 10 km on 9/125 µm SMF
- Digital Diagnostics (SFF-8472)
- Commercial operating temperature range
- RoHS compliant and Lead Free
- Metal enclosure, for lower EMI

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	85	ºC	-
Storage Temperature	T_S	-40	85	ºC	-
Relative Humidity (Non-Condensing)	RH	0	85	%	-

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

General Specifications

Parameter	Symbol	Minimum	Maximum	Unit	Note
Data Rate	BR	2.125	8.5	Gbps	1
Bit Error Rate	BER	-	10^{-12}	-	2
Max. Supported Link Length on 9/125 µm SMF, 2.125, 4.25, 8.5 Gbps	L_{MAX1}	-	10	km	3

Notes:
1. 2x/4x/8x Fibre Channel compliant.
2. Tested with a PRBS 2^7-1 test pattern.
3. Distances are based on IEEE 802.3 standards and FC-PI-4 Rev. 7.00 ("Fibre Channel Physical Interface-4 Specification". American National Standard for Information Systems, September 20, 2007.)

Electrical Specifications					
Parameter	**Symbol**	**Minimum**	**Maximum**	**Unit**	**Note**
Supply Voltage	V_{CC}	3.00	3.60	V	1
Supply Current	I_{CC}	-	300	mA	1
Transmitter					
Input Differential Impedance	R_{in}	80	120	Ω	2
Single Ended Data Input Swing	V in, pp	90	350	mV	-
Transmit Disable Voltage	V_D	2	V_{CC}	V	-
Transmit Enable Voltage	V_{EN}	V_{ee}	V_{ee} + 0.8	V	3
Receiver					
Single Ended Data Output Swing	V out, pp	150	425	mV	4
Data Output Rise/Fall Time @ 2.125 Gbps, 4.25 Gbps	t_r, t_f	-	120	ps	5
Data Output Rise/Fall Time @ 8.5 Gbps	t_r, t_f	-	60	ps	5
LOS Fault	$V_{LOS\ fault}$	2	$V_{CC_{HOST}}$	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 < 4.25 Gbps	RX Δ DJ	-	51.7	ps	8,9
Total Jitter Contribution < 4.25 Gbps	RX Δ TJ	-	122.4	ps	9
Deterministic Jitter Contribution = 4.25 Gbps	RX Δ DJ	-	25.9	ps	8,9
Total Jitter Contribution = 4.25 Gbps	RX Δ TJ	-	61.2	ps	9

Notes:

1. Module power consumption never exceeds 1W.
2. AC coupled.
3. Or open circuit.
4. Into 100 ohm differential termination.
5. 20 – 80 %.
6. LOS is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
7. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver MultiSource Agreement (MSA) 6, September 14, 2000. The Power Supply Rejection applies for a supply voltage range of 3.1 to 3.6 V.
8. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and Δ DJ.
9. For 8.5 Gbps operation, Jitter values for gamma T and gamma R are controlled by TDP and stressed receiver sensitivity.

Optical Specifications

Parameter	Symbol	Minimum	Maximum	Unit	Note
Transmitter					
Output Optical Power @ 8.5 Gbps	$P_{O, RH}$	-8.4	0.5	dBm	1
Output Optical Power @ 2.125, 4.25 Gbps	$P_{O, RL}$	-8.4	-3	dBm	2
Optical Wavelength	λ	1285	1345	nm	3
Spectral Width	σ	-	1	nm	3
Optical Modulation Amplitude	OMA	-5.4	-	dBm	3,4
Transmitter and Dispersion Penalty @ 8.5 Gbps	TDP	-	3.2	dB	5
Optical Rise/Fall Time @ 2.125, 4.25 Gbps	t_r/t_f	-	90	ps	6
Relative Intensity Noise	RIN	-	-128	dB/Hz	-
Receiver					
Unstressed Receiver OMA Sensitivity @ 8.5 Gbps	R_{SENSr}	-	-13.8	dBm	7
Unstressed Receiver OMA Sensitivity @ 4.25 Gbps	R_{SENS4}	-	-15.4	dBm	7
Unstressed Receiver OMA Sensitivity @ 2.125 Gbps	R_{SENS2}	-	-18.2	dBm	7
Maximum Average Receiver Power	Rx_{MAX}	0.5	-	dBm	-
Optical Center Wavelength	λ_C	1260	1360	nm	-
Optical Return Loss	-	12	-	dB	-
LOS De-Assert	LOS_D	-	-19	dBm	-
LOS Assert	LOS_A	-30	-	dBm	-
LOS Hysteresis	-	0.5	-	dB	-

Notes:

1. High Bandwidth Mode. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
2. Low Bandwidth Mode. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
3. Also specified to meet curves in FC-PI-4 Rev 7.00 ("Fibre Channel Physical Interface-4 Specification". American National Standard for Information Systems, September 20, 2007) Figures 21, 22, and 23, which allow trade- off between wavelength, spectral width and OMA.
4. Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
5. For 8.5 Gb/s operation, Jitter values for gamma T and gamma R are controlled by TDP and stressed receiver sensitivity.
6. Unfiltered, 20-80%. Complies with IEEE 802.3 (Gig. E), FC 1x and 2x eye masks when filtered.
7. Measured with conformance signals defined in FC-PI-4 Rev. 10.0 specifications. Value in OMA. Measured with PRBS 2^7-1 at 10^{-12} BER.

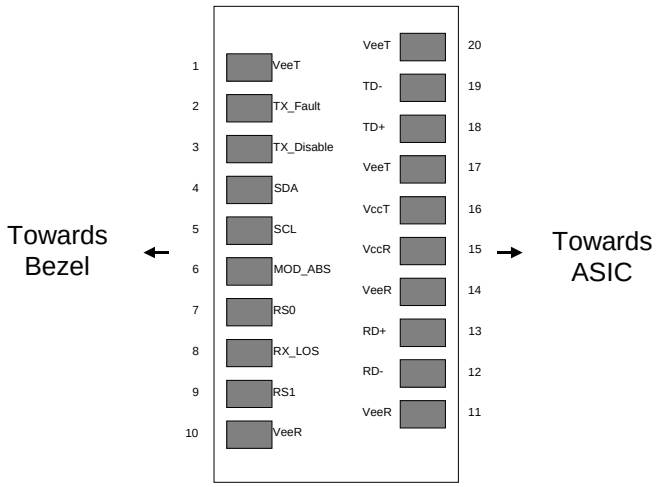
Pin Descriptions

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	Rx Rate Select: Open or Low = 2.125 or 4.25 Gbps Fibre Channel (Low Bandwidth) High = 8.5 Gbps Fibre Channel (High Bandwidth)	5
8	LOS	Loss of Signal Indication. Logic 0 Indicates Normal Operation.	6
9	RS1	Tx Rate Select: Open or Low = 2.125 or 4.25 Gbps Fibre Channel (Low Bandwidth) High = 8.5 Gbps Fibre Channel (High Bandwidth)	5
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

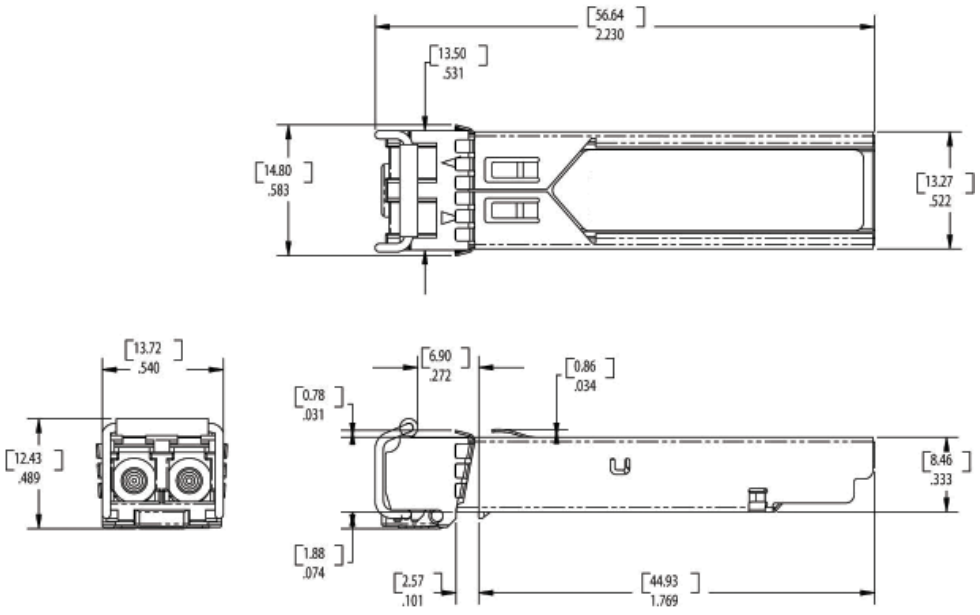
Notes:

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 < 0.8 V.
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. Rate select can also be set through the 2-wire bus in accordance with SFF-8472 v. 10.1. Rx Rate Select is set at Bit 3, Byte 110, Address A2h. Tx Rate Select is set at Bit 3, Byte 118, Address A2h. Note: writing a "1" selects maximum bandwidth operation. Rate select is the logic OR of the input state of Rate Select Pin and 2-wire bus.
6. 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



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Ordering Information

Model	Description	Data Rate (Mbps)	Wavelength (nm)	Connector	Bail Latch Color	Max. Link Length (km)
SFP-8GD-LR	SFP+, 2.125 / 4.25 / 8.5 Gb/s, SM, with Digital Diagnostics.	2125 - 8500	1310	Duplex LC	Blue	0 -10

Regulatory and Industry Compliances

Class 1 Laser Product, Complies with 21CFR 1040.10, 1040.11 and EN 60825-1

Certified by one or more of the following agencies: TÜV, UL, CSA

RoHS Directive; China RoHS; California RoHS Law, REACH Directive SVHC

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