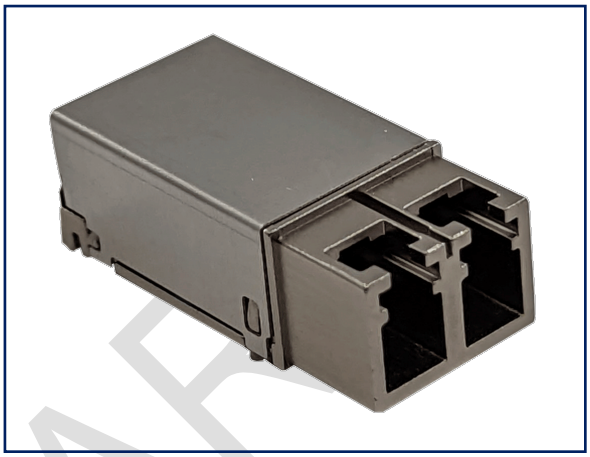
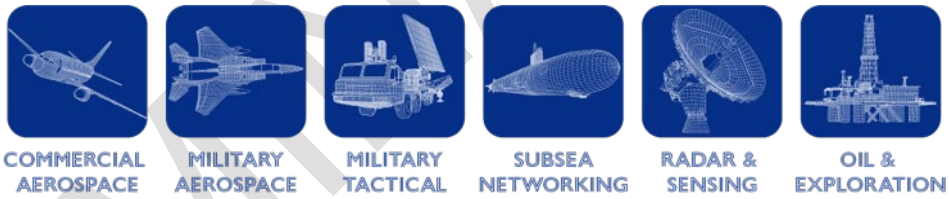
RJ-10G-DW-E
10.3125Gbps
Rugged RJ Size Fiber Optic Transceiver

Features:

- Duplex transceiver module.
- Compliant operation at 10.3125Gbps.
- EML DWDM transmitter and APD wideband receiver.
- Compliant to IEC-60825-1, Class 1 laser eye safe.
- Solder-down 1x12 electrical interface.
- +3.3V and +2.5V power supply.
- SFF-8472 compliant control and diagnostics monitor interface.
- –40°C to +85°C case temperature operating range.
- –55°C to +105°C storage temperature range.
- Conformal coating options for harsh environment use.
- Option for RoHS 6(6) compliant and lead free per Directive 2002/95/EC.



The RJ-10G-DW-E is a unique ruggedized fiber optic transceiver designed to provide peak performance in hazardous enfironments.



Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
3.3V Supply Voltage	V_{CC_3V3}	–0.3	4.0	V	
2.5V Supply Voltage	V_{CC_2V5}	–0.5	3.0	V	
Storage Temperature	T_{sto}	–55	105	°C	
Case Operating Temperature	T_{OP}	–40	85	°C	
Relative Humidity	RH	-	85	%	Based on conformal coating, (1)
Hot Bar Soldering Temperature	-	-	260	°C	10 seconds, leads only, (2)
Hand Lead Soldering Temperature	-	-	260	°C	10 seconds, leads only, (2)
Conformal Coating	-	0.8	1.2	mil	(3)

Notes:
1) RJ transceivers may be water washed. The process must be followed by an 80° 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.
3) See ruggedization notes on page 10.

General Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate, Ethernet	BR_{EE}	6	-	10.3125	Gbps	64b/66b
3.3V Supply Voltage	V_{CC_3V3}	3.14	3.3	3.47	V	
2.5V Supply Voltage	V_{CC_2V5}	2.375	2.5	2.625	V	

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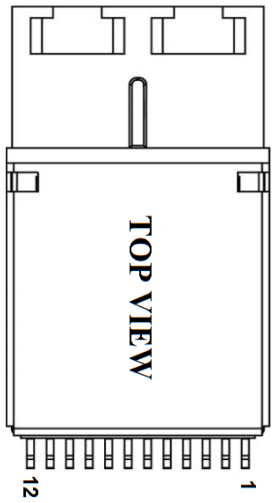
Electrical Specifications (T_{OP} = –40 to 85°C, V_{CC_3V3} = 3.14 to 3.47 Volts, V_{CC_2V5} = 2.375 to 2.625 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Total Module Power Dissipation	P_{DISS}	-	-	2.5	W	
Total Module Power Dissipation (TX Disable)	P_{DISS_TXD}	-	-	2.0	W	
3.3V Supply Current	I_{CC3V3}	-	-	500	mA	
2.5V Supply Current	I_{CC2V5}	-	-	380	mA	
Transmitter						
Differential Input Impedance	R_{IN}	80	100	120	Ω	
Differential Data Input Swing	V_{DTX}	150	-	1250	mV	
TX Disable Input Voltage	V_D	2.0	-	V_{CC}+0.3	V	
TX Enable Input Voltage	V_{EN}	–0.3	-	0.8	V	
TX Fault Output Low	V_{TFL}	–0.3	-	0.4	V	
TX Disable Assert Time	t_{off}	-	-	100	ms	
TX Enable Assert Time	t_{on}	-	-	2	ms	
Initialization Time for Cooled Module	$t_{startup}$	-	-	90	s	
Receiver						
Differential Output Impedance	R_{OUT}	80	100	120	Ω	
Differential Data Output Swing	V_{DRX}	500	-	-	mV	
Data Output Rise Time	t_r	-	-	90	ps	(1)
Data Output Fall Time	t_f	-	-	90	ps	(1)
Data Dependent Output Jitter	DDJ	-	-	0.42	UI	(2)
Total Contributed Jitter	RXΔTJ	-	-	0.75	UI	(3)
LOS De-Assert Voltage	LOS_D	0	-	0.4	V	(4)
LOS Assert Voltage	LOS_A	V_{CC_3V3} – 0.5	-	V_{CC_3V3} + 0.3	V	(4)
Loss of Signal Assert Time	t_a	-	12	100	µs	
Loss of Signal De-Assert Time	t_d	-	12	100	µs	
Serial Bus						
Data, Clock Input Low Voltage	V_{IL}	–0.3	-	0.3*V_{CC}	V	
Data, Clock Input High Voltage	V_{IH}	0.7*V_{CC}	-	V_{CC}+0.3	V	
Data, Clock Output Low Voltage	V_{OL}	-	-	0.4	V	
Data, Clock Output High Voltage	V_{OH}	V_{CC}–0.4	-	-	V	

Notes:
1) K28.5.
2) 231^{-1}.
3) 20% to 80%.
4) LOS is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal is detected.

Pin Configuration



PIN #	Symbol	Description	Notes
1	TX-	Transmitter Data Input, Negative	CML
2	TX+	Transmitter Data Input, Positive	CML
3	GND	Ground	0V
4	VCC_2V5	2.5V Supply	2.5V
5	TX_DIS	Transmitter Disable	LVTTL
6	SCL	I2C Clock	I2C
7	SDA	I2C Data	I2C
8	LOS	Receiver Loss of Signal	LVTTL
9	VCC_3V3	3.3V Supply	3.3V
10	GND	Ground	0V
11	RX+	Receiver Data Output, Positive	CML
12	RX-	Receiver Data Output, Negative	CML

Digital Diagnostics Information:

The COTSWORKS RJ module utilizes signal pins for a 2-wire bus required 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 table.

For more information on Digital Diagnostics, visit www.cotsworks.com/support.

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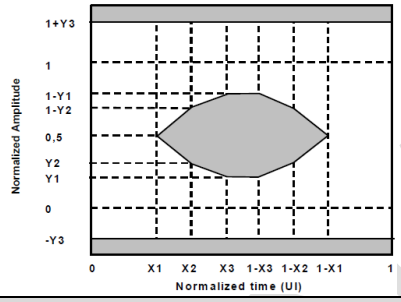
Optical Characteristics (T_{OP} = –40 to 85°C, V_{CC_3V3} = 3.14 to 3.47 Volts, V_{CC_2V5} = 2.375 to 2.625 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
Average Output Optical Power (SMF)	P_{OUT}	0	-	+2	dBm	(1)
Optical Modulation Amplitude (SMF)	OMA	1.70	-	-	dBm	(1)
Optical Center Wavelength	λ	-	λ	-	nm	(3)
Spectral Width (RMS) (–20dB)	σ	-	-	0.11	nm	(4)
Extinction ratio	ER	8.2	-	-	dB	
Side Mode Suppression Ratio	SMSR	35	-	-	dB	Based on center wavelength
TX Mask Compliance	-	{X1, X2, X3, Y1, Y2, Y3} = {0.25, 0.40, 0.45, 0.25, 0.28, 0.75}				



Receiver						
Receiver Sensitivity	RX_{SENS}	-	-	–22.8	dBm	(2)
Receiver Sensitivity (OMA)	RX_{SENS_OMA}	-	-	–21.11	dBm	(2)
Receiver Saturation	RX_{SAT}	–4.0	-	-	dBm	
Optical Wavelength	λ_C	1270	-	1577	nm	
Loss of Signal De-Assert	LOS_D	-	-	–26	dBm	
Loss of Signal Assert	LOS_A	–36	-	-	dBm	
Loss of Signal Hysteresis	LOS_H	0.5	-	5	dB	

Notes:
1) Measured at the end of a 2m SMF jumper.
2) Measured at a 10.3125Gbps with a BER=10^{-12}.
3) See ITU Channel Ordering Options table on sheet 11.
4) Defined as ± the parameter value.

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	00
04				00
05				00
06				00
07				90
08				10
09				01
10				40
11	1	Encoding	Code for high speed serial encoding algorithm	06
12	1	BR, Nominal	Nominal signaling rate, units of 100 MBd	67
13	1	Rate Identifier	Type of rate select functionality	00

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14	1	Length (SMF, km)	Link length supported for single mode fiber, units of km	50
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	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				31
43				30
44				44
45				57
46				45
47				XX
48				XX
49				XX
50				XX
51				XX
52				41
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

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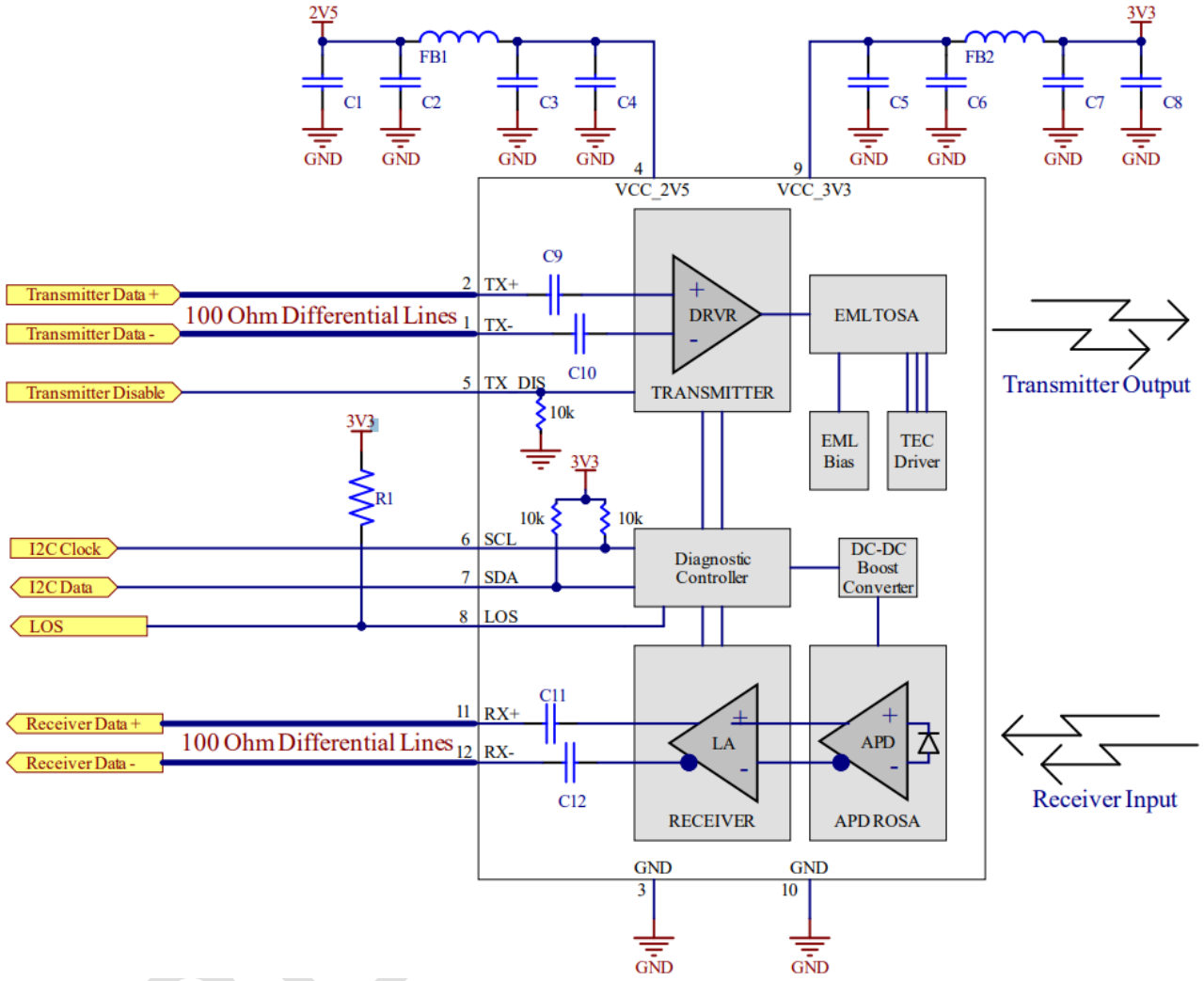
60	1	Left Shift of Wavelength Designation	Laser wavelength (DEC 15)	0F
61	1	Right Shift of Wavelength Designation	Laser Wavelength Varies by ITU Channel Option	XX
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	XX
Extended ID Fields				
64	2	Options	Indicates which optional transceiver signals are implemented	14
65				14
66	1	BR, max	Upper bit rate margin, units of %	00
67	1	BR, min	Lower bit rate margin, units of %	28
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	F0
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

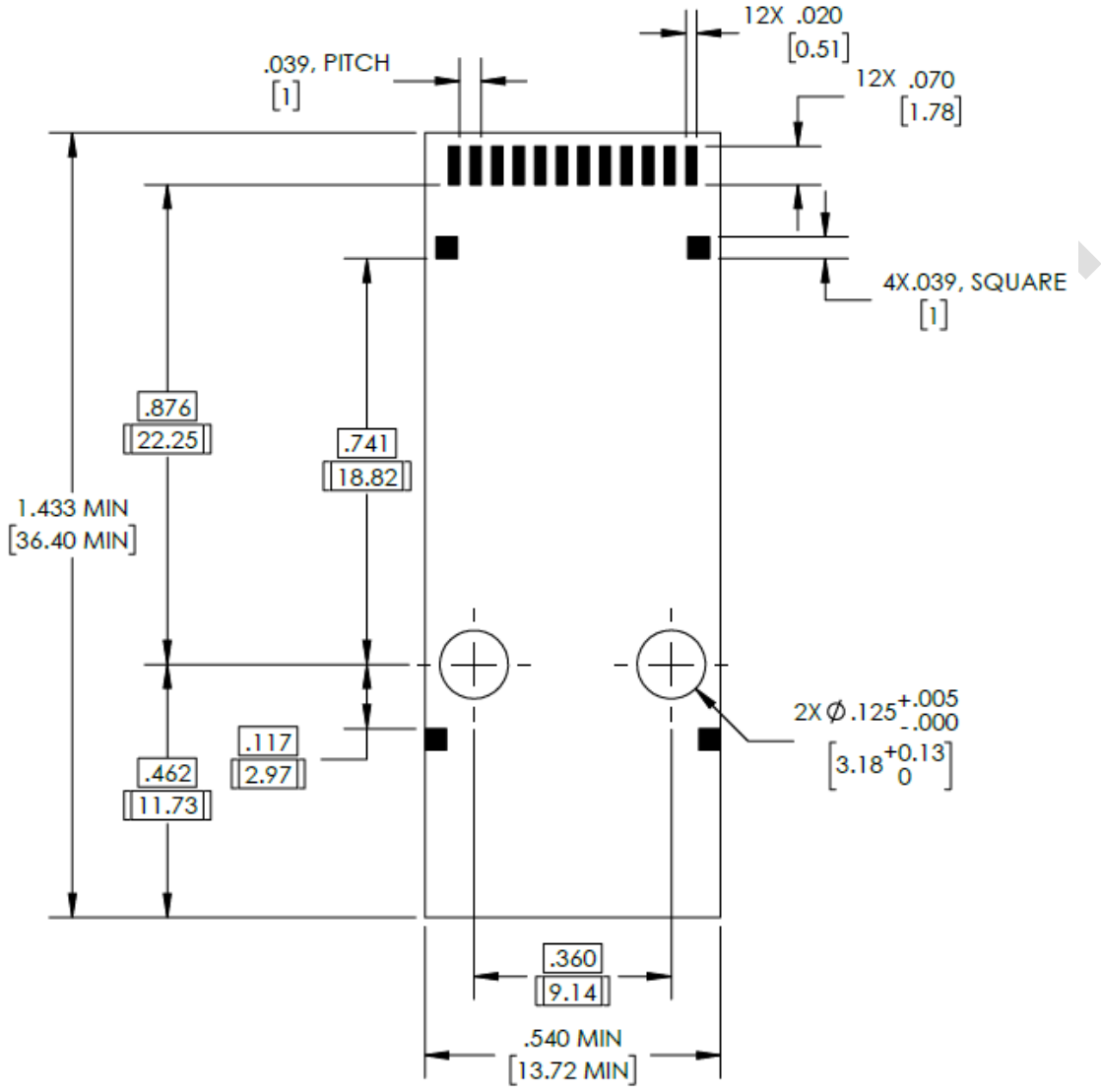
HOST BOARD APPLICATION SCHEMATIC



Notes:

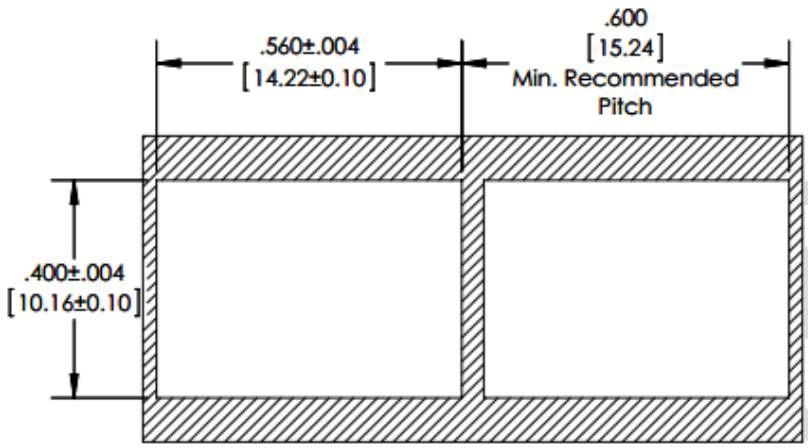
- Recommend host routes separate supply voltages and filtering for RJ-module transmitter and receiver as shown in the schematic above:
  - FB1/FB2 ferrite bead for power supply noise suppresion; Murata BLM18KG601SN1, 0603, 600Ω @ 100MHz, 1300mA.
  - C1/C4/C5/C8 bulk capacitance; Murata GRM21BR61C106KE15L,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

PCB Design Guidelines



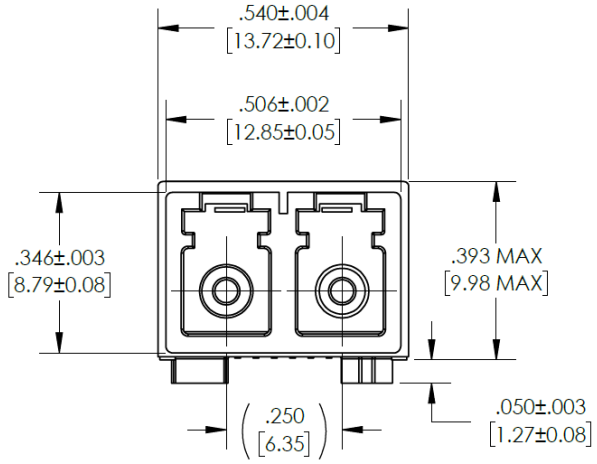
Dimensions in inches [mm]
Unless otherwise noted, tolerance of +/- .005"

Panel Cutout

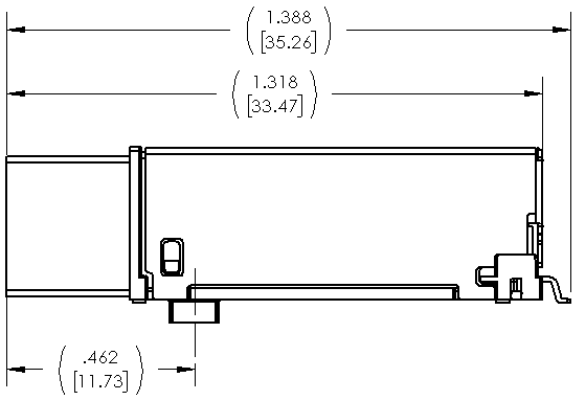


Dimensions in inches [mm]

Standard Mechanical Dimensions

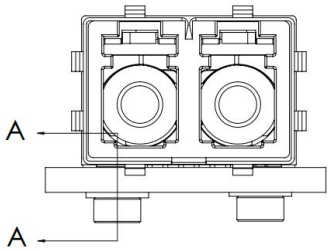


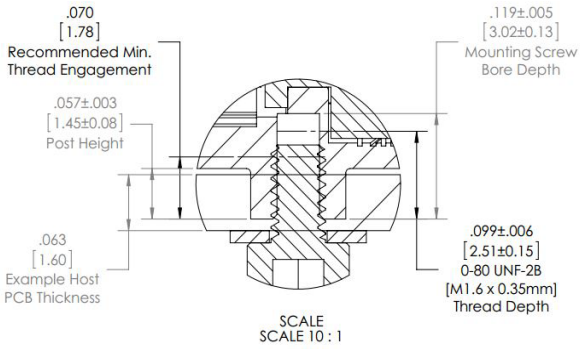
Front View, dimensions in inches [mm]



Side View, dimensions in inches [mm]

Mounting Hardware Guidelines





Notes:

1) An example illustrating a possible hardware combination to secure RJ-10G-DW-E to host PCB.
2) For further mounting hardware options and support contact COTSWORKS.
3) 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.

Ruggedization Notes

- Parylene Type 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.
- Contact COTSWORKS for all MSDS and case composition information.

Reference Information

1) IEC-60825-1 Safety of laser products.
2) IEC-60950-1 Information technology equipment – Safety.
3) SFF-8472 Management Interface for SFP+.
4) ITU-T G.694.1.

Regulatory Compliance

- COTSWORKS transceivers are Class 1 Laser Products and 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.

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-10G-DW-E	-xx	-xx	-x	-x	-x	-x	-x
RJ Form Factor **10Gbps MAX Data Rate** **Long Reach (SMF)** **DWDM 100Ghz Spacing** **Extended Link Budget (APD RX)**	**ITU Channel Wavelength** **ITU Channel** from ITU Channel Ordering Options Table	**Connector Type** LC: *Standard LC* LX: *ARINC 801*	**Ruggedized Coating** N: *Non-coated* R: *Parylene*	**Operating Temp Range** A: *–40° to 85°C*	**EMI Shield** N: *No Shield* E: *Shield*	**RoHS Level** 5: *Level 5* 6: *Level 6*	**Mounting** I: *Imperial Screw* U: *Metric Screw*

Example part Number: RJ-10G-DW-E-45-LC-R-A-N-5-I
[Rugged Jack Surface Mount, 10.3125Gbps DWDM Long Reach Transceiver, Extended Link Budget, Digital Diagnostics, ITU Channel 45 Transmitting Wavelength, Standard LC Receptacle, Parylene Conformal Coated, –40° to 85°C Operating Temperature Range, No EMI Shield, RoHS Level 5(6), Imperial Screw Thread]

ITU Channel Ordering Options

ITU Channel	Center Wavelength (nm)
34	1550.12
35	1549.32
36	1548.51
37	1547.72
38	1546.92
39	1546.12
40	1545.32
41	1544.53
42	1543.73
43	1542.94
44	1542.14
45	1541.35
46	1540.56
47	1539.77
48	1538.98
49	1538.19

Contact COTSWORKS for additional wavelength options.