

#### Features:

- 125 Mbps to 3.125 Gbps duplex data links
- Compliant to 802.3z Ethernet, Fiber Channel (1x/2x/3x), Infiniband SDR, sFPDP, FCAV and ARINC818
- 1310nm FP laser transmitter and PIN Receiver (LX Version)
- 1310nm DFB laser transmitter and PIN Receiver (EX Version)
- Class 1 Laser Int. Safety Std. IEC-825 compliant
- Up to 32 km on 9/125  $\mu$ m SMF (EX version)
- 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 to +85 C operating temperature
- 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-LX is ideal for harsh environment connectivity because of its low cost, availability, and wide operating parameters



Commercial Aerospace



Military Aerospace



Military Tactical



Industrial Oil & Gas



Military Sensing



Undersea Networking

#### 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:

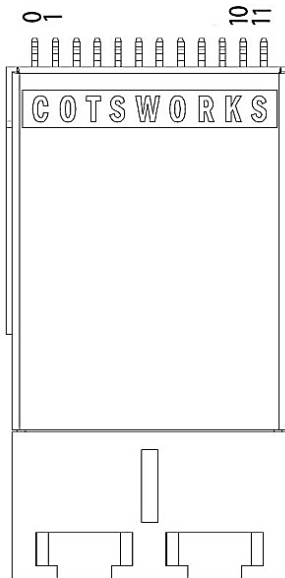
- 1) RJ transceivers may be water washed. The process must be followed by an 80°C bake for one hour to ensure the drying of any water inside the shell.
- 2) The components should not undergo Reflow Soldering under any circumstances.

#### General Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate	BR	0.125		3.125	Gb/s	

**Electrical Specifications** ( $T_{OP} = -40$  to  $85^{\circ}C$ ,  $V_{CC} = 3.14$  to  $3.47$  Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	$V_{CC}$	3.14		3.47	V	
<b>Transmitter</b>						
Supply Current	$I_{CC}$		120	200	mA	
Input differential impedance	$R_{in}$		100		$\Omega$	
TX Common Mode Voltage	$V_{CM}$	1.7			V	LVPECL
TX Differential Input Voltage	$V_{DTX}$	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
<b>Receiver</b>						
Supply Current	$I_{CC}$		70	100	mA	
RX Differential Output Voltage	$V_{DRX}$	250		800	mV	CML
Signal Detect Assert Voltage	$SD_{norm}$	2.4		$V_{CC}$	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%

**Pin Configuration**


PIN #	Symbol	Description	Logic Family
GP	GP	Grounding Posts Connect to chassis ground	N/A
0	SCL	I2C Clock (1)(2)	I2C
1	TD+	Transmitter DATA In +	LVPECL
2	$V_{EET}$	Transmitter Signal Ground	N/A
3	TD-	Transmitter DATA In -	LVPECL
4	$V_{CCT}$	Transmitter Power Supply	N/A
5	SD	Signal Detect output Satisfactory Optical Input: Logic "1" Output Fault Condition: Logic "0" Output	LVTTTL
6	$T_{DIS}$	Transmit Disable input Logic 1 = Disable Optical Output Logic 0 = Enable Optical Output Internal 10K ohm pull-down (enable)	LVTTTL
7	RD+	Receiver DATA Out +	CML
8	$V_{CCR}$	Receiver Power Supply	N/A
9	RD-	Receiver DATA Out -	CML
10	$V_{EER}$	Receiver Signal Ground	N/A
11	SDA	I2C Data (1)(2)	I2C

**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 DDMI.

**Optical Characteristics** (T<sub>OP</sub> = -40 to 85°C, V<sub>CC</sub> = 3.135 to 3.465 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Output Power (-LX)	P <sub>OUT-LX</sub>	-5	-	1	dBm	(9/125 SMF) (1)
Output Power (-EX)	P <sub>OUT-EX</sub>	-1	-	3	dBm	(9/125 SMF) (1)
Optical Wavelength	$\lambda$	1280	1310	1340	nm	(2)
Spectral Width (-LX)	$\sigma_{LX}$	-	-	2.5	nm	(RJ-3G-LX)(2)
Spectral Width (-EX)	$\sigma_{EX}$	-	-	1.0	nm	(RJ-3G-EX)(2)
Extinction Ratio (-LX)	ER <sub>LX</sub>	9	-	-	dB	(3)
Extinction Ratio (-EX)	ER <sub>EX</sub>	6	-	-	-	-
Optical Rise/Fall Time:	t <sub>r</sub> /t <sub>f</sub>	-	-	130	ps	(3)(4) 20% - 80%
Relative Intensity Noise	RIN	-	-	-120	dB/Hz	(3) FCPI-4 ( $\delta_R$ - $\gamma_R$ )
Total Jitter Contribution (p-p)	TX $\Delta$ TJ	-	-	119	ps	-
<b>Receiver</b>						
Receiver Sensitivity @1.25Gbps	RX <sub>SENS1</sub>	-	-	-22	dBm	(1)(4)(5)
Receiver Sensitivity @3.125Gbps	RX <sub>SENS2</sub>	-	-	-20	dBm	
Overload	RX <sub>MAX</sub>	0	-	-	dBm	
Optical Center Wavelength	$\lambda_c$	1270	-	1360	nm	-
Return Loss	RL	12	-	-	dB	-
Signal Detect Assert	P <sub>A</sub>	-	-	-25	dBm	(1)(5)
Signal Detect De-Assert	P <sub>D</sub>	-34	-	-	dBm	(1)(5)
Signal Detect Hysteresis	P <sub>A</sub> - P <sub>D</sub>	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 <sup>7</sup> -1 at 3.125Gbps.						
5) Measured using a 9 $\mu$ m single-mode variable optical attenuator.						

**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 [www.cotsworks.com/support](http://www.cotsworks.com/support).



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

A0h Address (dec)	# Bytes	Name	Description	Value (hex)
<b>Base ID Fields</b>				
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 100 MBd	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 100 m	96
16	1	Length (50um)	Link length supported for 50 um OM2 fiber, units of 10 m	00
17	1	Length (62.5um)	Link length supported for 62.5 um OM1 fiber, units of 10 m	00
18	1	Length (OM4 or copper cable)	Link length supported for 50um OM4 fiber, units of 10m. Alternatively copper or direct attach cable, units of m	00
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	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	3	Vendor OUI	SFP vendor IEEE company ID	00





38				00
39				00
40	16	Vendor PN	Part number provided by SFP vendor (ASCII)	52
41				4A
42				33
43				47
44				4C
45				58
46				XX
47				XX
48				XX
49				XX
50				XX
51				XX
52				XX
53				XX
54				XX
55				XX
56	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	30
57				30
58				30
59				30
60	2	Wavelength	Laser wavelength	05
61				1E
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	XX
<b>Extended ID Fields</b>				
64	2	Options	Indicates which optional transceiver signals are implemented	10
65				14
66	1	BR, max	Upper bit rate margin, units of %	00
67	1	BR, min	Lower bit rate margin, units of %	00
68	16	Vendor SN	Serial number provided by vendor (ASCII)	XX
69				XX
70				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

### Address A0h Data Fields (RJ-3G-EX)

A0h Address (dec)	# Bytes	Name	Description	Value (hex)
<b>Base ID Fields</b>				
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				14
05				40
06				02
07				12
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 100 MBd	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	28
15	1	Length (SMF)	Link length supported for single mode fiber, units of 100 m	FF
16	1	Length (50um)	Link length supported for 50 um OM2 fiber, units of 10 m	00
17	1	Length (62.5um)	Link length supported for 62.5 um OM1 fiber, units of 10 m	00
18	1	Length (OM4 or copper cable)	Link length supported for 50um OM4 fiber, units of 10m. Alternatively copper or direct attach cable, units of m	00
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	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				45
45				58
46				XX
47				XX
48	16	Vendor PN	Part number provided by SFP vendor (ASCII)	XX
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)	C9
<b>Extended ID Fields</b>				
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





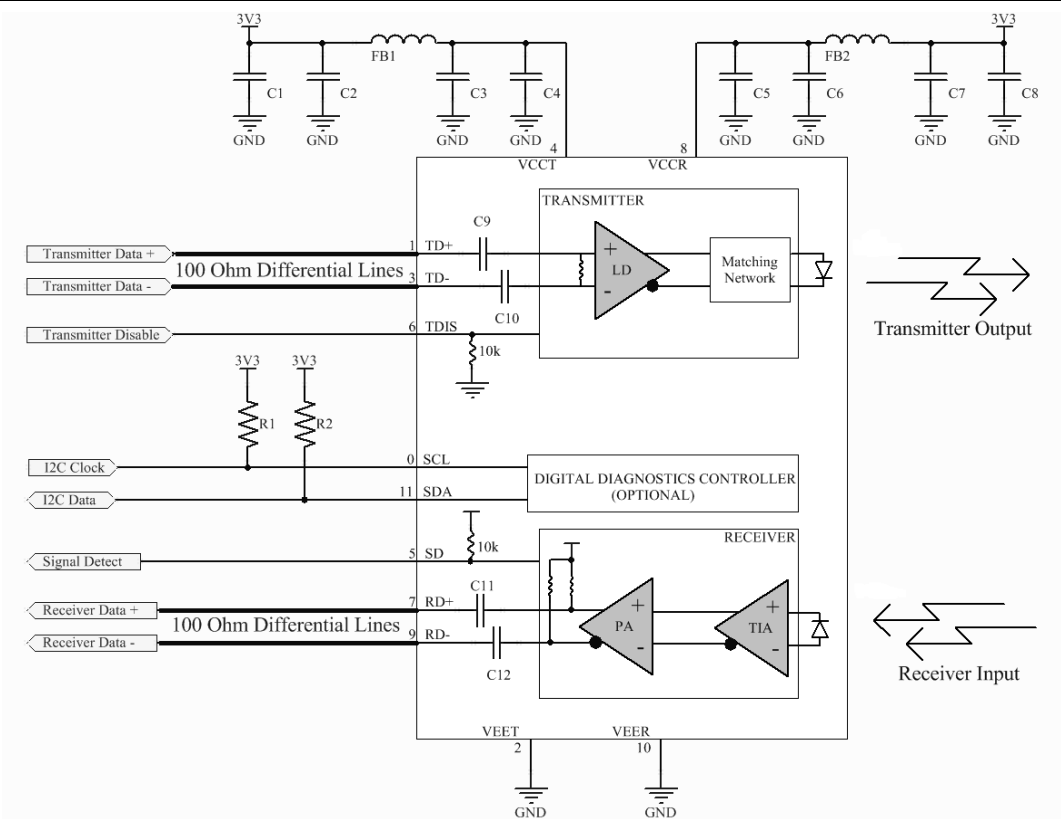
73				XX
74				XX
75				XX
76				XX
77				XX
78				XX
79				XX
80				XX
81				XX
82				XX
83				XX
84	8	Date code	Vendor's manufacturing date code	XX
85				XX
86				XX
87				XX
88				XX
89				XX
90				20
91				20
92	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (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

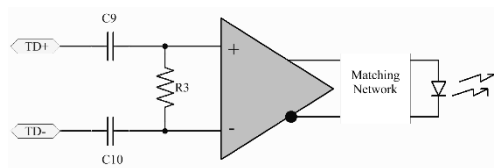
#### HOST BOARD APPLICATION SCHEMATIC



#### Notes:

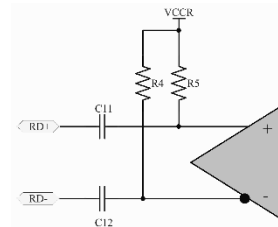
- Recommend host routes separate supply voltages and filtering for RJ-module transmitter and receiver as shown in the schematic above
  - FB1/FB2 ferrite bead for power supply noise suppression; Murata BLM18KG601SN1, 0603, 600Ω @ 100MHz, 1300mA
  - C1/C4/C5/C8 bulk capacitance; Murata GRM21BR61C106KE15L, 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

#### TRANSMITTER EQUIVALENT INPUT CIRCUIT



- C9/C10 0.1μF internal input data coupling capacitors
- R3 internal 100Ω input differential termination
- Transmitter electrical input is LVPECL compatible

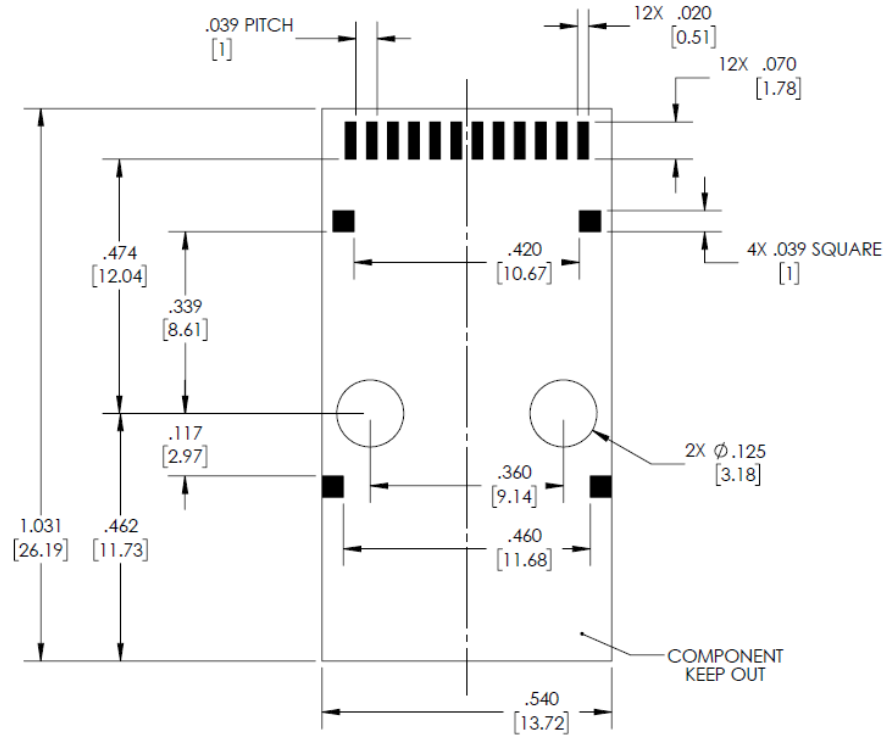
#### RECEIVER EQUIVALENT OUTPUT CIRCUIT



- C11/C12 are 0.1μF output data coupling capacitors
- R4/R5 are 50Ω pull-up resistors to Vcc
- Receiver electrical output is CML compatible



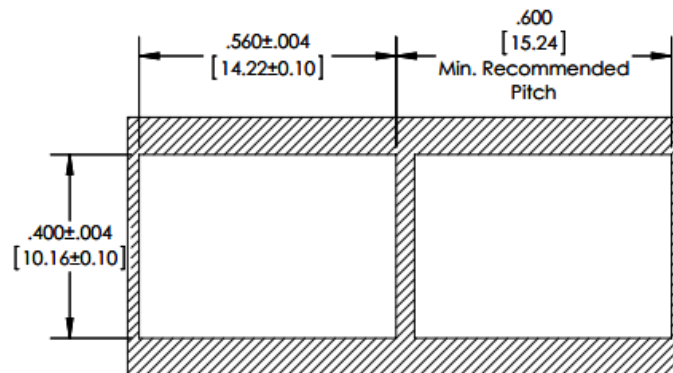
### PCB Design Guidelines



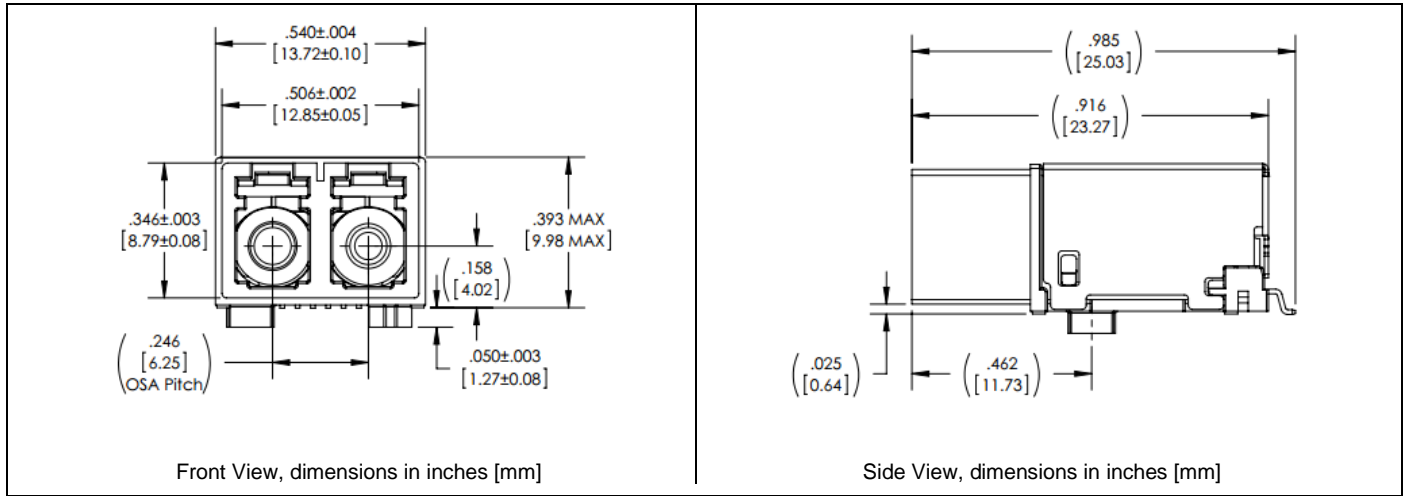
**Notes:**

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

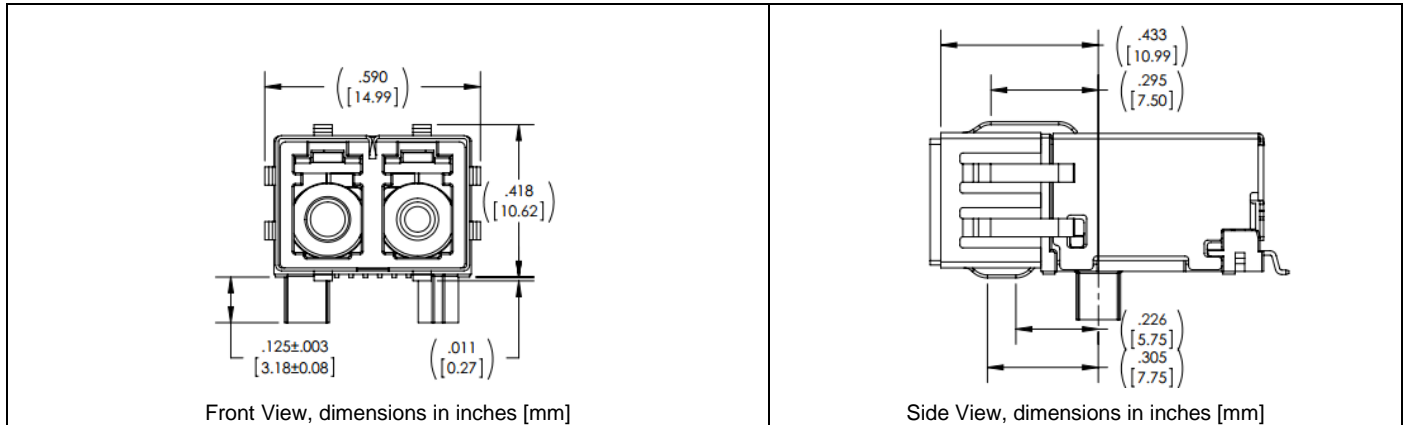
### Panel Cutout



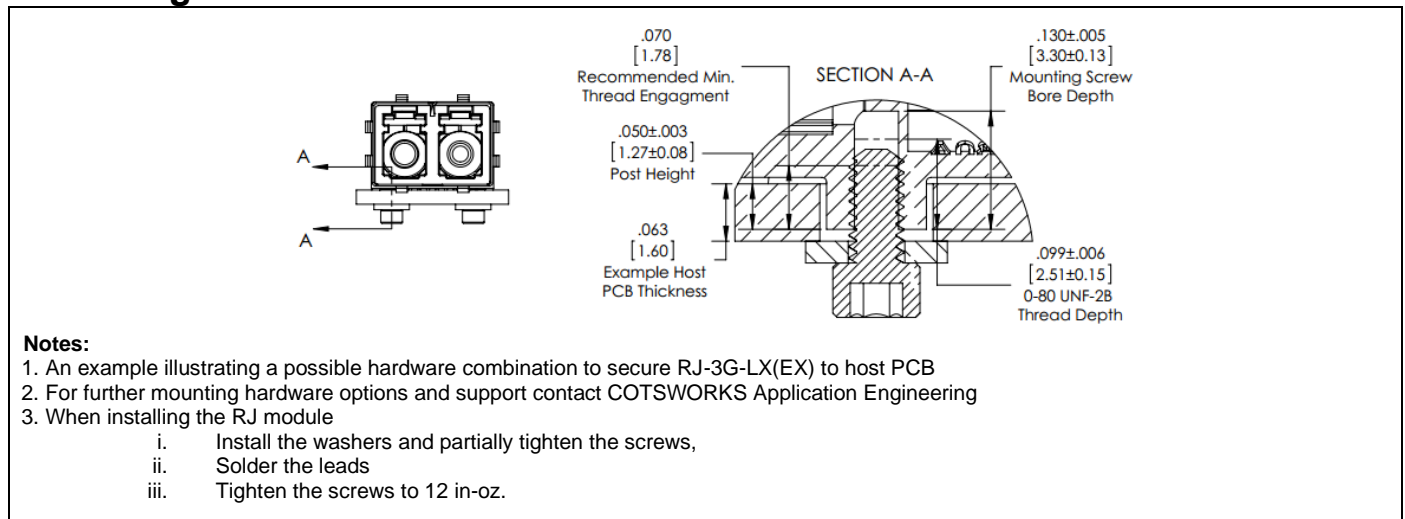
### Screw Post Mechanical Dimensions



### Solder Post Mechanical Dimensions



### Mounting Hardware Guidelines



## Ruggedization Notes

- Parylene Type C coating can be used with a 1.0 mil ± 0.2 mil thickness through a deposition process. Parylene C has a 5600 VPM 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 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**

RJ-3G-	XX	-X-	DPLX	-xx-	x	-x-	x	-x-	x
<b>RJ Form Factor</b>	LX: 20km, SMF Fabry-Perot Tx	<b>Pins and Diagnostics</b>	<b>Duplex</b>	<b>LC: LC Receptacle</b>	<b>Ruggedized Coating</b>	<b>Operating Temp Range</b>	<b>EMI Shield</b>	<b>RoHS Level</b>	<b>Mounting</b>
<b>3Gbps Max Data Rate</b>		(): 1x10							(): Imperial Screw
<b>Long Reach (SMF)</b>	EX: 32 km, SMF DFB Tx	No Diagnostics		<b>LX: ARINC-801 Receptacle</b>	(): Non-coated	A: -40 to 85°C	(): No Shield	(): Lvl 5	U: Metric Screw
		D: 1x12			R: Parylene	M: -40 to 95°C	E: Shield	6: Lvl 6	P: Solder Posts
		Digital Diagnostics							

**Example part number: RJ-3G-LX-DPLX-LC-R-A-U**

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

Contact COTSWORKS for mechanical dimensional information and other configuration options.