8 Gbps Bi-Directional SFP+ Transceiver

SFP-8GD-SX

Features

- Designed for SFF-8472 compliance (SFP)
- Up to 8.5 Gbps data rates
  - 2.125/4.25/8.5 Gbps Fibre Channel
- Multi-mode optics (Duplex LC)
- Dual-fiber, bi-directional
- Class 1 laser (Tx): 850 nm
- 50 m range on 50/125 µm MMF
- 150 m range on high-bandwidth 50/125 um (OM3) MMF
- Digital Diagnostics (SFF-8472)
- Extended 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	70	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
Fiber Length on 50/125 µm MMF	L	-	300 150 50	m	3 4 5
Fiber Length on 50/125 µm high-bandwidth (OM3) MMF	L	-	500 380 150	m	3 4 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.

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 Gbps, 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.

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	λ_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 λ_T and λ_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:

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

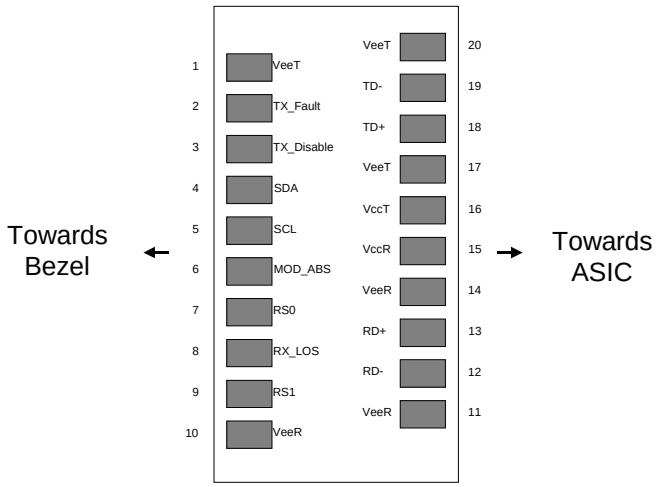
Pin Descriptions

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}	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

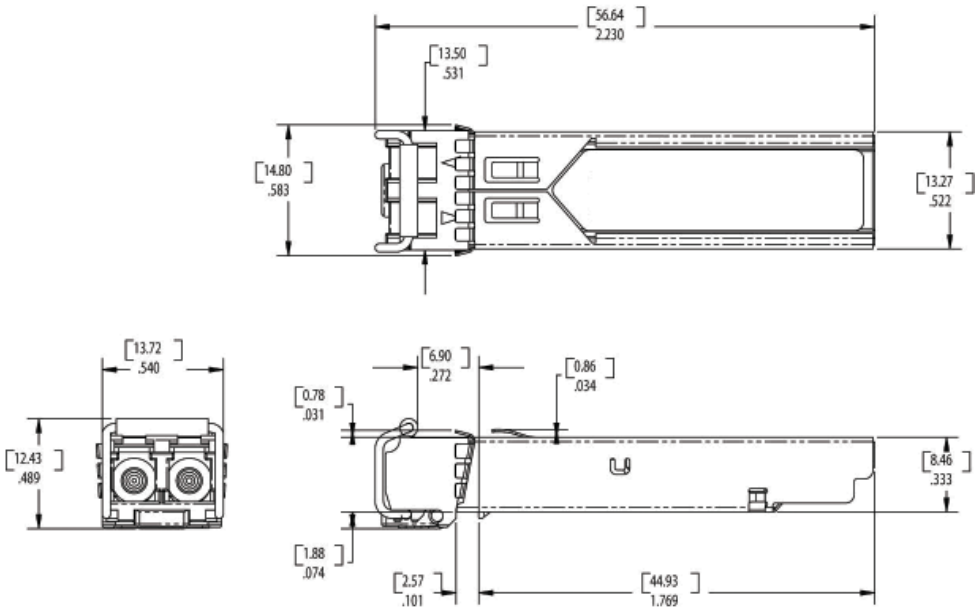
Notes:

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 < 0.8 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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Datasheet

Ordering Information

Model	Description	Data Rate (Mbps)	Wavelength (nm)	Connector	Bail Latch Color	Max. Link Length (m)
SFP-8GD-SX	SFP+, 2.125 / 4.25 / 8.5 Gbps, MM, with Digital Diagnostic.	2125 - 8500	850	Duplex LC	Black	0 -300

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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