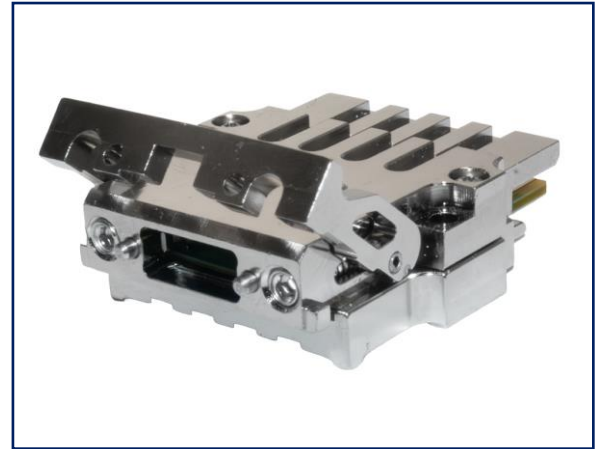


#### Features:

- SPOT-MB with MT-R™ is designed for mid-board applications
- MT-R “clamp” is a secure means of holding the MT ferrule in place during operation
- Optical fiber not permanently installed
- No special tools required for installation
- Ruggedized industry standard QSFP+ electrical interface
- 4Tx/4Rx parallel 850 nm VCSEL and SWDM PIN photodiode
- IEEE 802.3x performance at 1.25 and 10.3125 Gbps
  - 4x 1000BASE-SX for 550m over OM2, 3, or OM4
  - 4x 10GBASE-SR for 300m over OM3 or OM4
  - 40GBASE-SR4 for 150m on OM4
- IEC-60825-1 Class 1 eye safe optical power
- Digital Diagnostics per SFF-8636
- -40 to +85°C operation standard, -40 to +95°C optional
- Parylene coating optional



Designed for rugged networking in aerospace and defense applications, SPOT-MB is a high-speed rugged pluggable transceiver with a secure and separable MT ferrule retention mechanism.



COMMERCIAL  
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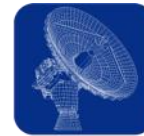
MILITARY  
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MILITARY  
TACTICAL



SUBSEA  
NETWORKING



RADAR &  
SENSING



OIL &  
EXPLORATION

## General Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate per Channel (1G)	DR <sub>1G</sub>	-	1.25	-	Gbps	(1)
Data Rate per Channel (10G)	DR <sub>10G</sub>	-	10.3125	-	Gbps	(2)
Transmitting Optical Wavelength	$\lambda$	840	-	860	nm	
Total Module Power Dissipation	P <sub>DISS</sub>	-	-	1.5	W	

#### Notes:

- 1) 8b/10b encoding
- 2) 64b/66b encoding

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Maximum Supply Voltage	V <sub>MAX</sub>	-0.5	3.6	V	
Storage Temperature	T <sub>sto</sub>	-40	95	°C	
Operating Temperature	T <sub>OP</sub>	-40	85	°C	(1)
Relative Humidity	RH	0	85	%	(2)
Conformal Coating	-	0.8	1.2	mil	(3)

#### Notes:

- 1) -40 to 95C option available
- 2) Based on conformal coating, non-condensing
- 3) See ruggedization notes on page 7

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

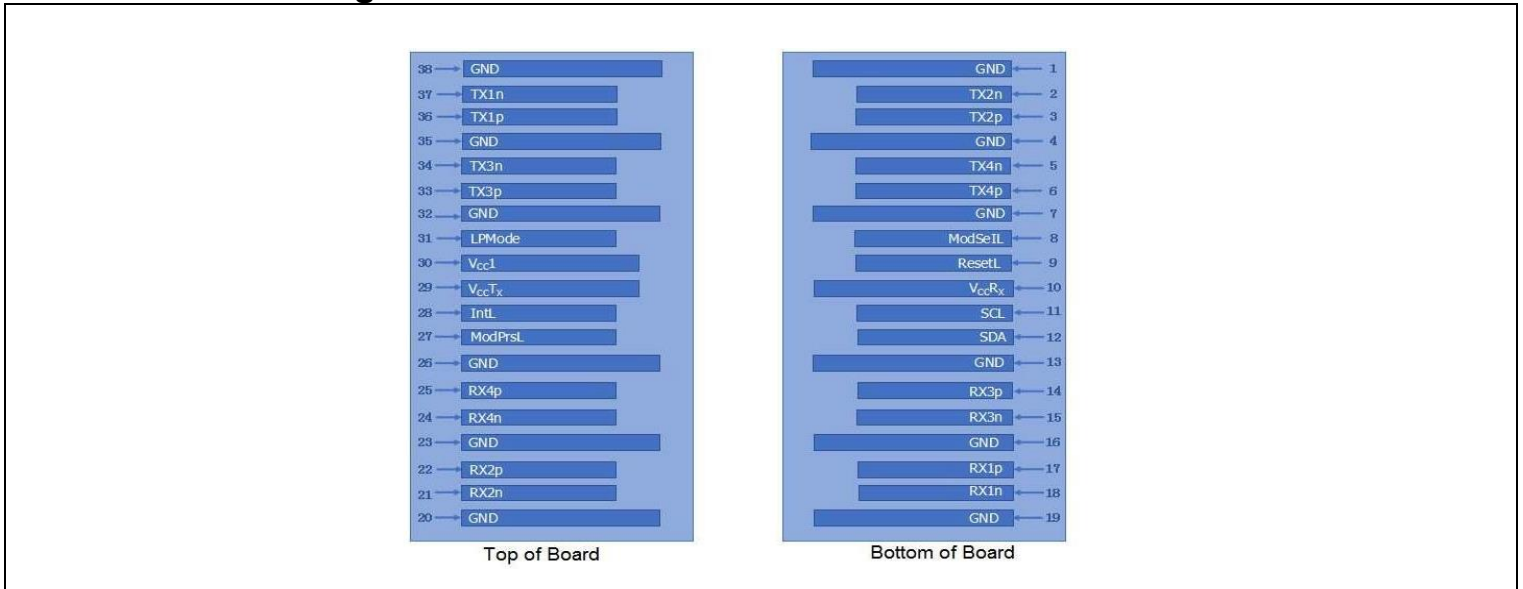
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Total Module Power Dissipation	$P_{DISS}$	-	-	1.5	W	
<b>Transmitter</b>						
TX Differential Input Voltage Swing	$V_{DTX}$	180	-	1200	mV	
TX Single-Ended Input Voltage Tolerance	$V_{IN\_TOL}$	-0.3	-	3.8	V	
TX Disable Input Voltage	$V_D$	$V_{CC} - 1.3$	-	$V_{CC}$	V	
<b>Receiver</b>						
RX Differential Output Voltage Swing	$V_{DRX}$	340	-	800	mV	
RX Differential Output Amplitude in Squelched State	$V_{DSQ}$	-	-	50	mV	
RX Single-Ended Output Voltage Tolerance	$V_{OUT\_TOL}$	-0.3	-	3.8	V	
Output AC Common Mode Voltage	$V_{CM}$	-	-	7.5	mV	
Data Output Rise / Fall Time	$t_r / t_f$	28	-	-	ps	(1)
Total Jitter (p-p)	TJ	-	-	0.7	UI	
Deterministic Jitter (p-p)	DJ	-	-	0.4	UI	
<b>Serial Bus</b>						
Data, Clock Input Low Voltage	$V_{IL}$	-0.3	-	$V_{CC} * 0.3$	V	
Data, Clock Input High Voltage	$V_{IH}$	$V_{CC} * 0.7$	-	$V_{CC} + 0.5$	V	
Data, Clock Output Low Voltage	$V_{OL}$	0	-	0.4	V	
Data, Clock Output High Voltage	$V_{OH}$	$V_{CC} - 0.5$	-	$V_{CC} + 0.3$	V	
<b>Notes:</b>						
1) 20% to 80%						

## Digital Diagnostics Information

The Moog | COTSWORKS SPOT-MB module supports a 2-wire bus required to access digital diagnostics compliant to SFF-8636 multi-source agreement. The transceiver pinout (including those pins required for 2-wire communication to access the digital diagnostics) appears on pages 3 and 4.

For more information on Digital Diagnostics, visit [www.cotsworks.moog.com/support-documents](http://www.cotsworks.moog.com/support-documents)

## Electrical Pad Assignment



## Electrical Pad Assignment Details

PIN #	Symbol	Description	Notes
1	GND	Ground	(5)
2	Tx2n	Transmitter Inverted Data Input, LAN2	
3	Tx2p	Transmitter Non-Inverted Data Input, LAN2	
4	GND	Ground	(5)
5	Tx4n	Transmitter Inverted Data Input, LAN4	
6	Tx4p	Transmitter Non-Inverted Data Input, LAN4	
7	GND	Ground	(5)
8	ModSeIL	Module select pin, the module responds to two-wire serial communication when low level	(1)
9	ResetL	Module Reset	(2)
10	VccRX	+3.3V Power Supply Receiver	
11	SCL	2-Wire Serial Interface Clock	
12	SDA	2-Wire Serial Interface Data	
13	GND	Ground	(5)
14	Rx3p	Receiver Non-Inverted Data Output, LAN3	
15	Rx3n	Receiver Inverted Data Output, LAN3	
16	GND	Ground	(5)
17	Rx1p	Receiver Non-Inverted Data Output, LAN1	
18	Rx1n	Receiver Inverted Data Output, LAN1	
19	GND	Ground	(5)
20	GND	Ground	(5)
21	Rx2n	Receiver Inverted Data Output, LAN2	
22	Rx2p	Receiver Non-Inverted Data Output, LAN2	
23	GND	Ground	(5)
24	Rx4n	Receiver Inverted Data Output, LAN4	
25	Rx4p	Receiver Non-Inverted Data Output, LAN4	
26	GND	Ground	(5)



27	ModPRsL	Module Present	
28	IntL	Interrupt	(4)
29	VccTX	+3.3V Power Supply Transmitter	
30	Vcc1	+3.3V Power Supply	
31	LPMMode	Low Power Mode	(3)
32	GND	Ground	(5)
33	Tx3p	Transmitter Non-Inverted Data Input, LAN3	
34	Tx3n	Transmitter Inverted Data Input, LAN3	
35	GND	Ground	(5)
36	Tx1p	Transmitter Non-Inverted Data Input, LAN1	
37	Tx1n	Transmitter Inverted Data Input, LAN1	
38	GND	Ground	(5)

**Notes:**

- 1) ModSelL is the input pin. The module responds to 2-wire serial communication commands when it is held low by the host. ModSelL allows multiple SPOT modules to be used on a single 2-wire interface bus. If ModSelL is High, the module will not respond to any 2-wire interface communication from the host. ModSelL has internal pull-up resistors in the module.
- 2) The module reset pin, when the low level on the ResetL pin lasts longer than the minimum pulse length, resets the module and restores all user modules to their default state. When performing reset device, the host should ignore all status bits. Until the module reset interrupt is completed, please note that during hot plugging, the module will issue this information to complete the reset interrupt without resetting.
- 3) This pin is active high, indicating that the module is running under a low power module.
- 4) IntL is the output pin, which is the open collector output and must be pulled up to Vcc on the motherboard. When it is low, it indicates that the module may malfunction. The host uses a 2-wire serial interface to identify the interrupt source.
- 5) Circuit ground is internally isolated from chassis ground.

### Rate Select Logic and i2C Controls

Input byte address in A0h	Bits	Bit Configuration	Notes
87	7 / 6	0 / 0	RX_4 optimized for data rates less than 6.6 Gbps.
87	7 / 6	1 / 0	RX_4 optimized for 6.6 Gbps data rates and above.
87	5 / 4	0 / 0	RX_3 optimized for data rates less than 6.6 Gbps.
87	5 / 4	1 / 0	RX_3 optimized for 6.6 Gbps data rates and above.
87	3 / 2	0 / 0	RX_2 optimized for data rates less than 6.6 Gbps.
87	3 / 2	1 / 0	RX_2 optimized for 6.6 Gbps data rates and above.
87	1 / 0	0 / 0	RX_1 optimized for data rates less than 6.6 Gbps.
87	1 / 0	1 / 0	RX_1 optimized for 6.6 Gbps data rates and above.
88	7 / 6	0 / 0	TX_4 optimized for data rates less than 6.6 Gbps.
88	7 / 6	1 / 0	TX_4 optimized for 6.6 Gbps data rates and above.
88	5 / 4	0 / 0	TX_3 optimized for data rates less than 6.6 Gbps.
88	5 / 4	1 / 0	TX_3 optimized for 6.6 Gbps data rates and above.
88	3 / 2	0 / 0	TX_2 optimized for data rates less than 6.6 Gbps.
88	3 / 2	1 / 0	TX_2 optimized for 6.6 Gbps data rates and above.
88	1 / 0	0 / 0	TX_1 optimized for data rates less than 6.6 Gbps.
88	1 / 0	1 / 0	TX_1 optimized for 6.6 Gbps data rates and above.

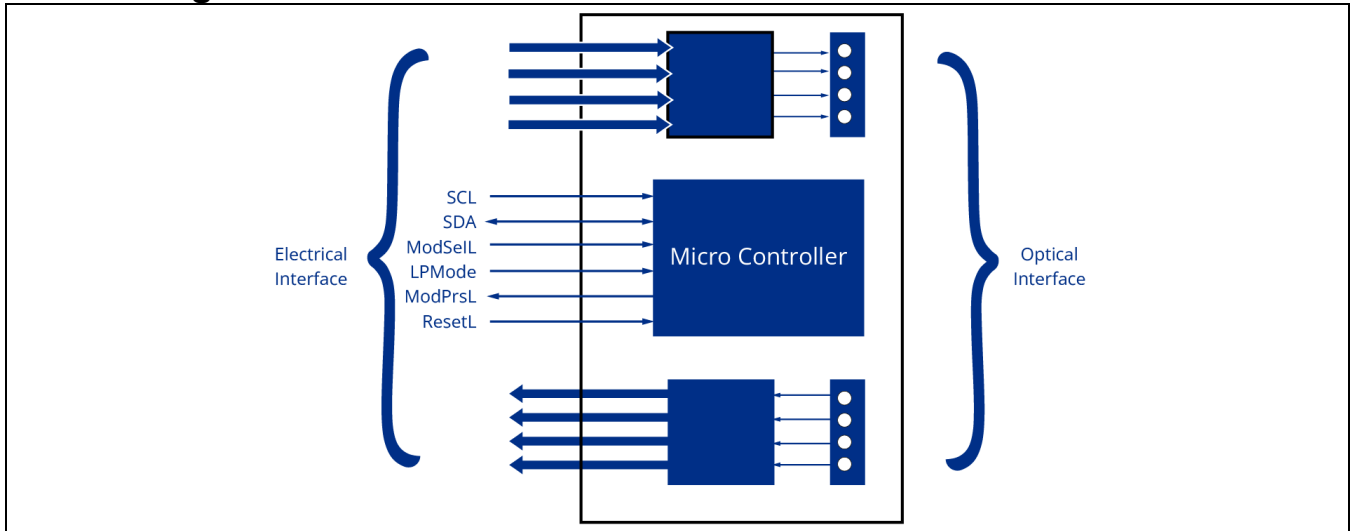


**Optical Characteristics** (TOP = -40 to 85°C, VCC = 3.14 to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Average Output Optical Power Per Lane (1G)	P <sub>OUT1G</sub>	-5	-	0	dBm	(1)
Average Output Optical Power Per Lane (10G)	P <sub>OUT10G</sub>	-5	-	0	dBm	(2)
OMA Output Optical Power Per Lane (10G)	OMA <sub>10G</sub>	-4.3	-	-	dBm	(2)
OMA Output Optical Power Per Lane, Minus TDP (10G)	OMA-T <sub>10G</sub>	-	-	-6.5	dBm	(2)
Optical Wavelength	λ	840	-	860	nm	
Spectral Width (RMS)	σ	-	-	0.45	nm	
Extinction Ratio (1G)	ER <sub>1G</sub>	9	-	-	dB	(1)
Extinction Ratio (10G)	ER <sub>10G</sub>	3	-	-	dB	(2)(6)
Relative Intensity Noise	RIN	-	-	-128	dB / Hz	
Transmitter Dispersion Penalty (10G)	TDP	-	-	3.5	dB	(2)
Output Optical Power TX Disable Per Lane	P <sub>OUT_OFF</sub>	-	-	-30	dBm	(5)
TX Mask Compliance (10G)	-	Compliant to IEEE 802.3ba				(2)
<b>Receiver</b>						
Unstressed Receiver Sensitivity (1G)	RX <sub>SENS1G</sub>	-	-	-17	dBm	(3)
Unstressed Receiver Sensitivity (10G)	RX <sub>SENS10G</sub>	-	-	-9.9	dBm	(4)
Unstressed Receiver Sensitivity in OMA (10G)	RX <sub>SENS10G_OMA</sub>	-	-	-11.3	dBm	(4)
Stressed Receiver Sensitivity in OMA (10G)	RX <sub>ST10G_OMA</sub>	-	-	-7.5	dBm	(4)
Receiver Saturation (1G)	RX <sub>SAT1G</sub>	2.4	-	-	dBm	(3)
Receiver Saturation (10G)	RX <sub>SAT10G</sub>	2.4	-	-	dBm	(4)
Receiver Saturation in OMA (10G)	RX <sub>SAT10G_OMA</sub>	3	-	-	dBm	(4)
Receiver Overload	RX <sub>OV</sub>	3.4	-	-	dBm	
Optical Center Wavelength (1G)	λ <sub>C1G</sub>	770	-	860	nm	
Optical Center Wavelength (10G)	λ <sub>C10G</sub>	840	-	860	nm	
Receiver Reflectance	RL	-	-	-12	dB	
Vertical Eye Closure Penalty	VECP	-	-	3.5	dB	
Loss of Signal De-Assert (1G)	LOS <sub>D1G</sub>	-	-	-12	dBm	(3)
Loss of Signal De-Assert (10G)	LOS <sub>D10G</sub>	-	-	-18	dBm	(4)
Loss of Signal Assert	LOS <sub>A</sub>	-26	-	-	dBm	
Loss of Signal Hysteresis	LOS <sub>H</sub>	0.5	-	-	dB	
<b>Notes:</b>						
1) Rate Select TX Low. 2) Rate Select TX High. 3) Rate Select RX Low; BER 1E-12. 4) Rate Select RX High; BER 1E-12. 5) Average. 6) At low transmit OMA, the product supports a higher extinction ratio than 3dB to achieve the minimum average output power spec listed.						



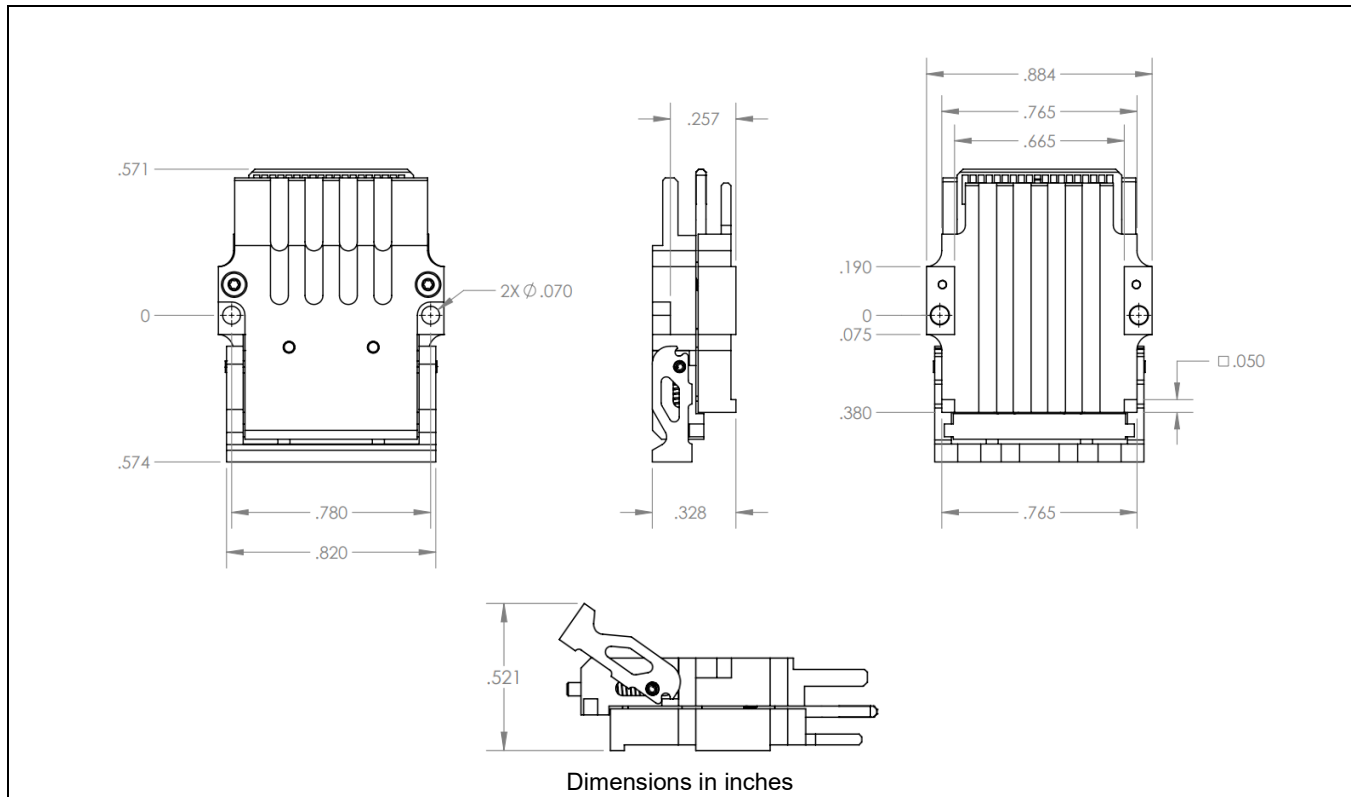
### Block Diagram of Transceiver



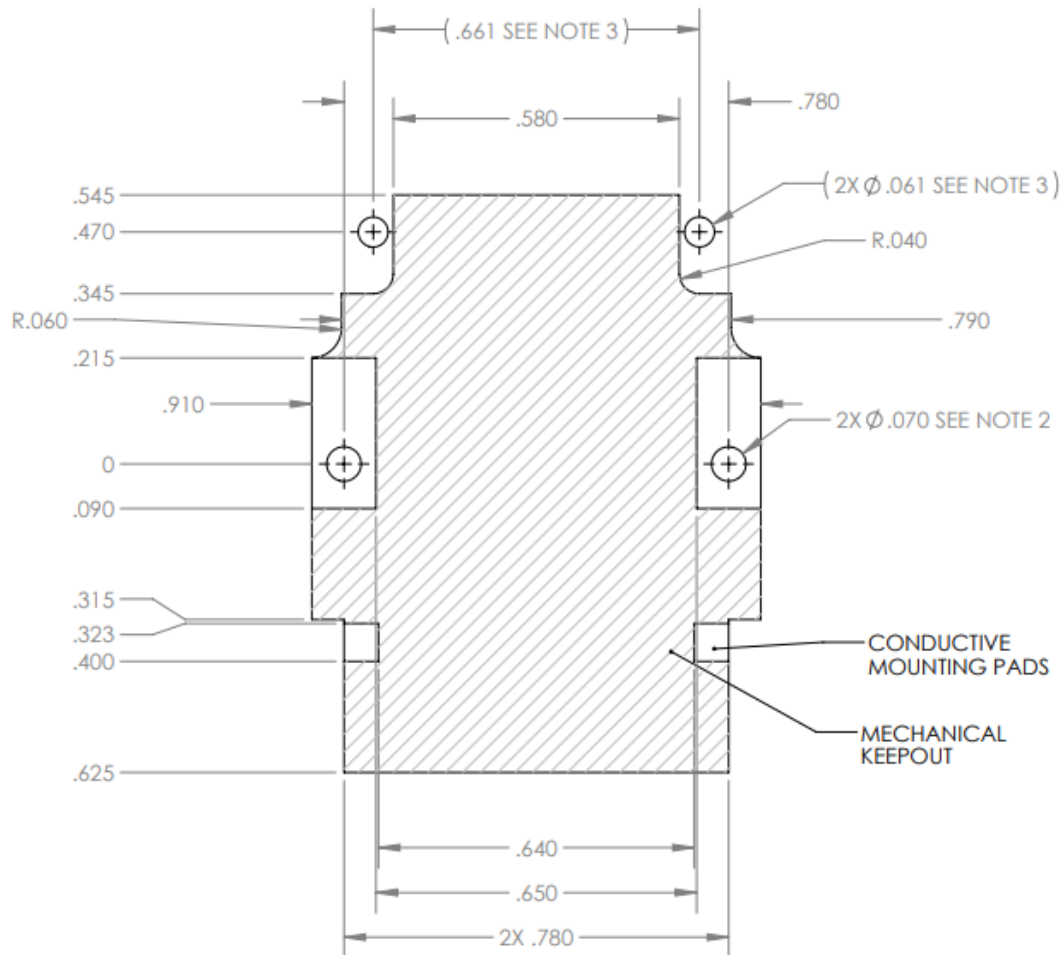
### Functional Description:

SPOT-MB has an optical engine embedded into the module. The engine connects 4 transmit/receive lanes. A functional block diagram of the engine is shown in the above Block Diagram. The transmitter sections consist of a 4-channel VCSEL array, a 4-channel input buffer and laser driver. An on-board micro-controller provides control, diagnostics and monitoring, as well as the external i2C serial communication interface. The receiver section consists of a 4-channel PIN photodiode array, a 4-channel TIA array, and a 4-channel output buffer as well as the external i2C serial interface.

### Mechanical Dimensions



### PCB Design Guidelines


**Note:**

1. 2D reference file: 943-00134-02.DXF
2. Recommended hole diameter for #0-80 and M1.6 mounting screws. If using solder mount PEMS, use manufacturer specifications.
3. Alignment holes for QSFP+ connector. Refer to manufacturer specifications.

### Ruggedization Notes

- Parylene Type C can be used for conformal coating with a 1.0 mil ± 0.2 mil thickness through a deposition process.
- Parylene Type C: 5600 VPM rating, withstands high temperatures, and extremely resistant to oil, dirt, and object impact.
- Contact Moog | COTSWORKS for all SDS and case composition 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.

SPOT	-MB	-SR4	-x	-x
<b>Secure Parallel Optical Transceiver</b>  <b>Rate Selectable for 1, 10, 40 Gbps</b>	<b>Mechanical Configuration</b>  <i>Mid-Board</i>	<b>Wavelength</b>  <i>850nm Short Reach</i>	<b>Ruggedized Coating</b>	<b>Operating Temperature Range</b>
			<i>( ): Non-Coated</i>  <i>R: Coated</i>	<i>A: -40 to 85°C</i>  <i>M: -40 to 95°C</i>

Contact MOOG | COTSWORKS for mechanical dimensional information, lead times, and other configuration options (including operating specification customization).

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