

Features:

- SFP+ MSA compliant envelope per SFF-8432
- IEEE 802.3 compliant performance for 10GBASE-LR
- IEEE 802.3 compliant performance for 1000BASE-LX
- 1310nm DFB laser and PIN photodiode
- Typical reach:
 - 10km over OS2 Singlemode Fiber at 10GBASE-LR
 - 5km over OS1/OS2 Singlemode Fiber at 1000BASE-LX
- Digital Diagnostics per SFF-8472 and SFF-8024
- Industrial temperature range -40 to +85°C
- Single 3.3V power supply
- Duplex LC receptacle



The SFP+10G-LR provides
1 & 10G rugged singlemode
networking



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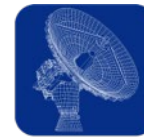
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MILITARY
TACTICAL



SUBSEA
NETWORKING



RADAR &
SENSING



OIL &
EXPLORATION

General Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Rate (1G)	DR _{1G}	-	1.25	-	Gbps	(1)
Data Rate (10G)	DR _{10G}	-	10.31	-	Gbps	(2)
Average Output Optical Power 1G	P _{OUT 1G}	-9	-	-3	dBm	
Average Output Optical Power 10G	P _{OUT 10G}	-4.2	-	0.5	dBm	
Receiver Sensitivity 1G	RX _{SENS 1G}	-	-	-20	dBm	(3)
Receiver Sensitivity 10G (OMA)	RX _{SENS 10G}	-	-	-13.6	dBm	(4)
Total Module Power Dissipation	P _{DISS}	-	-	1	W	

Notes:

- 1) 8b/10b encoding
- 2) 64b/66b encoding
- 3) Measured at a 1.25 Gbps data rate with a BER = 10⁻¹².
- 4) Measured at a 10.3125 Gbps data rate with a BER = 10⁻¹².

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Maximum Supply Voltage	V _{CC}	0	3.6	V	
Storage Temperature	T _{sto}	-40	85	°C	
Case Operating Temperature	T _{OP MAX}	-40	85	°C	
Relative Humidity	RH	5	95	%	Based on conformal coating
Conformal Coating	-	0.8	1.2	mil	(1)

Notes:

1. See ruggedization notes on page 6.



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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Total Module Power Dissipation	P_{DISS}	-	-	1	W	
Total Module Supply Current	I_{CC}	-	-	350	mA	
Transmitter						
Input Differential Impedance	Z_{in}	90	100	110	Ω	
TX Differential Input Voltage Swing	V_{DTX}	180	-	700	mV	
TX Disable Input Voltage	V_D	2	-	V_{CC}	V	
TX Enable Input Voltage	V_{EN}	V_{EE}	-	$V_{EE}+0.8$	V	
Receiver						
Rx Single-Ended Output Voltage Swing	V_{out}	300	-	850	mV	(1)
Data Output Rise/Fall Time 1G	t_r / t_f , _{1G}	30	-	-	ps	(2)
Data Output Rise/Fall Time 10G	t_r / t_f , _{10G}	30	-	-	ps	(2)
Loss of Signal Assert	LOS_{fault}	2	-	V_{CC}	V	(3)
Loss of Signal De-Assert	LOS_{norm}	V_{EE}	-	$V_{EE}+0.8$	V	(3)
Serial Bus						
Data, Clock Input Low Voltage	V_{IL}	-0.3	-	$0.3 \cdot V_{CC}$	V	
Data, Clock Input High Voltage	V_{IH}	$0.7 \cdot V_{CC}$	-	$V_{CC}+0.3$	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) Internally AC-coupled.						
2) 20% to 80%.						
3) LOS is LVTTTL. Logic 0 indicates normal operation; Logic 1 indicates no signal is detected.						

Digital Diagnostics Information:

The COTSWORKS SFP+ module supports 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 Pin Configuration table on page 3.

For more information on Digital Diagnostics, visit <https://www.cotsworks.com/support>



Pin Configuration

		PIN #	Symbol	Description	Notes
		1	VeeT	Transmitter Ground (Common with Receiver Ground).	(1)
		2	TX_Fault	Transmitter Fault.	
		3	TX_Disable	Transmitter Disable. Laser output disabled on high or open.	(2)
		4	SDA	Data line for Serial ID.	(3)
		5	SCL	Clock line for Serial ID.	(3)
		6	MOD_ABS	Module Definition 0. Grounded within module.	(3)
		7	RS0	Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate > 4.25 GBd and when low input signal rate ≤ 4.25 GBd.	
		8	RX_LOS	Loss of Signal Indication. Logic 0 indicates normal operation.	(4)
		9	RS1	Rate Select 1, optionally controls SFP+ module transmitter. When high input signaling rate > 4.25 GBd and when low input signal rate ≤ 4.25 GBd.	
		10	VeeR	Receiver Ground (Common with Transmitter Ground).	(1)
		11	VeeR	Receiver Ground (Common with Transmitter Ground).	(1)
		12	RD-	Receiver Inverted DATA out. AC Coupled.	
		13	RD+	Receiver Non-inverted DATA out. AC Coupled.	
		14	VeeR	Receiver Ground (Common with Transmitter Ground).	(1)
		15	VccR	Receiver Power Supply.	
		16	VccT	Transmitter Power Supply.	
		17	VeeT	Transmitter Ground (Common with Receiver Ground).	(1)
		18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
		19	TD-	Transmitter Inverted DATA in. AC Coupled.	
		20	VeeT	Transmitter Ground (Common with Receiver Ground).	(1)

		PIN #	Symbol	Description	Notes
1	VeeT	20	VeeT		
2	TX_Fault	19	TD-		
3	TX_Disable	18	TD+		
4	SDA	17	VeeT		
5	SCL	16	VccT		
6	MOD_ABS	15	VccR		
7	RS0	14	VeeR		
8	RX_LOS	13	RD+		
9	RS1	12	RD-		
10	VeeR	11	VeeR		

← Towards Bezel
Towards ASIC →

Notes:

- 1) Circuit ground is internally isolated from chassis ground.
- 2) Laser output disabled on $T_{DIS} > 2.0V$ or open, enabled on $T_{DIS} < 0.8V$.
- 3) Pull up with 4.7k – 10k Ohms on host board to voltage between 2.0V and 3.6V. MOD ABS(0) pulls line low to indicate module is plugged in.
- 4) LOS is open collector output. Should be pulled up with 4.7k – 10k Ohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation, Logic 1 indicates loss of signal.

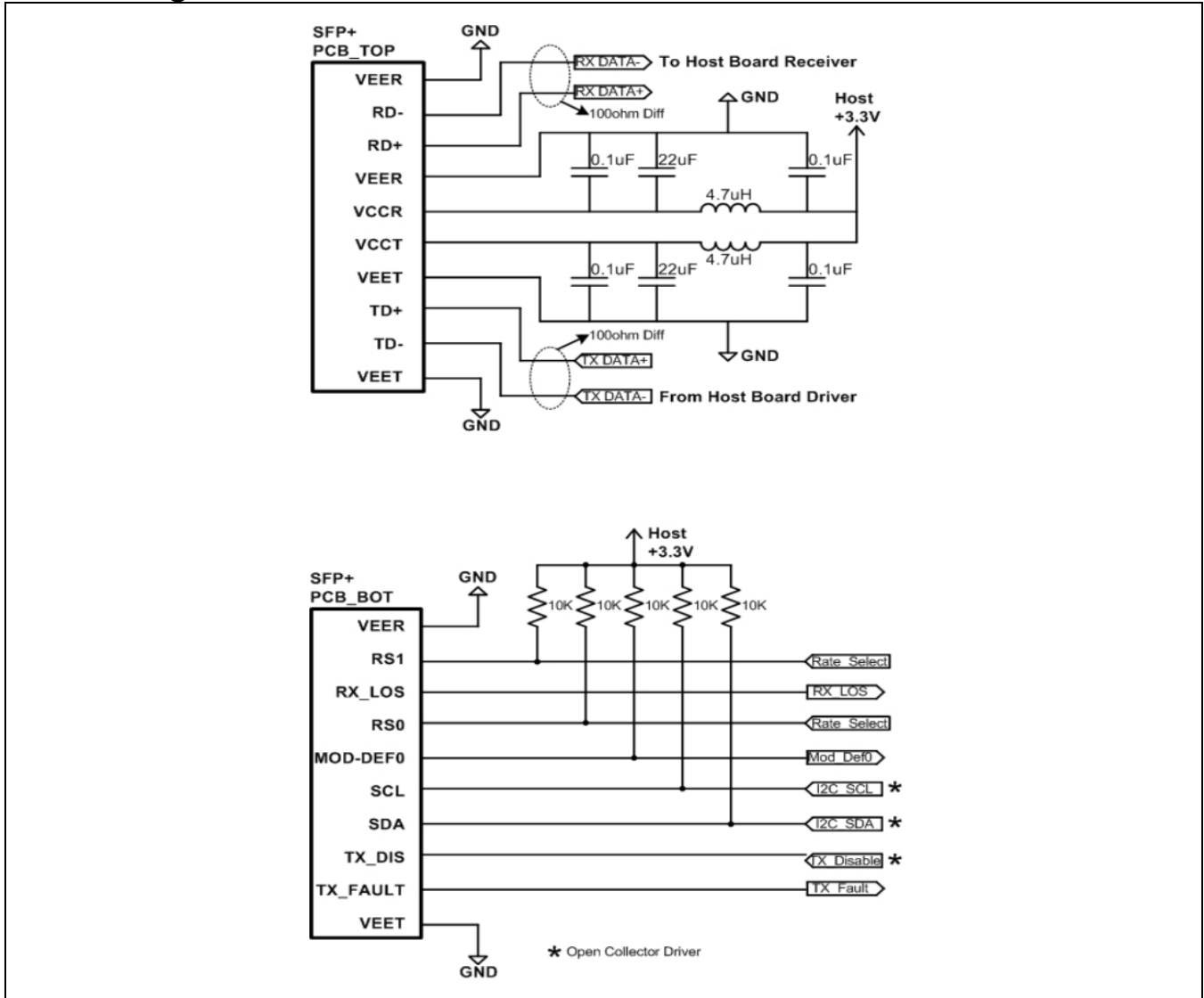


Optical Characteristics (T_{OP} = -40 to 85°C, V_{CC} = 3.14 to 3.47 Volts)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
Average Output Optical Power 1G	P _{OUT_1G}	-8.3	-	-3	dBm	
Average Output Optical Power 10G	P _{OUT_10G}	-5.2	-	0.5	dBm	
Optical Wavelength	λ	1260	1310	1355	nm	
Spectral Width (-20dB)	σ	-	-	1	nm	
Extinction Ratio 1G	ER _{1G}	9	-	-	dB	
Extinction Ratio 10G	ER _{10G}	3.5	-	-	dB	
Transmitter and Dispersion Penalty	TDP	-	-	3.2	dB	
Average Launch Power of OFF TX	P _{OFF}	-	-	-30	dBm	
RIN ₂ OMA (max)	RIN	-	-	-128	dB / Hz	
TX Mask Compliance	-	{X1, X2, X3, Y1, Y2, Y3} = {0.25, 0.40, 0.45, 0.25, 0.28, 0.40}				
Receiver						
Receiver Sensitivity 1G	RX _{SENS_1G}	-	-	-19	dBm	(1)
Receiver Sensitivity 10G (OMA)	RX _{SENS_10G}	-	-	-10.3	dBm	(2)
Receiver Saturation 1G	RX _{SAT_1G}	-3	-	-	dBm	
Receiver Saturation 10G	RX _{SAT_10G}	0.5	-	-	dBm	
Optical Center Wavelength	λ _C	1260	-	1355	nm	
Return Loss	RL	-	-	-12	dB	
Loss of Signal De-Assert	LOS _D	-	-	-17	dBm	
Loss of Signal Assert	LOS _A	-30	-	-	dBm	
Loss of Signal Hysteresis	LOS _H	0.5	-	-	dB	
Notes:						
1) Measured at a 1.25 Gbps data rate with a BER = 10 ⁻¹² .						
2) Measured at a 10.3125 Gbps data rate with a BER = 10 ⁻¹² .						

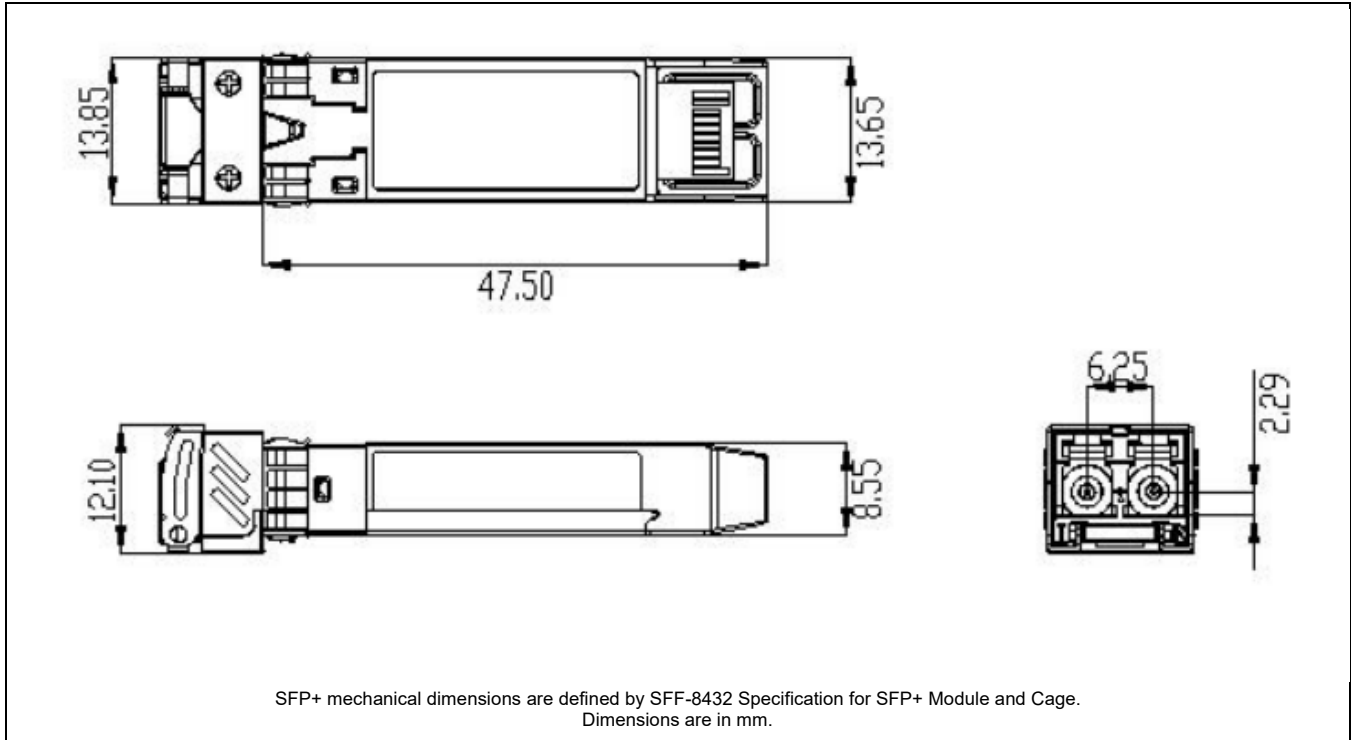


PCB Design Guidelines





Standard Mechanical Dimensions



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) SFF-8431 Specification for SFP+ 10 Gb/s and Low Speed Electrical Interface.
- 2) SFF-8432 Specification for SFP+ Module and Cage.
- 3) IEEE 802.3ae for 10GBASE-LR Ethernet
- 4) IEEE 802.3z for 1000BASE-LX
- 5) SFF-8472 Specification for Management Interface for SFP+

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.

SFP+10G	-LR	-LC	-x	-B	-x	-x
Small Form Factor Pluggable Transceiver 10.7 Gbps MAX Data Rate	Wavelength LR: <i>1310 nm Long Reach</i>	Optical Interface LC: <i>LC Receptacle</i>	Staking Option N: <i>No Internal Component Staking</i> S: <i>Internal Component Staking</i>	Latching Mechanism B: <i>Bail Latch</i>	Ruggedized Coating N: <i>Non-coated</i> R: <i>Parylene</i>	Operating Temp Range I: <i>0 to 70°C</i> A: <i>-40° to 85°C</i>

Part Number: SFP+10G-LR-LC-N-B-R-A

[SFP+ Transceiver with Digital Diagnostics, 1310nm Long Reach, LC Receptacle, No Internal Component Staking, Bail Latch, Parylene Coated, -40 to 85°C Operating Temperature Range]

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

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