



Features

- Simplex LC Connector, Bi-directional
- Single 3.3V Supply
- 10km Minimum Reach
- Commercial Temperature Available
- 1270nm DFB Laser transmitter, 1330nm receiver
- Compliant with IEEE 802.3-2005 10GBASE-LR and 10GBASE-LW
- SFP+ MSA SFF-8431 Compliant
- Digital Diagnostic SFF-8472 Compliant
- Telcordia GR-468 Compliant
- Color Coded Bail Latch Tube: Grey
- RoHS Compliant

Regulatory Compliance

Table 1 – Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1 (>1000 V)
Electrostatic Discharge (ESD) at the Faceplate	IEC 61000-4-2	Compatible with Standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with Standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 Laser Product
RoHS Compliance	2002/95/EC	Compatible with Standards

Absolute Maximum Ratings

Table 2 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T _s	-40	-	+85	°C	
Supply Voltage	V _{cc}	-0.5	-	4.0	V	
Operating Relative Humidity	RH	-	-	85	%	

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Voltage	V _{cc}	3.14	3.3	3.46	V	
Supply Current	I _{cc}	-	-	300	mA	
Maximum Power Dissipation	P _{vcc}	-	-	1	W	
Inrush Current	I _{IN-RUSH}	-	-	30	mA	1
Power Supply Noise Rejection	PSR	66/99	-	-	mVp-p	2
Operating Temperature (Case)	T _{opr}	-5	-	70	°C	
Data Rate	DR	9.953	-	11.09	Gb/s	3

Note 1: Max. duration 500ms

Note 2: 66 mVp-p:10Hz-1MHz, 2% p-p, 3.3V power supply. 99 mVp-p: 1-10MHz, 3% p-p, 3.3V power supply.

Note 3: Supports 10GE at 9.953, 10.3125 and 11.09 Gb/s, 10GFC at 10.51 Gb/s. PRBS2³¹-1.

Optical and Electrical Characteristics

Table 4 – Transmitter Specifications (Optical)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Optical Power	P_{op}	-8.2	-	0.5	dBm	
Optical Crosstalk	XT	-	-	-30	dB	
Average Launch Power Tx_Off	P_{off}	-	-	-30	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Eye Mask		Compliant with IEEE 802.3				
Mean Wavelength	λ	1260	1270	1280	nm	
Side Mode Suppress Ratio	SMSR	30	-	-	dB	
RIN ₁₂ OMA	RIN	-	-	-128	dB/Hz	
Optical Modulation Amplitude	OMA	-5.2	-	-	dBm	
Launch Power in OMA minus TDP	OMA-TDP	-6.2	-	-	dBm	
Transmitter and Dispersion Penalty	TDP	-	-	3.2	dB	
Optical Return Loss Tolerance	-	-	-	12	dB	
Transmitter Reflectance	-	-	-	-12	dB	

Table 5 – Receiver Specifications (Optical)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Average Receiver Power	-	-14.4	-	0.5	dBm	4
Receiver Sensitivity in OMA	-	-	-	0.055(-12.6)	mW(dBm)	5
Stressed Receiver Sensitivity in OMA	-	-	-	0.093(-10.3)	mW(dBm)	
Wavelength	λ	1320	-	1340	nm	
Damage Threshold For Receiver	$P_{in, damage}$	-	-	4	dBm	
Receiver Total Jitter	TJ	-	-	0.70	UI	
Receiver Deterministic Jitter	DJ	-	-	0.42	UI	
Vertical Eye Closure Penalty	-	2.2	-	-	dBm	
Receiver Reflectance	RX_r	-	-	-12	dB	
LOS Assert	-	-30	-	-	dBm	
LOS De-Assert	-	-	-	-14.4	dBm	
LOS Hysteresis	-	0.5	-	-	dB	

Note 4: Average Receiver Power (Min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant.

Note 5: Measured with a PRBS231-1 test pattern @10.3125Gbps, BER \leq 10⁻¹²

Table 6 – Electrical Specifications and Timing

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Input Differential Impedance	R_{in}	90	100	110	Ω	
PECL Differential Data Input Swing	$V_{in, p-p}$	400	-	1600	mV	
PECL Differential Data Output Swing	$V_{out, p-p}$	300	600	900	mV	
Output Differential Impedance	R_{out}	80	100	120	Ω	
TX_Fault, RX_LOS	V_{OL}	0.0	-	0.4	V	
	V_{OH}	Host_Vcc -0.5	-	Host_Vcc +0.3	V	
TX_Disable	V_{IL}	-0.3	-	0.8	V	
	V_{IH}	2.0	-	VccT+0.3	V	
RS0, RS1	V_{IL}	-0.3	-	0.8		
	V_{IH}	2.0	-	VccT+0.3		
Tx Disable Negate Time	t_{on}	-	-	2	ms	
Tx Disable Assert Time	t_{off}	-	-	10	μ s	
Time to Initialize 2-Wire Interface	$t_{2w_start_up}$	-	-	300	ms	
Time to Initialize	t_{start_up}	-	-	300	ms	
Tx Fault Assert Time	t_{fault_on}	-	-	1	ms	
Tx Fault Reset	TX_Fault Reset	10	-	-	μ s	
RX_LOS Assert delay	t_{loss_on}	-	-	100	μ s	
RX_LOS Negate delay	t_{loss_off}	-	-	100	μ s	

Diagnostics

Table 7 – Diagnostics

Parameter	Range	Accuracy	Unit	Calibration	Formula
Temperature	-5 to 70	± 3	$^{\circ}$ C	External	$T_c(C) = T_{slope} * T_{ad} (16 \text{ bit signed twos complement value}) + T_{offset}$
Voltage	0 to Vcc	0.1	V	External	$V(\text{Volts}) = V_{slope} * V_{ad} (16 \text{ bit unsigned integer}) + V_{offset}$
Bias Current	0 to 120	5	mA	External	$I(\text{mA}) = I_{slope} * I_{ad} (16 \text{ bit unsigned integer}) + I_{offset}$
Tx Power	-8.2 to 0.5	± 3	dBm	External	$Tx_PWR(\mu W) = Tx_PWR_{slope} * Tx_PWR_{ad} (16 \text{ bit unsigned integer}) + Tx_PWR_{offset}$
Rx Power	-14.4 to 0.5	± 3	dBm	External	$Rx_PWR(\mu W) = A_0 + A_1 * x + A_2 * x^2 + A_3 * x^3 + A_4 * x^4$

Table 8 – EEPROM Serial ID (A0h)

Name of Field	Description of Field	Address	Hex	ASCII
Identifier	Type of transceiver	0	03	
Ext. Identifier	Extended identifier of type of transceiver	1	04	
Connector	Code for connector type	2	07	
Transceiver	Code for electronic compatibility or optical compatibility	3	20	
		4	00	
		5	00	
		6	00	
		7	00	
		8	00	
		9	00	
10	00			
Encoding	Code for high speed serial encoding algorithm (64B/66B)	11	06	
BR.Nominal	Nominal signalling rate, units of 100MBd.	12	67	
Rate Identifier	Type of rate select functionality	13	00	
Length (SMF,km)	Link length supported for single mode fiber, units of km	14	0A	
Length (SMF)	Link length supported for single mode fiber, units of 100 m	15	64	
Length (50µm)	Link length supported for 50 um OM2 fiber, units of 10 m	16	00	
Length (62.5µm)	Link length supported for 62.5 um OM1 fiber, units of 10 m	17	00	
Length (Copper)	Link length supported for copper, units of meters	18	00	
Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	19	00	
Vendor Name	SFP vendor name (ASCII)	20	53	S
		21	4F	O
		22	55	U
		23	52	R
		24	43	C
		25	45	E
		26	50	P
		27	48	H
		28	4F	O
		29	54	T
		30	4F	O
		31	4E	N
		32	49	I
		33	43	C
		34	53	S
35	20	[Space]		

Table 8 – EEPROM Serial ID (A0h)

Name of Field	Description of Field	Address	Hex	ASCII
Unallocated		36	00	
Vendor OUI	SFP vendor IEEE company ID for Source Photonics Inc.	37	00	
		38	1F	
		39	22	
Vendor PN	Part number in ASCII, e.g. SPPLROXEBCDFA	40	53	S
		41	50	P
		42	50	P
		43	4C	L
		44	52	R
		45	4F	O
		46	58	X
		47	45	E
		48	42	B
		49	58	X
		50	43	C
		51	44	D
		52	46	F
		53	41	A
54	20	[Space]		
55	20	[Space]		
Vendor Rev.	Revision level for part number provide by vendor (ASCII)	56	41	A
		57	20	[Space]
		58	20	[Space]
		59	20	[Space]
Wavelength	Laser wavelength, 1270nm	60	04	
		61	F6	
Unallocated		62	00	
CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	63	xx	
Options	Indicates which optional transceiver signals are implemented	64	00	
		65	1A	

Table 8 – EEPROM Serial ID (A0h)

Name of Field	Description of Field	Address	Hex	ASCII
BR, max	Upper bit rate margin, unit of %	66	00	
BR, min	Lower bit rate margin, unit of %	67	00	
Vendor SN	Serial number	68-83	xx	
Date Code	Vendor's manufacturing date code	84-91	xx	
Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented in the transceiver	92	68	
Enhanced Options	Indicates which optional enhanced features are implemented in the transceiver	93	F0	
SFF-8472 Compliance	Indicates which revision of SFF-8472 the transceiver complies with	94	03	
CC_EXT	Check code for Extended ID Fields (addresses 64 to 94)	95	xx	
Vendor Specific	Vendor Specific EEPROM	96-127	xx	

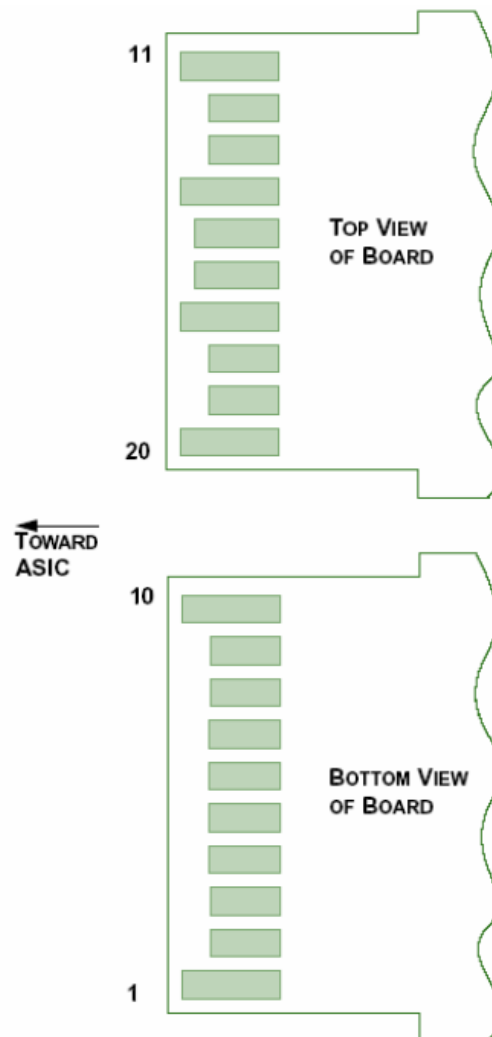
Table 9 – Pin Definitions

Pin	Symbol	Name/Description
1	VeeT	Module Transmitter Ground
2	TX_FAULT	Module Transmitter Fault
3	TX_DISABLE	Transmitter Disable; Turns off transmitter laser output
4	SDL	2-Wire Serial Interface Data Line (MOD-DEF2)
5	SCL	2-Wire Serial Interface Clock (MOD-DEF1)
6	MOD_ABS	Module Absent, connected to VeeT or VeeR in the module
7	RS0	Rate Select 0 – Not in use
8	RX_LOS	Receiver Loss of Signal Indication (in FC designated as RX_LOS, in SONET designated as LOS, and in Ethernet designated as NOT Signal Detect)
9	RS1	Rate Select 1 – Not in use
10	VeeR	Module Receiver Ground
11	VeeR	Module Receiver Ground
12	RXD-	Receiver Inverted Data Output
13	RXD+	Receiver Non-Inverted Data Output
14	VeeR	Module Receiver Ground
15	VCCR	Module Receiver 3.3V Supply
16	VCCT	Module Transmitter 3.3V Supply
17	VeeT	Module Transmitter Ground
18	TXD+	Transmitter Non-Inverted Data Input
19	TXD-	Transmitter Inverted Data Input
20	VeeT	Module Transmitter Ground

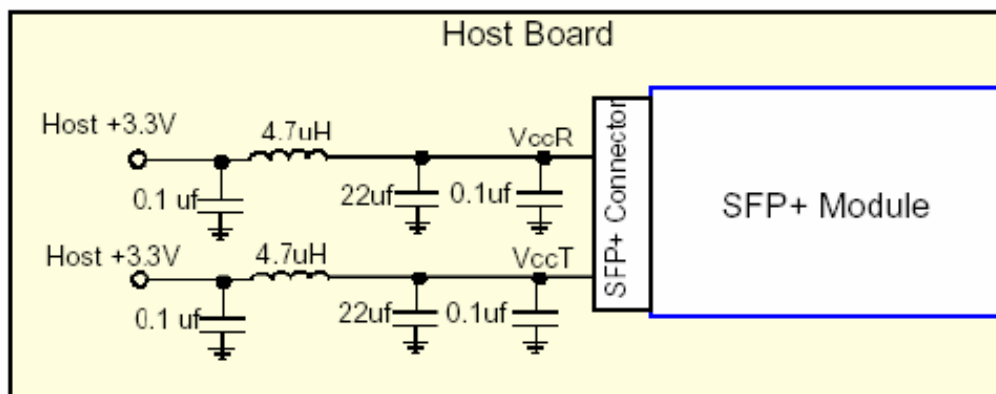
Note

1. The module ground pins, VeeR and VeeT, shall be isolated from the module case.
2. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10K ohms to a Host_Vcc on the host board
3. Shall be pulled up with 4.7K-10K ohms to VccT in the module
4. This pin is an open collector/drain input pin and shall be pulled up with 4.7K-10K ohms to VccT in the module.

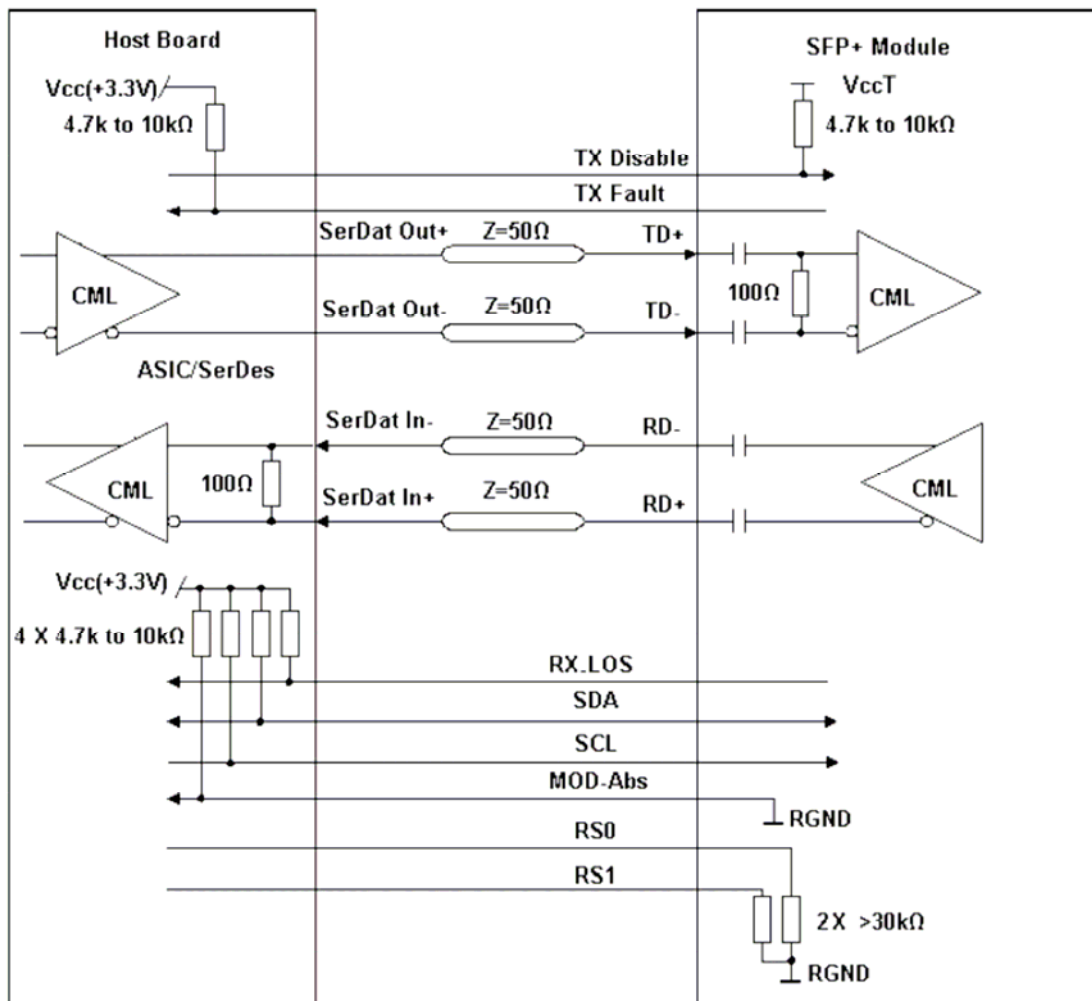
SFP+ Module PCB Pinout



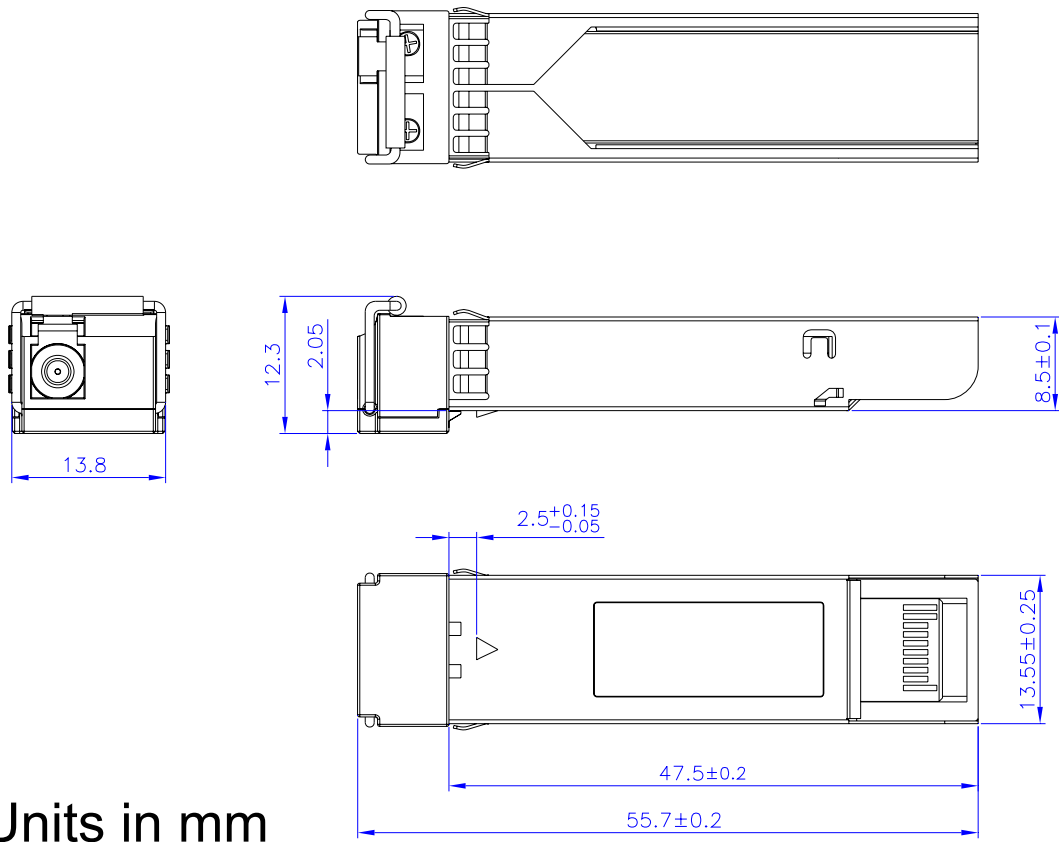
Recommended Host Board Power Supply Circuit



Recommended Interface Circuit



Mechanical Diagram



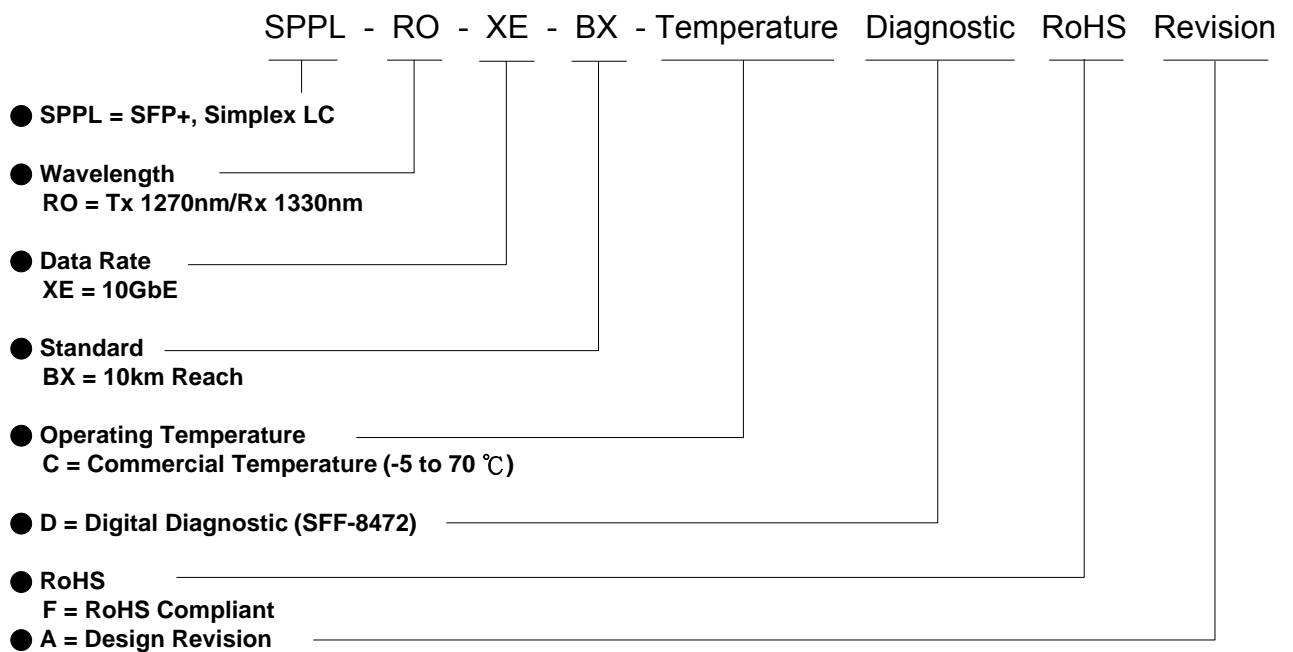
Units in mm

Order Information

Table 10 – Order Information

Part No.
SPPL-RO-XE-BX-CDFA

Part Numbering Definition:



Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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