Features:

- 125Mbps to 5Gbps duplex data links
- Compliant to 802.3z Ethernet, Fibre Channel (1x/2x/4x), Infiniband, sFPDP, XAUI, FCAV and ARINC 818
- ATEX and IECEx certified configuration available (contact COTSWORKS)
- 850 nm VCSEL laser transmitter and PIN receiver
- Typical reach of 500 m on 50/125 and 250 m on 62.5/125 µm MMF
- Duplex LC or Dual ARINC-801 connector options
- -40 to +85°C operating temperature standard, -55 to +95°C option
- Option for RoHS 6/6 compliant and lead free per Directive 2011/65/EU
- Single +3.3V power supply
- AC-Coupled Transmitter & Receiver Data
- 1x12 Electrical Interface with Digital Diagnostics (DDMI) standard
- Common Pin-Out configuration
  - Matches COTSWORKS RJ-10G device pin assignments

The RJ-5G-SX-C is ideal for harsh environment connectivity because of its low cost, availability, and wide operating parameters
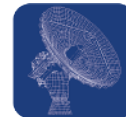
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Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTES
Maximum Supply Voltage	V_{CC}	-0.3	4.0	V	
Storage Temperature	T_{sto}	-55	105	°C	
Operating Temperature	T_{OP}	-40	85	°C	-55°C to 95°C option available
Relative Humidity	RH	0	85	%	Based on conformal coating (1)
Hot Bar Soldering Temperature			260	°C	10 seconds, leads only, (2)(3)
Hand Lead Soldering Temperature			260	°C	10 seconds, leads only, (2)(3)
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 drying of any water inside the shell.
2) For optional solder post version, solder posts are intended for mechanical retention only and do not have to comply fully to IPC J-STD-001 Class 3
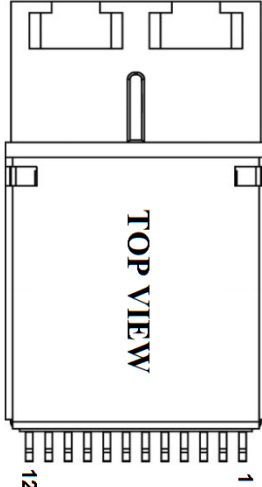3) The components should not undergo Reflow Soldering under any circumstances.

General Specifications

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTES
Data Rate	BR	0.125		5	Gb/s	8b10b encoding

Electrical Specifications (T$_{OP}$ = -40 to 85°C, V$_{CC}$ = 3.14 to 3.47 Volts)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTES
Supply Voltage	V$_{CC}$	3.14	3.3	3.47	V	
Total Module Power Dissipation	P$_{DISS}$			0.83	W	
Total Supply Current (Tx + Rx)	I$_{CC}$			240	mA	
Transmitter						
Supply Current	I$_{CC}$			120	mA	
Input differential impedance	R$_{in}$	90	100	110	Ω	
Single-Ended Input Voltage Swing	V$_{DTX}$	100		1200	mV	CML
Transmit Disable Voltage	V$_D$	1.8		V$_{CC}$	V	LVTTL
Transmit Enable Voltage	V$_{EN}$	-0.3		0.8	V	LVTTL
Receiver						
Supply Current	I$_{CC}$			120	mA	
Single-Ended Output Voltage Swing	V$_{DRX}$	100	300	500	mV	CML
Signal Detect Assert	SD$_{norm}$	V$_{CC}$-0.5		V$_{CC}$	V	LVTTL
Signal Detect De-assert	SD$_{fault}$	0		0.4	V	LVTTL
Deterministic Jitter Contribution	RXΔDJ			0.10	UI	(1)
Total Jitter Contribution (p-p)	RXΔTJ			0.16	UI	(2)

Notes:
1) Measured running 4.25 Gb/s, K28.5 test pattern
2) Measured running 4.25 Gb/s, PRBS 2^7-1 data

Pin Configuration

Pin	Symbol	Description	Logic/Protocol
1	TX-	Transmitter Data Input, Negative	CML
2	TX+	Transmitter Data Input, Positive	CML
3	GND	Ground	0V
4	TX_VCC	Transmitter Supply	3.3V
5	TX_DIS	Transmitter Disable	LVTTL
6	SCL	I2C Clock	I2C
7	SDA	I2C Data	I2C
8	SD	Receiver Signal Detect	LVTTL
9	RX_VCC	Receiver Supply	3.3V
10	GND	Ground	0V
11	RX+	Receiver Data Output, Positive	CML
12	RX-	Receiver Data Output, Negative	CML

Optical Characteristics (T$_{OP}$ = -40 to 85ºC, V$_{CC}$ = 3.14 to 3.47 Volts)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTES
Transmitter						
Optical Output Power	P$_{OUT}$	-5		-1	dBm	(1)(4)
Optical Output Power	P$_{OUT}$	-7		-1	dBm	(1)(3)(4)
Optical Wavelength	λ	840	850	860	nm	(2)
RMS Spectral Width	σ			.85	nm	(2)
Extinction Ratio	ER	6			dB	(2)(3)
Optical Rise Time	t$_r$			90	ps	Unfiltered 20% - 80%,
Optical Fall Time	t$_f$			125	ps	(1)(2)
Relative Intensity Noise	RIN			-117	dB/Hz	
Deterministic Jitter Contribution	TX$_\Delta$DJ			0.12	UI	(6)
Total Jitter Contribution (p-p)	TX$_\Delta$TJ			0.40	UI	(2)
Receiver						
Sensitivity: 5 Gb/s	RX$_{SENS5G}$			-14	dBm	
Sensitivity: 4.25 Gb/s	RX$_{SENS4G}$			-16	dBm	
Sensitivity: 3.00 Gb/s	RX$_{SENS3G}$			-16	dBm	
Sensitivity: 2.125 Gb/s	RX$_{SENS2G}$			-18	dBm	
Sensitivity: 1.25 Gb/s	RX$_{SENS1G}$			-21	dBm	(5)
Sensitivity: 768 Mb/s	RX$_{SENS768M}$			-18	dBm	
Sensitivity: 125 Mb/s	RX$_{SENS125M}$			-20	dBm	
Overload	RX$_{MAX}$			0	dBm	
Optical Center Wavelength	λ_c	840		860	nm	
Return Loss	RL	12			dB	
Signal Detect Assert: 5.00 Gb/s	P$_{A5G}$			-14	dBm	
Signal Detect Assert: 4.25 Gb/s	P$_{A4G}$			-15	dBm	
Signal Detect Assert: 3.00 Gb/s	P$_{A3G}$			-16	dBm	
Signal Detect Assert: 2.125 Gb/s	P$_{A2G}$			-17	dBm	
Signal Detect Assert: 1.25 Gb/s	P$_{A1G}$			-20	dBm	
Signal Detect Assert: 768 Mb/s	P$_{A768M}$			-19	dBm	
Signal Detect Assert: 125 Mb/s	P$_{A125M}$			-21	dBm	
Signal Detect De-Assert	P$_D$	-29			dBm	All data rates
Signal Detect Hysteresis	P$_A$ - P$_D$	1		5	dB	

Notes:
1) Measured at the end of a 2m to 5m 62.5µm multi-mode fiber patch cord
2) Measured running 4.25 Gb/s, PRBS 2^7-1 data
3) Applicable between the extended temperature ranges of -55°C to -40°C and 85°C to 95°C
4) Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations
5) Measured using PRBS 2^7-1 pattern
6) Measured running 4.25 Gb/s, K28.5 test pattern

Digital Diagnostics Information

The COTSWORKS RJ-5G-SX-C features signal pins for a 2-wire bus which are required in order to access digital diagnostics compliant to SFF 8472 multi-source agreement.

The transceiver pinout, including the pins provided for 2-wire communication to access the digital diagnostics, is shown on page 2 under the section "Pin Configuration".

Address A0h Data Fields

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	08
04				00
05				00
06				01
07				40
08				40
09				0C
10				15
11	1	Encoding	Code for high speed serial encoding algorithm	01
12	1	BR, Nominal	Nominal signaling rate, units of 100 MBd	32
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	00
15	1	Length (SMF)	Link length supported for single mode fiber, units of 100 m	00
16	1	Length (50um)	Link length supported for 50 um OM2 fiber, units of 10 m	37
17	1	Length (62.5um)	Link length supported for 62.5 um OM1 fiber, units of 10 m	1C
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	64
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	37
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				32
43				47
44				53
45				58
46				48
47				XX
48				XX

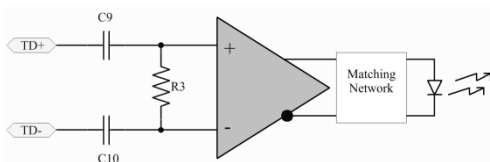| Address	Length	Name	Description	Value
49				XX
50				XX
51				XX
52				XX
53				XX
54				XX
55				XX
56	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	30
57				30
58				30
59				30
60	2	Wavelength	Laser wavelength	03
61				52
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	XX
Extended ID Fields				
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

Application Schematics

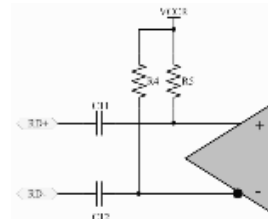| HOST BOARD APPLICATION SCHEMATIC |
| --- |
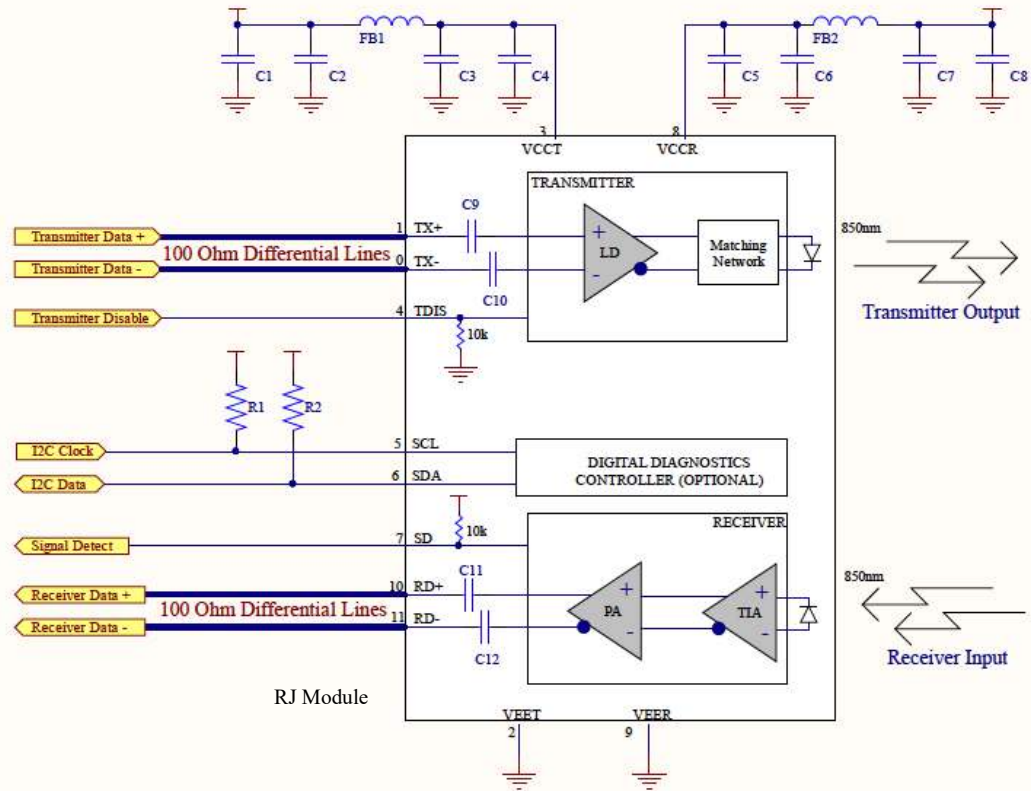
Notes:

- 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 suppresion; 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.
- Screw or solder posts are not internally connected to signal ground. 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.

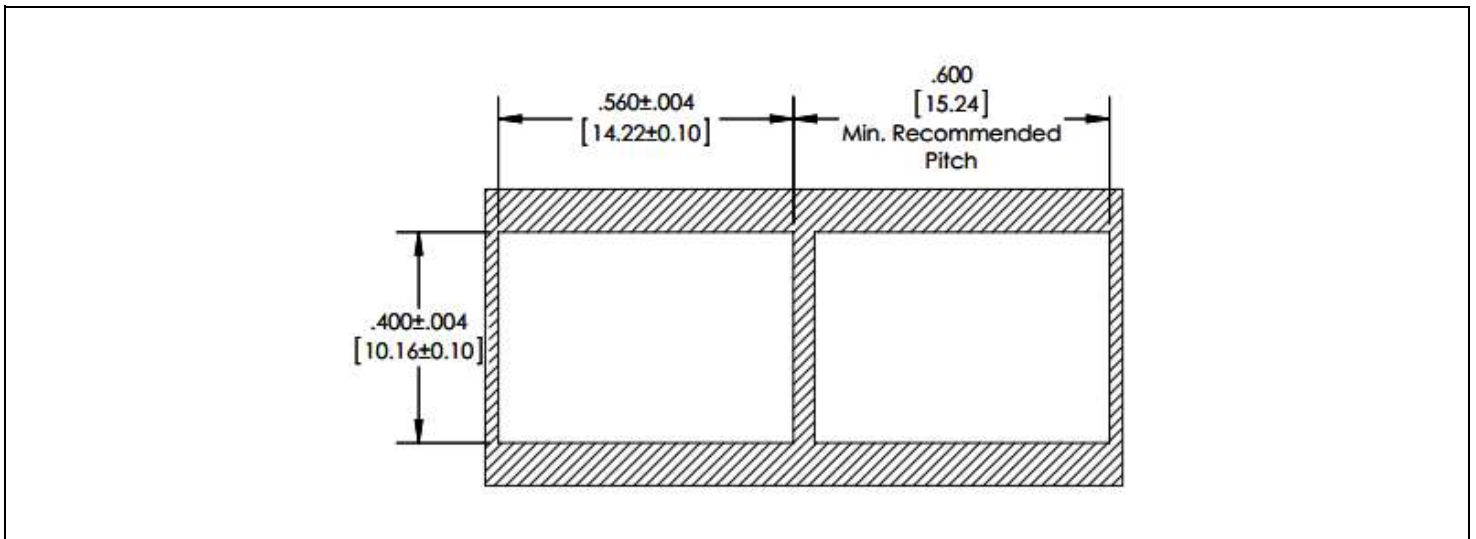| TRANSMITTER EQUIVALENT INPUT CIRCUIT	RECEIVER EQUIVALENT OUTPUT CIRCUIT
- C9/C10 0.1µF internal input data coupling capacitors. - R3 internal 100Ω input differential termination. - Transmitter electrical input is CML compatible.	- C11/C12 are 0.1µF output data coupling capacitors. - R4/R5 are 50Ω pull-up resistors to Vcc. - Receiver electrical output is CML compatible.

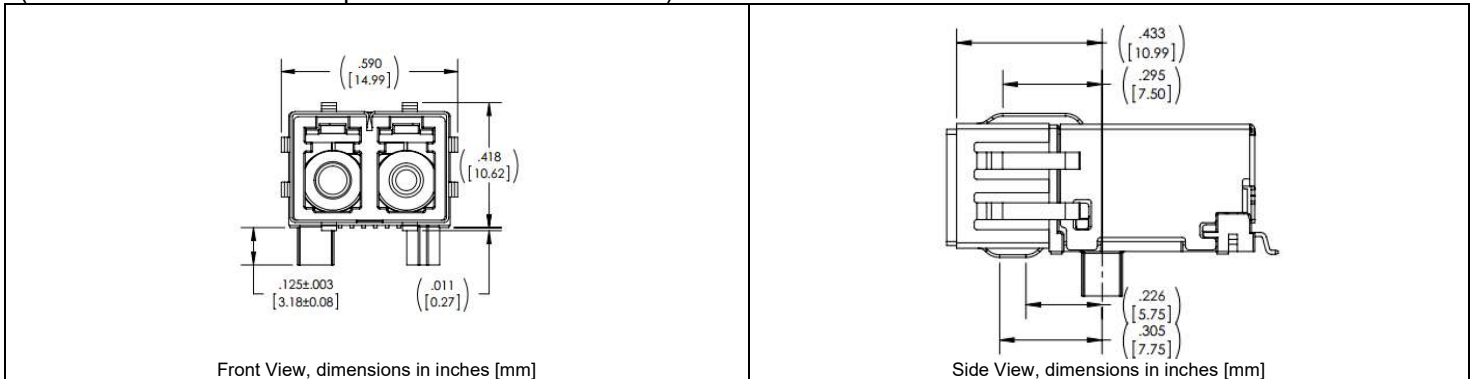**COTSWORKS**

PCB Design Guidelines
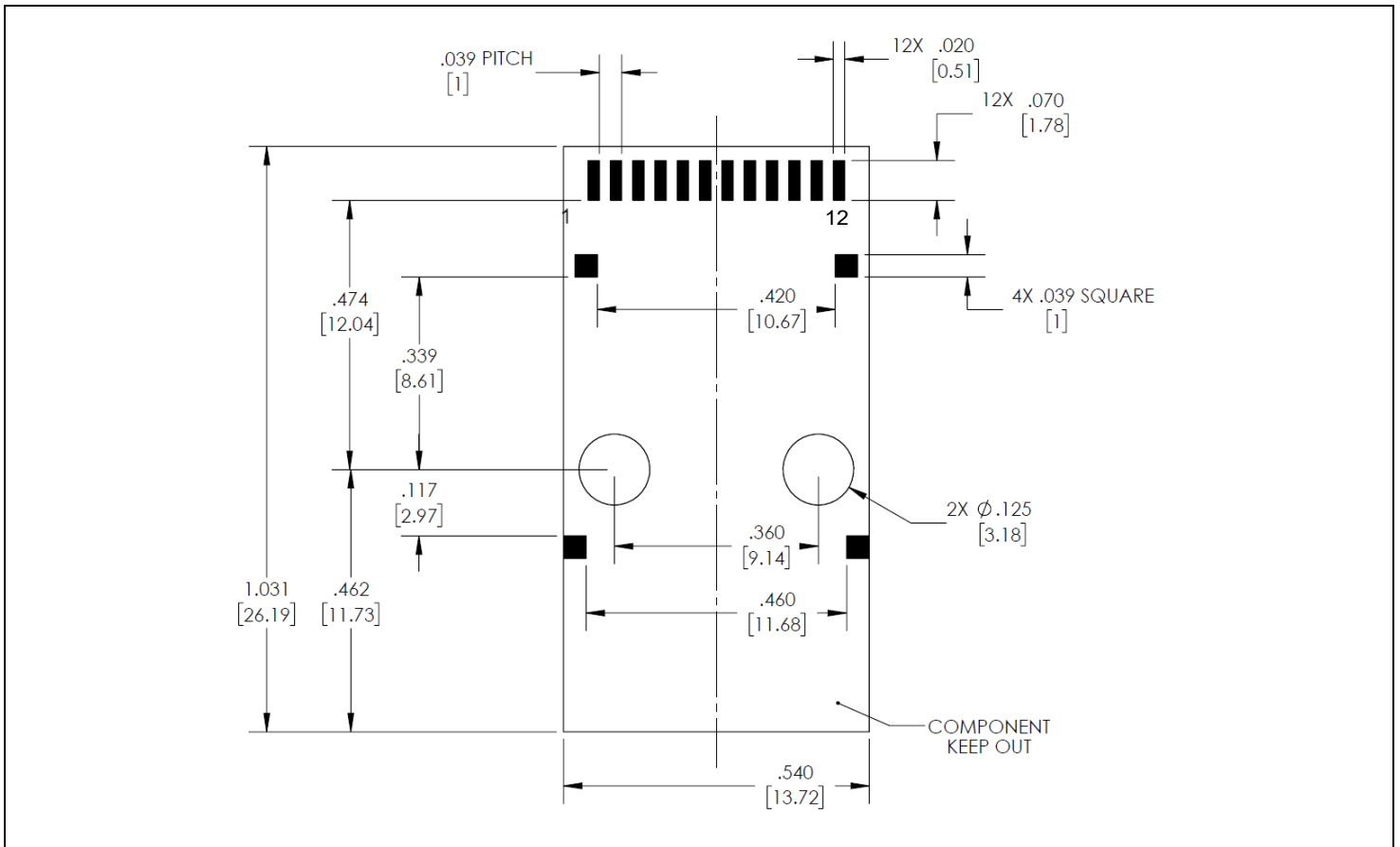
Panel Cutout

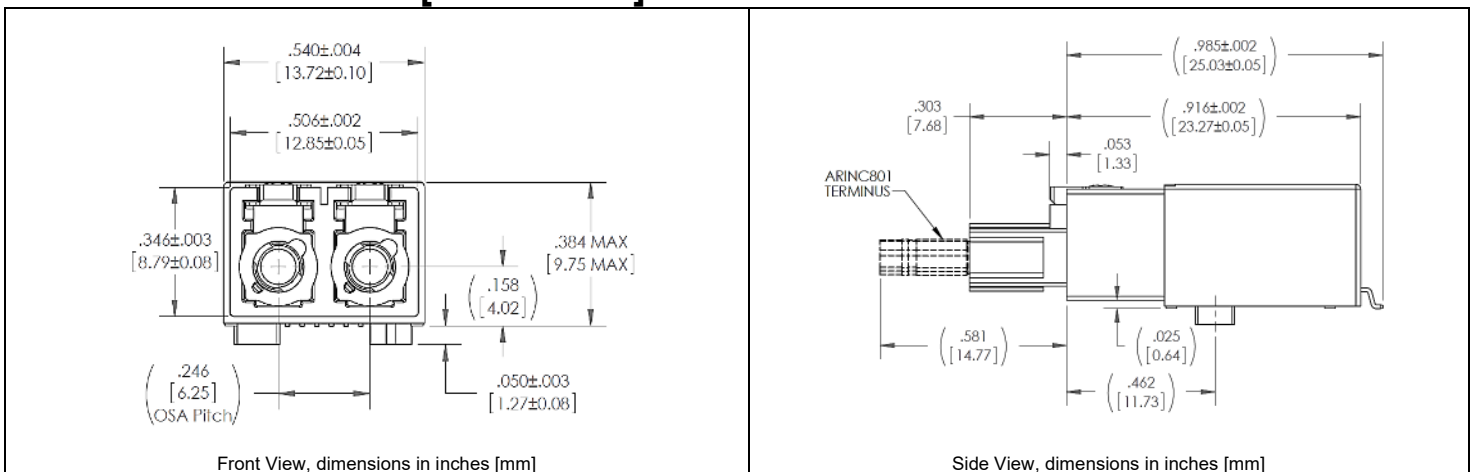## LC Connector [Screw Post] Mechanical Dimensions

Front View, dimensions in inches [mm]

Side View, dimensions in inches [mm]
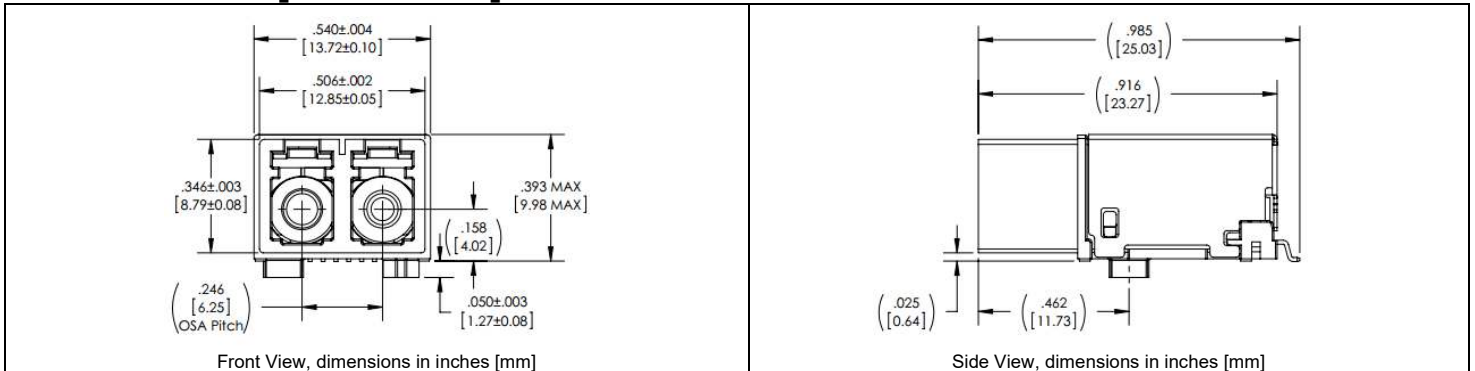
LC Connector [Solder Post] Mechanical Dimensions

(Illustration shown is with Optional EMI Shield Installed)

Front View, dimensions in inches [mm]
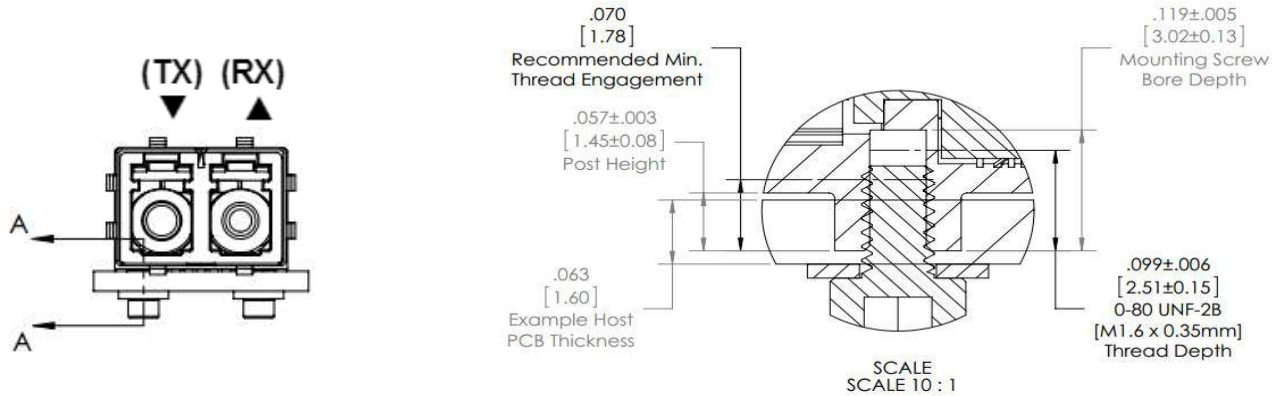

Side View, dimensions in inches [mm]

ARINC-801 Connector [Screw Post] Mechanical Dimensions

Front View, dimensions in inches [mm]

Side View, dimensions in inches [mm]

Mounting Hardware Guidelines

Notes:
1. An example illustrating a possible hardware combination to secure RJ-5G-SX-C to host PCB
2. For further mounting hardware options and support contact COTSWORKS Application Engineering
3. Default case configuration: Imperial-threaded Posts. #0-80 thread size
4. Follow screw dimensions listed above to avoid damage during mounting
5. When installing the RJ module:
   a. install the washers and partially tighten the screws,
   b. solder the leads,
   c. tighten the screws to 12 in-oz
6. The pins are phosphor bronze 510 spring temper with 10 micro-inches of gold.

Ruggedization Notes

- Parylene C coating can be used for conformal coating with a 1.0 mil ± 0.2 mil thickness through a deposition process
  - It has a 5600 VPM rating, withstands high temperatures, extremely resistant to oil/dirt, and object impact
- This part is also available in a pigtail fiber optic version. Contact COTSWORKS for available fiber and termini options.
- Transceiver case is nickel-plated

Reference Information

1) IEEE Standard 802.3, 2002 Edition
2) Directive 2011/65/EU of the European Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment." June 8th, 2011

Regulatory Compliance

- COTSWORKS transceivers are Class 1 Laser Products and 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 2011/65/EU covering restriction on certain hazardous substances (RoHS)
- ATEX / Ex Protection Provided: op is, [Ex op is T4 Ga] IIC
  - Contact COTSWORKS support for a product compliance matrix

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.

COTSWORKS®

Ordering Information

RJ-5G-SX	-C	-xx	-x	-x	-x	-x	-x	-x
RJ Form Factor	Pins & Diagnostics	Receptacle Type	Ruggedized Coating	Operating Temp (°C)	EMI Shield?	RoHS Level	Mounting	ATEX & IECEx
5 Gbps Max Data Rate	1x12 Header (DDMI Standard)	(): *LC Receptacle*	(): *Non-coated*	A: *-40 to 85* M: *-40 to 95*	(): No *Shield*	(): Lvl *5*	(): *Imperial* U: *Metric*	T: *Certified*
(MMF)	**Common Pin Assignment** (matching RJ-10G)	LX: *ARINC-801 Receptacle*	R: *Parylene*	Z: *-55 to 95*	E: *Shield*	6 Lvl *6*	P: *Solder Posts*	(): *Not Certified*

Example part number: RJ-5G-SX-C-R-M
[5G RJ Form Factor Transceiver, 850nm, Common RJ Pin-Out, digital diagnostics,
Duplex LC Receptacles, Parylene-coated, -40 to 95°C operating temp range, Imperial Screw Posts]

Contact COTSWORKS for mechanical dimensional information and other configuration options.