

Features:

- 1.25Gbps to 3.125Gbps duplex data links
- Compliant to 802.3z Ethernet, Fiber Channel (1x/2x/3x), Infiniband SDR, sFPDP, FCAV and ARINC818
- Compatible with Single-mode and multimode fiber
- 1310nm FP laser transmitter and PIN Receiver
- Class 1 Laser Int. Safety Std. IEC-825 compliant
- 1x10 surface mount connector, standard
- 1x12 surface mount connector option providing Digital Diagnostics
- Rugged LC connector housing including screw mounted OSAs
- MIL-STD-883 certified
- -40°C to +85°C operating temperature
- -55°C to +95°C operating temperature option
- Option for RoHS 6/6 compliant and lead free per Directive 2002/95/EC
- Single +3.3V power supply
- AC-Coupled Transmitter & Receiver Data
- Conformal coating options for harsh environment use
- COTSWORKS RJs are fully tested over the operating temperature range
- Pigtail Assembly option is available. Contact COTSWORKS for details



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



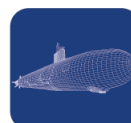
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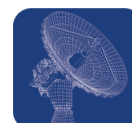
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TACTICAL



SUBSEA
NETWORKING



RADAR &
SENSING



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EXPLORATION

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Maximum Supply Voltage	V _{CC}	-0.5	4.5	V	
Storage Temperature	T _{sto}	-55	100	°C	
Case Operating Temperature	T _{OP}	-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) RJ 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.

**Optical Specifications** ($T_{OP} = -55$ to 95°C , $V_{CC} = 3.14$ to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
Output Power	P_O	-7	-	1	dBm	(9/125 SMF) (1)
Optical Wavelength	λ	1280	1310	1340	nm	(2)
RMS Spectral Width	σ_{LX}	-	-	2.5	nm	(2)
Extinction Ratio	ER	6	-	-	dB	(3)
Optical Rise/Fall Time:	t_r/t_f	-	-	130	ps	20%–80% (3)(4)
Relative Intensity Noise	RIN	-	-	-120	dB/Hz	FCPI-4 ($\delta_R - \gamma_R$) (3)
Total Jitter Contribution (p-p)	$TX\Delta TJ$	-	-	119	ps	-
Receiver						
Receiver Sensitivity@1.25Gbps	RX_{SENS1}	-	-	-22	dBm	(1) (4) (5)
Receiver Sensitivity@3.125Gbps	RX_{SENS2}	-	-	-20	dBm	
Overload	RX_{MAX}	0	-	-	dBm	
Optical Center Wavelength	λ_c	1270	-	1360	nm	-
Return Loss	RL	12	-	-	dB	-
Signal Detect Assert	P_A	-	-	-20	dBm	(1) (5)
Signal Detect De-Assert	P_D	-36	-	-	dBm	(1) (5)
Signal Detect Hysteresis	$P_A - P_D$	1	-	-	dB	-

NOTES:

- 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 2⁷-1 at 3.125Gbps.
- 5) Measured using a 9 μm single-mode variable optical attenuator.

Electrical Specifications ($T_{OP} = -55$ to 95°C , $V_{CC} = 3.14$ to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate	BR	0.125		3.125	Gb/s	
Supply Voltage	V_{CC}	3.14		3.47	V	(1)
Power Dissipation	P_{BUS}	-		1041	mW	
Transmitter						
Supply Current	I_{CC}		120	200	mA	
Input differential impedance	R_{in}		100		Ω	
TX Common Mode Voltage	V_{CM}	1.7			V	LVPECL
TX Differential Input Voltage	$V_{D_{TX}}$	200		2400	mV	LVPECL
Transmit Disable Voltage Threshold	V_D	2.0		V_{CC}	V	LVTTTL
Transmit Enable Voltage Threshold	V_{EN}	0		0.8	V	LVTTTL
Receiver						
Supply Current	I_{CC}			100	mA	
RX Single-Ended Output Voltage	V_{DRX}	250		800	mV	CML
Signal Detect Assert Voltage	SD_{norm}	2.0		V_{CC}	V	LVTTTL
Signal Detect De-Assert	SD_{fault}	0		0.4	V	LVTTTL
Total Contributed Jitter (p-p)	$RX\Delta TJ$			0.4	UI	FCPI-4 ($\delta_R - \gamma_R$)
Data Output Rise/Fall Time	t_r/t_f			130	ps	20% - 80%

Notes:

- 1) Supply Voltage must settle within listed tolerance in less than 2ms.

Communication Specifications ($T_{OP} = -55$ to 95°C , $V_{CC} = 3.14$ to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
Temperature Difference	$\Delta^{\circ}\text{C}$	-3	-	3	$^{\circ}\text{C}$	





Voltage	V _{CC}	-3	-	3	%	
RX Power Difference	ΔRX	-3	-	3	dBm	
TX Power Difference	ΔTX	-3	-	3	dBm	

Pin Configuration



Pin	Symbol	Description
0	SCL	I2C Clock
1	TD+	Transmitter Data IN+
2	V _{EE}	Ground
3	TD-	Transmitter Data IN-
4	V _{CCT}	Transmitter Power Supply
5	SD	Signal Detect Output
6	T _{DIS}	Transmitter Disable Input
7	RD+	Receiver Data OUT+
8	V _{CCR}	Receiver Power Supply
9	RD-	Receiver Data OUT-
10	V _{EE}	Ground
11	SDA	I2C Data

Notes:

- 1) Pins 0 and 11 are optional pins for the I2C bus that is used for Digital Diagnostics per SFF-8472.
- 2) Pins 1-10 are the only pins on a transceiver without DDML.

Video Characteristics (T_{OP} = -55 to 95°C, V_{CC} = 3.14 to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Receiver						
RX Alignment Jitter	T _{JV}	-	-	0.3	UI	100% Color Bars Pattern
Overshoot	OS%	-	-	10	%	100% Color Bars Pattern
Rise Time	t _{rv}			150	ps	100% Color Bars Pattern
Fall time	t _{fv}			150	ps	100% Color Bars Pattern
Rise/Fall Symmetry	t _{r-f}			20	Ps	100% Color Bars Pattern
Single-Ended Output Voltage Swing	V _{SEV}	250		800	mV	100% Color Bars Pattern
Pathological Pattern Errors	P _{RX}			0	Errors	
Transmitter						
Pathological Pattern Errors	P _{TX}			0	Errors	





Digital Diagnostics Information

The COTSWORKS RJ module is available with optional signal pins for a 2-wire bus required in order to access digital diagnostics compliant to SFF 8472 multi-source agreement. The transceiver pinout (including those pins required for 2-wire communication to access the digital diagnostics) appears on the previous page.

For more information on Digital Diagnostics, visit <https://cotsworks.com/support-documents/digital-diagnostic-overviews/>

Address A0h Data Fields (RJ-3G-S-LX)

A0h Address (dec)	# Bytes	Name	Description	Value (hex)
Base ID Fields				
00	1	Identifier	Type of transceiver	02
01	1	Ext. Identifier	Extended identifier of type of transceiver	04
02	1	Connector	Code for connector type	07
03	8	Transceiver	Code for electronic or optical compatibility	04
04				53
05				00
06				02
07				22
08				00
09				01
10				05
11	1	Encoding	Code for high speed serial encoding algorithm	01
12	1	BR, Nominal	Nominal signaling rate, units of 100MBd	1F
13	1	Rate Identifier	Type of rate select functionality	00
14	1	Length (SMF, km)	Link length supported for single mode fiber, units of km	0F
15	1	Length (SMF)	Link length supported for single mode fiber, units of 100m	96
16	1	Length (50µm)	Link length supported for 50µm OM2 fiber, units of 10m	00
17	1	Length (62.5µm)	Link length supported for 62.5µm OM1 fiber, units of 10m	00
18	1	Length (OM4 or copper cable)	Link length supported for 50µm OM4 fiber, units of 10m. Alternatively copper or direct attach cable, units of m	00
19	1	Length (OM3)	Link length supported for 50µm OM3 fiber, units of 10m	00
20	16	Vendor Name	SFP vendor name (ASCII)	43
21				4F
22				54





23				53
24				57
25				4F
26				52
27				4B
28				53
29				20
30				20
31				20
32				20
33				20
34				20
35				20
36	1	Transceiver	Code for electronic or optical compatibility	00
37				00
38	3	Vendor OUI	SFP vendor IEEE company ID	00
39				00
40				52
41				4A
42				33
43				47
44				53
45				44
46				49
47				4C
48	16	Vendor PN	Part number provided by SFP vendor (ASCII)	58
49				XX
50				XX
51				XX
52				XX
53				XX
54				XX
55				XX
56				30
57	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	30
58				30
59				30
60				05
61	2	Wavelength	Laser wavelength	1E
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	XX
Extended ID Fields				
64				10
65	2	Options	Indicates which optional transceiver signals are implemented	14
66	1	BR, max	Upper bit rate margin, units of %	00
67	1	BR, min	Lower bit rate margin, units of %	00
68				XX
69				XX
70	16	Vendor SN	Serial number provided by vendor (ASCII)	XX
71				XX





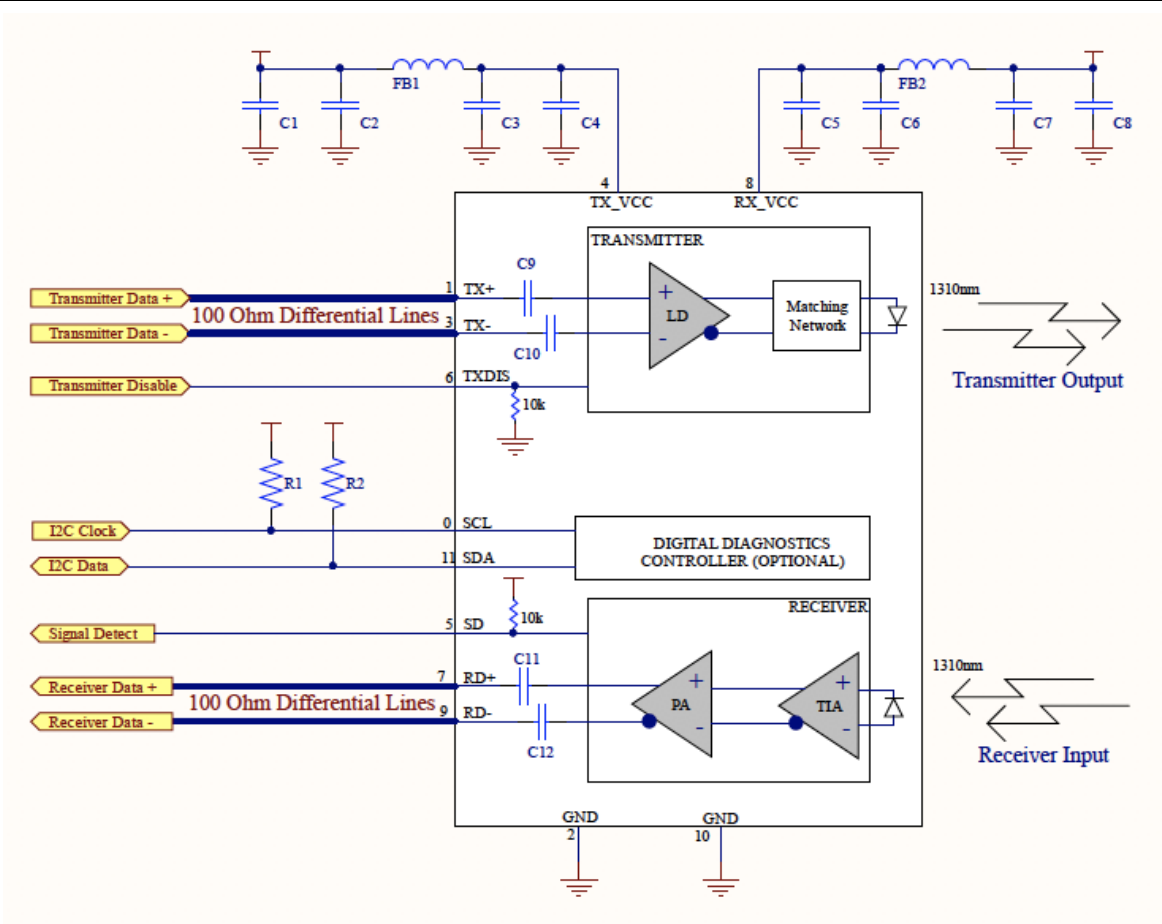
72				XX
73				XX
74				XX
75				XX
76				XX
77				XX
78				XX
79				XX
80				XX
81				XX
82				XX
83				XX
84	8	Date code	Vendor's manufacturing date code	XX
85				XX
86				XX
87				XX
88				XX
89				XX
90				20
91				20
92	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (if any) in the transceiver	68
93	1	Enhanced Options	Indicates which optional enhanced features are implemented (if any) in the transceiver	70
94	1	SFF-8472 Compliance	Indicates which revision of SFF-8472 the transceiver complies with	08
95	1	CC_EXT	Check code for the Extended ID Fields (addresses 64 to 94)	XX





Application Schematics

HOST BOARD APPLICATION SCHEMATIC



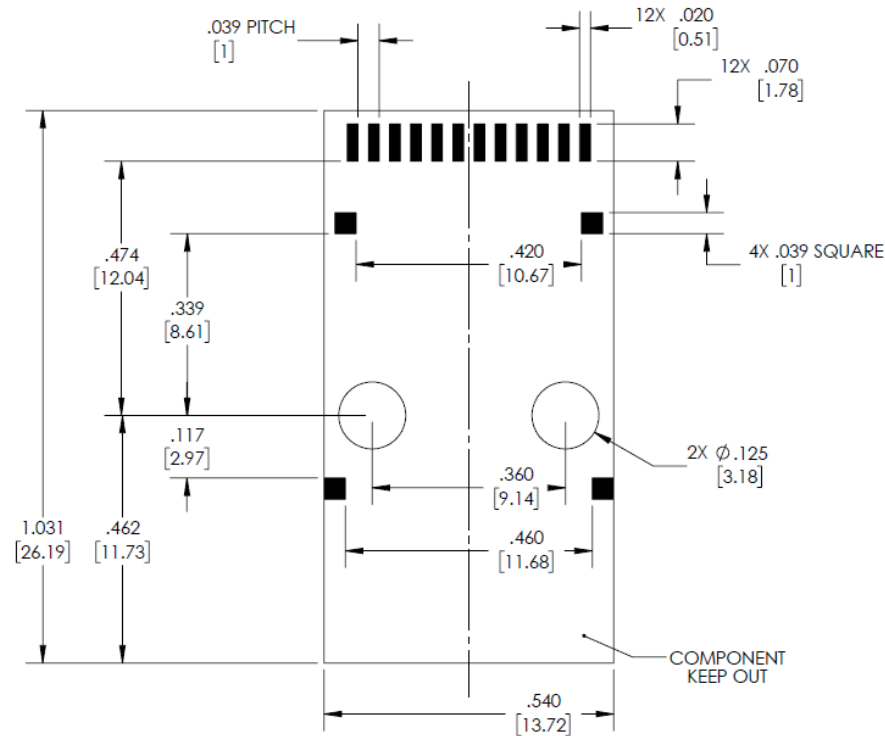
Notes:

- Recommend host routes separate supply voltages and filtering for RJ-module transmitter and receiver as shown in the schematic above
 - FB1/FB2 ferrite bead for power supply noise suppression; Murata BLM18KG601SN1, 0603, 600Ω @ 100MHz, 1300mA
 - C1/C4/C5/C8 bulk capacitance; Murata GRM21BR61C106KE15L, 0805, 10μF, 16V
 - C2/C3/C6/C7 de-coupling capacitors; Murata GRM155R71C104KA88D, 0402, 0.1μF, 16V
- R1/R2 2-wire bus pull-up resistors required on host for implementing optional digital diagnostics; 4.7kΩ to 10kΩ
- Recommend screw or solder posts be connected to chassis ground if available otherwise they should be tied to local signal ground
- For host with LVPECL electrical interface contact COTSWORKS' applications engineering





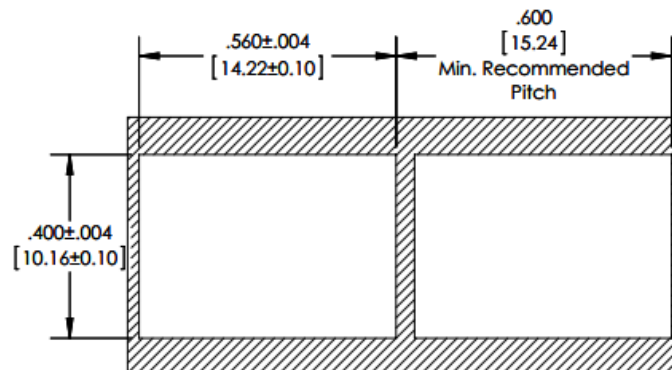
PCB Design Guidelines



Notes:

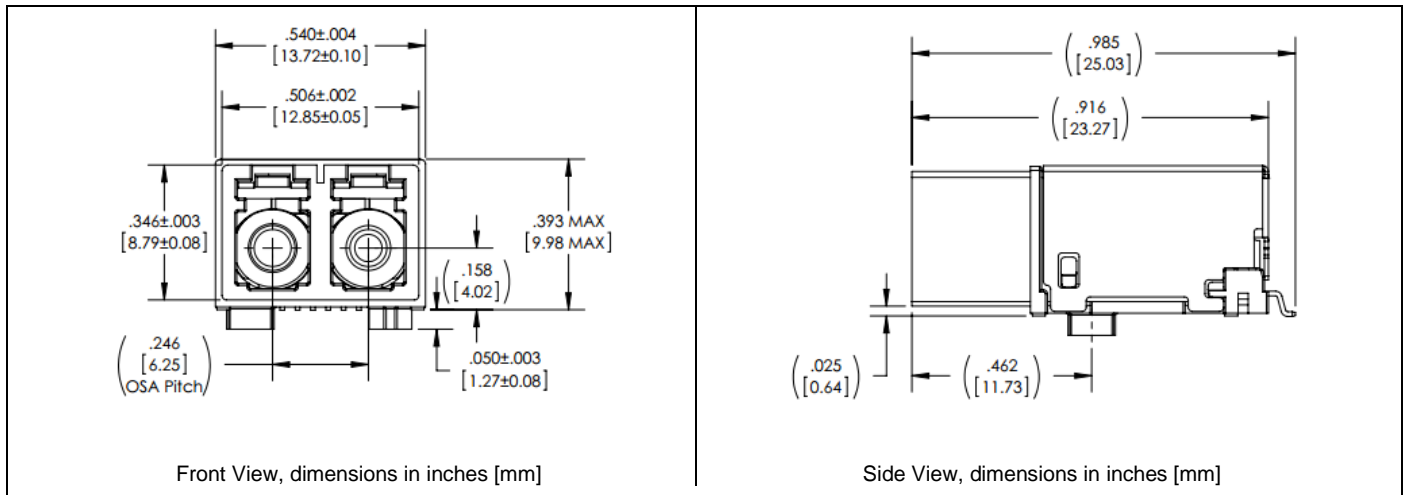
- 1) Pads 0 and 11 are the 2-wire bus signal pin pads for the digital diagnostics option

Panel Cutout

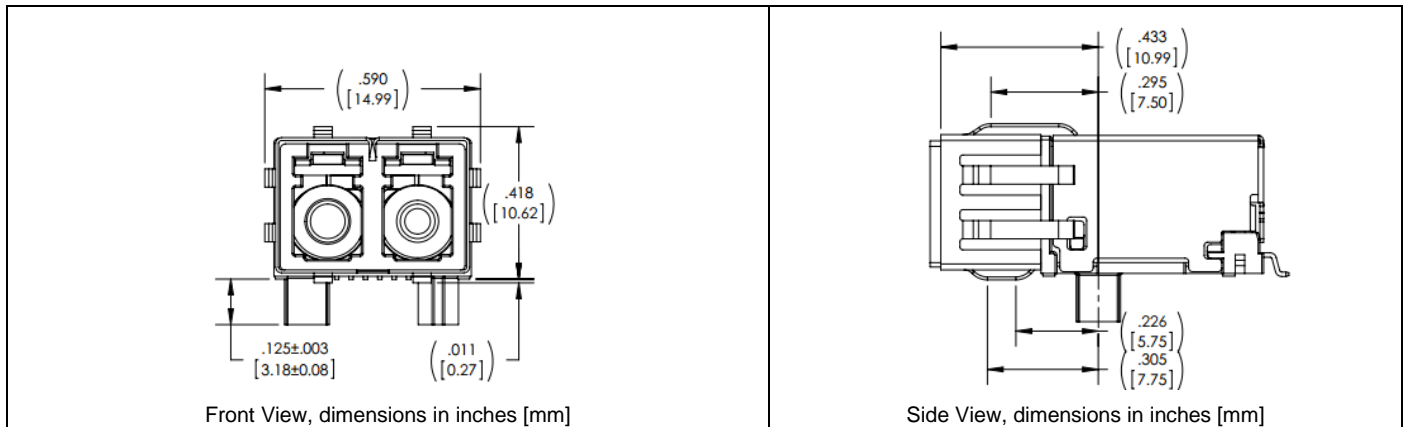




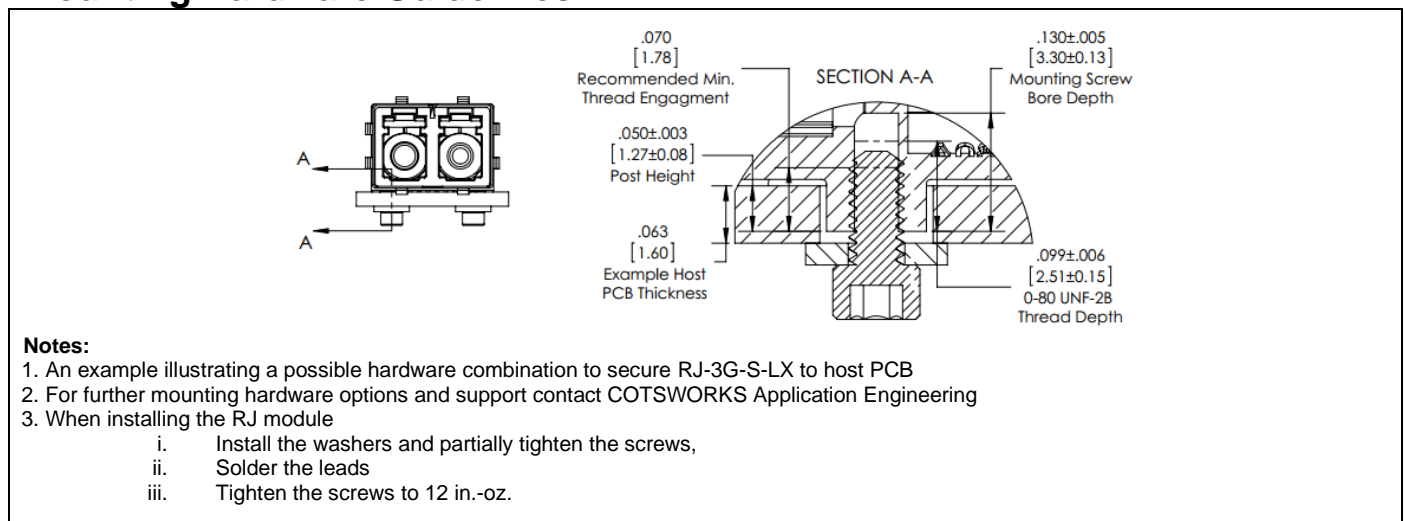
Screw Post Mechanical Dimensions



Solder Post Mechanical Dimensions



Mounting Hardware Guidelines



Ruggedization Notes

- Parylene Type C coating can be used with a 1.0mil \pm 0.2mil thickness through a deposition process. Parylene C has a 5600VPM rating, withstands temperatures of 350°F, and is extremely resistant to oil/dirt, and object impact.
- This part can come in a pigtail fiber optic version.
- Contact COTSWORKS for all MSDS, case composition, and burn analysis.

Reference Information

- 1) IEEE Standard 802.3, 2002 Edition, Clause 38, PMD Type 1000BASE-LX. IEEE Standards Department, 2002
- 2) "Fibre Channel Draft Physical Interface Specification (FC-PI-2 Rev. 10.0)". American National Standard for Information Systems
- 3) ARINC 818 specification at 1.0625 Gb/s, <http://www.arinc.com/>
- 4) 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 1M Laser Products and comply with US FDA regulations.
- These products are compliant to the Class 1M 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). It invokes item 5 of the Annex which allows "Pb in the glass of cathode ray tubes, electronic components, and fluorescent tubes." This part may contain Pb for components such as lenses, windows, isolators, and other electronic components.

Warnings:

Handling Precautions: This device is susceptible to damage from 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

RJ-3G-S	-XX	-X	-DX	-XX	-X	-X	-X	-X	-X
RJ Form Factor	LX: 20km, SMF Fabry-Perot Tx	Pins and Diagnostics	Duplex	LC: LC Receptacle	Ruggedized Coating	Operating Temp. Range	EMI Shield	RoHS Level	Mounting
3Gbps Max Data Rate		(): 1x10 No Diagnostics		LX: ARINC-801 Receptacle	(): Non-coated R: Parylene	A: -40 to 85°C M: -40 to 95°C Z: -55 to 95°C	(): No Shield E: Shield	(): Lvl 5 6: Lvl 6	(): Imperial Screw U: Metric Screw P: Solder Posts
SDI Video		D: 1x12 Digital Diagnostics							

Example part number: RJ-3G-S-LX-DX-LC-R-A-U

[3G-SDI RJ Transceiver, 1310nm, long-reach, Duplex LC connectors, Parylene-coated, -40 to 85°C operating temp range, metric-threaded screw posts]

Contact COTSWORKS for mechanical dimensional information and other configuration options.

