

### Features:

- 1.25 Gb/s to 3.125 Gb/s duplex data links
- 1310 nm Fabry-Perot laser transmitter and PIN receiver
- Class 1 Laser Int. Safety Std. IEC-825 compliant
- Standard reach of 10 km on 9/125  $\mu$ m SMF
- Industry Standard MSA 2x5 footprint
- MSA 2x7 option available providing Digital Diagnostics per SFF 8472
- Rugged LC connector housing
- -40 to +85 C operating temperature, -40 to 95C option
- Option for RoHS compliant and lead free per Directive 2002/95/EC
- Single +3.3V power supply
- AC Coupled Transmitter & Receiver Data
- Conformal coated for harsh environment use
- Pigtail Assembly option is available



**The SFF-3G-LX is ideal for harsh environment connectivity because of its low cost, availability, and wide operating parameters**



### Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Maximum Supply Voltage	V <sub>CC</sub>	-0.5	4.5	V	
Storage Temperature	T <sub>sto</sub>	-55	100	°C	
Case Operating Temperature	T <sub>OP</sub>	-40	85	°C	
Relative Humidity	RH	0	85	%	Based on conformal coating
Lead Soldering Temperature			260	°C	10 seconds on leads only
Conformal Coating		0.8	1.2	mil	See ruggedization notes

#### Notes:

- 1) SFF transceivers may be water washed. The process must be followed by an 80°C bake for one hour to ensure the drying of any water inside the shell.
- 2) The components should not undergo Reflow Soldering under any circumstances.

### General Specifications

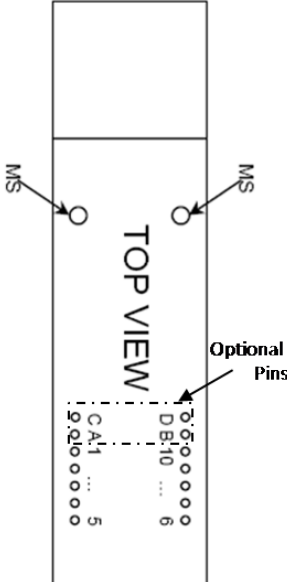
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	V <sub>CC</sub>	3.14		3.47	V	
Power Dissipation	P <sub>DIS</sub>			1.2	W	1.32W for T <sub>op</sub> > 85°C
Data Rate	BR	1.25		3.125	Gb/s	

### Electrical Specifications (T<sub>OP</sub> = -40 to 85°C, V<sub>CC</sub> = 3.14 to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Supply Current	I <sub>CC</sub> TX			275	mA	300mA for T <sub>OP</sub> > 85°C
Differential Impedance	Z <sub>IN</sub>		100		Ω	
Differential Voltage	V <sub>IN</sub> PP	200		2400	mV	LVPECL
Transmit Disable Voltage	V <sub>TXDIS</sub>	2.0		V <sub>CC</sub>	V	LVTTTL
Transmit Enable Voltage	V <sub>TXEN</sub>	0		0.8	V	LVTTTL
<b>Receiver</b>						
Supply Current	I <sub>CC</sub> RX			80	mA	
Differential Impedance	Z <sub>OUT</sub>		100		Ω	
Differential Voltage	V <sub>DRX</sub>	600		900	mV	AC-Coupled
Rise/Fall Time	t <sub>r</sub> /t <sub>f</sub>			130	ps	20% - 80%
Total Contributed Jitter	T <sub>JRX</sub>			0.4	UI	pk-pk
Signal Detect Assert	SD <sub>norm</sub>	2.0		V <sub>CC</sub>	V	LVTTTL
Signal Detect De-Assert	SD <sub>fault</sub>	0		0.8	V	LVTTTL

### Pin Configuration

PIN #	Symbol	Description	Logic Family
1	VEER	Receiver Ground (Common with Transmitter Ground)	NA
2	VCCR	Receiver Power Supply	NA
3	SD	Signal Detect. Logic 1 indicates normal operation.	LVTTTL
4	RD-	Receiver Inverted DATA out. AC Coupled	See Rx
5	RD+	Receiver Non-inverted DATA out. AC Coupled	See Rx
6	V <sub>CC</sub> T	Transmitter Power Supply	NA
7	VEET	Transmitter Ground (Common with Rx Ground)	NA
8	T <sub>DIS</sub>	Transmitter Disable	LVTTTL
9	TD+	Transmitter Non-Inverted DATA in, AC Coupled	See Tx
10	TD-	Transmitter Inverted DATA in. AC Coupled	See Tx
A	SDA	Two Wire Digital Diagnostics Data Interface	LVTTTL
B	SCL	Two Wire Digital Diagnostics Clock Interface	LVTTTL
C	Reserved		NA
D	TX_FAULT	Transmitter Fault Indication – High Indicates a fault condition	LVTTTL
MS	MS	Mounting studs are for mechanical attachment and are connected to chassis ground. Chassis ground is internally isolated from circuit grounds. Connection to user's ground planes is recommended.	NA



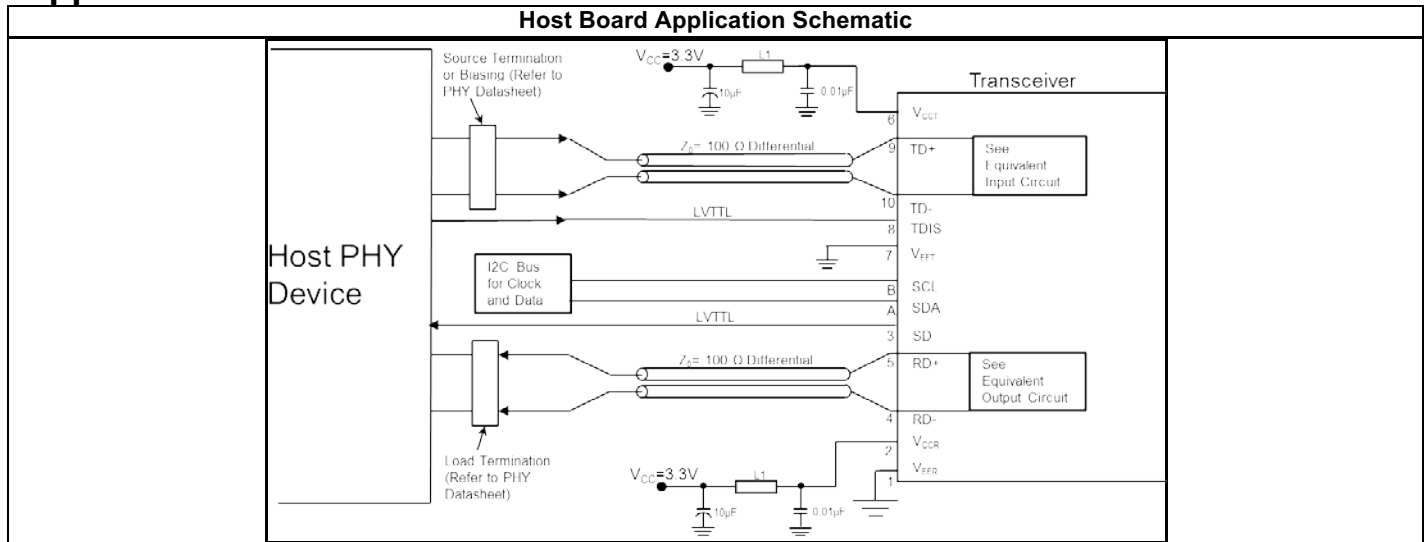
### Optical Characteristics ( $T_{OP} = -40$ to $85^{\circ}\text{C}$ , $V_{CC} = 3.135$ to $3.465$ Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Output Power (9/125 SMF)	$P_{OUT}$	-5		1	dBm	(1)
Optical Wavelength	$\lambda$	1270	1310	1355	nm	(2)
Spectral Width	$\sigma_{LX}$			2.5	nm	(2)
Extinction Ratio:	ER	9			dB	(3)
Optical Rise/Fall Time:	$t_r/t_f$			150	ps	180ps for $T_{op} > 85^{\circ}\text{C}$ (3)(4)(6)
Relative Intensity Noise	RIN			-120	dB/Hz	(3) FCPI-4 ( $\delta_R - \gamma_R$ )
Total Jitter Contribution	$TX_{TJ}$			0.4	UI	pk-pk
<b>Receiver</b>						
Receiver Sensitivity@1.25Gbps	$RX_{SENS1}$			-22	dBm	(1)(4)(5)
Receiver Sensitivity@3.125Gbps	$RX_{SENS2}$			-18	dBm	
Overload	$RX_{MAX}$	0			dBm	
Optical Center Wavelength	$\lambda_c$	1200	1310	1600	nm	
Return Loss	RL	12			dB	
Signal Detect Assert	$P_A$			-24	dBm	(1)(5)
Signal Detect De-Assert	$P_D$	-35			dBm	(1)(5)
Signal Detect Hysteresis	$P_A - P_D$	1			dB	
<b>Notes:</b>						
1) Measured using a broad area detector optical power meter.						
2) Measured using an optical spectrum analyzer.						
3) Measured using a high speed oscilloscope.						
4) Measured using a BERT set running PRBS $2^7-1$ at 3.125Gbps.						
5) Measured using a $9\mu\text{m}$ single-mode variable optical attenuator.						
6) 20% - 80%						

### Digital Diagnostics Information

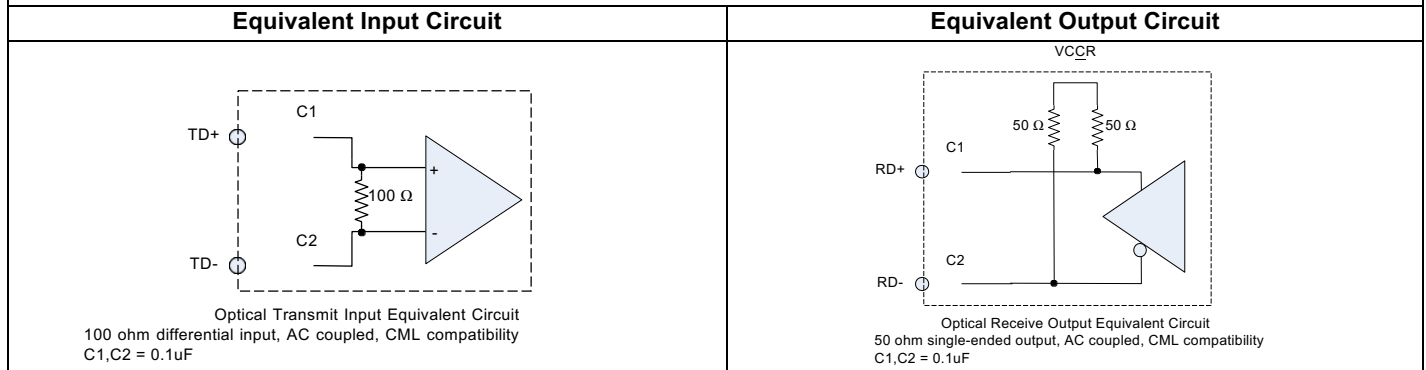
COTSWORKS' SFF parts include additional pins to read and write I2C information per the MSA SFF 8472 specification. While typically implemented in pluggable modules such as SFPs, all that is required to enable this functionality is two additional pins and internal circuitry in the transceiver. The circuitry in the COTSWORKS' SFF is a microcontroller providing EEPROM storage and accessing optical and electrical information from the laser and receiver.

### Application Schematics

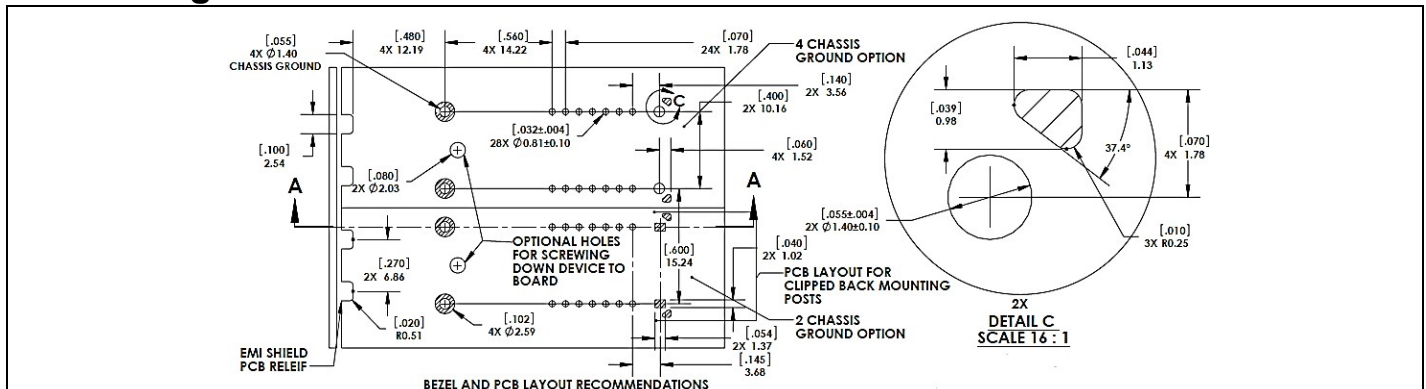


**Notes:**

- 1) L1 & L2 = 600Ω @ 100MHz or better
- 2) Mounting Studs are isolated from Signal Ground and may be connected to Chassis Ground or Signal Ground if Chassis Ground is not available
- 3) Pins A & B are optional and only come on the DD option



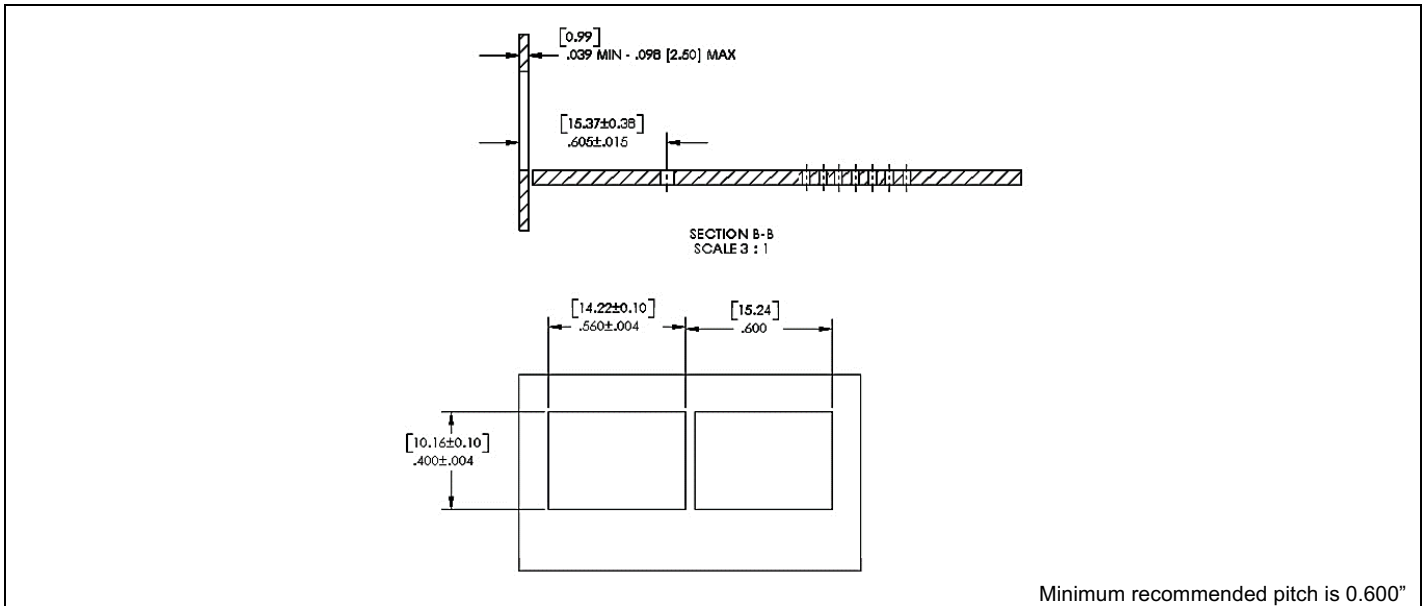
### PCB Design Guidelines



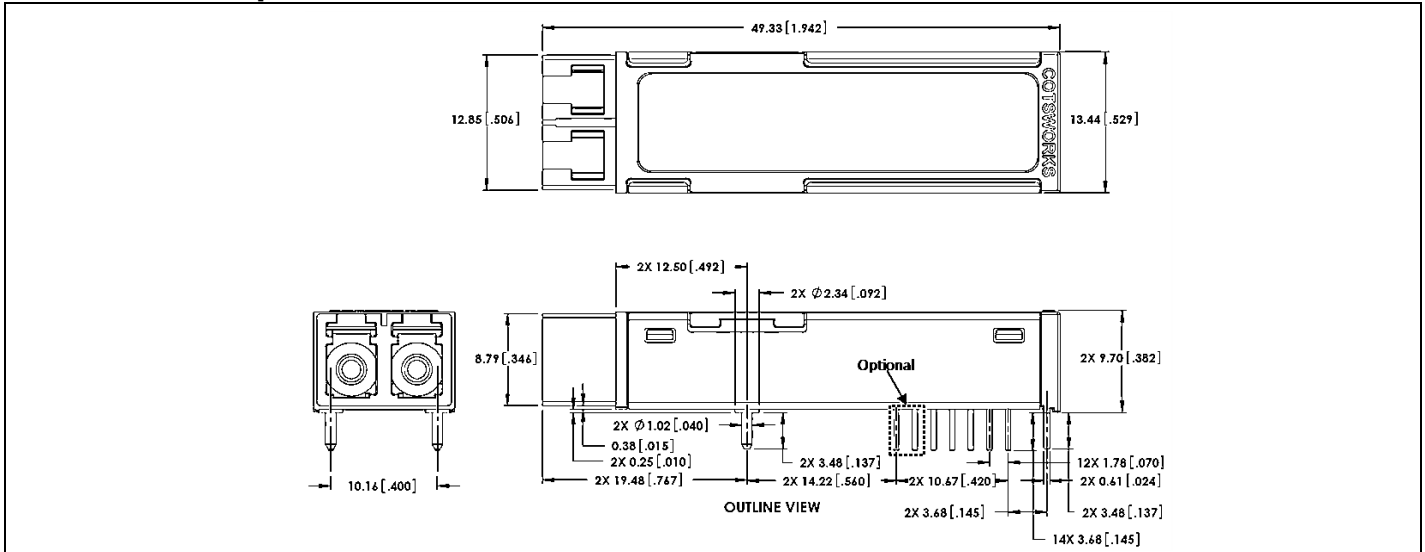
**Notes:**

- 1) The above drawing represents side by side board layout for 2 SFF transceivers.
- 2) The top SFF is shown with 4 mounting posts and the bottom SFF is shown with 2 front mounting posts.

### Panel Cutout



### Mechanical Specifications



SFF-3G-LX mechanical dimensions are defined by the Small Form Factor (SFF) Transceiver Multi-source Agreement (MSA). July 5, 2000. Mechanicals do not show optional EMI shield.

### Ruggedization Notes

- Parylene C coating can be used for conformal coating with a 1.0 mil ± 0.2 mil thickness through a deposition process.
  - Parylene Type C has a 5600 VPM rating, withstands high temperatures, and is extremely resistant to oil/dirt, and object impact.
- This part is also available in a pigtail fiber optic version. Contact COTSWORKS for more information.
- Contact COTSWORKS for all MSDS, case composition, and burn analysis.

### Reference Information

- 1) IEEE Standard 802.3, 2002 Edition, 1000BASE-X. IEEE Standards Department, 2002
- 2) "Fibre Channel Draft Physical Interface Specification (FC-PI-2 Rev. 10.0)". American National Standard for Information Systems
- 3) Infiniband 1.2.1 specification, [www.infinibandta.org](http://www.infinibandta.org)
- 4) 3.125 Gb/s XAUI specification, IEEE 802.3ae, section 47
- 5) ARINC 818 specification at 3.1875Gb/s, <https://www.arinc818.com/>
- 6) Directive 2002/95/EC of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment." January 27, 2003

### Regulatory Compliance

- COTSWORKS transceivers are Class 1 Laser Products and are designed to comply with US FDA regulations.
- These products are designed to comply with Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950.
- This part has an option for compliance with Directive 2002/95/EC covering restriction on certain hazardous substances (RoHS). Contact COTSWORKS for more information.

### Warnings

#### Handling Precautions:

This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended.

#### Laser Safety:

Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

### Ordering Information

SFF-3G-LX-	x	DPLX	-LC-	x	-x-	x	-x-	x
<b>SFF Form Factor</b>	<b>Pins and Diagnostics</b>	<b>Duplex LC Connector</b>		<b>Ruggedized Coating</b>	<b>Operating Temp Range</b>	<b>EMI Shield</b>	<b>RoHS Level</b>	<b>Posts</b>
<b>3 Gbps Max Data Rate</b>	(): 2x5 <u>No Diagnostics</u>			(): Non-coated	A: -40 to 85°C	(): No Shield	(): Level 5	(): Posts
<b>Long Reach (10km over SMF)</b>	D: 2x7 <u>Digital Diagnostics</u>			R: Parylene	M: -40 to 95°C	E: Shield	6: Level 6	NP: No Posts

**Example part number:** SFF-3G-LX-D-DPLX-LC-R-A

[3G SFF Duplex LC transceiver, Digital Diagnostics, Parylene-coated, Industrial temperature range, posts]

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