



## Applications

- LiDAR
- Free Space Optics
- Frequency Modulated Continuous Wavelength Sensing

## Features

- 15 dBm Optical Output Power
- Telcordia Technologies® GR-468 Compliant
- Monitor Photodiode
- RoHS

EMCORE's 1995 cooled TOSA laser module is characterized for use as a CW coherent optical source laser for LiDAR technology. The 1995 is DC-coupled with a built-in TEC, thermistor, and monitor photodiode. The device is in hermetic TO56 package with 6+1 pins. The 1995 incorporates a high efficiency coupling scheme to deliver 14 dBm of CW optical power.

## Performance Highlights

Parameter	Min	Typ	Max	Units
Operating Case Temperature	20		+60	°C
Wavelength	1550 +/- 10			nm
Optical Output Power	14	15	-	dBm
Threshold Current	-	-	40	mA
Operating Current	-	-	250	mA
Frequency Noise @ 100 kHz <sup>1</sup>	-	-	32	kHz <sup>2</sup> /Hz
Optical Isolation	40	50	-	dB
Maximum Laser Output Power (Eye Safety)	-	-	27	dBm
SMSR <sup>1</sup>	50	-	-	dB
Polarization Extinction Ratio (PMF pigtail)	17	-	-	dB
Optical Return Loss	40	-	-	dB

1. @ operating current

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

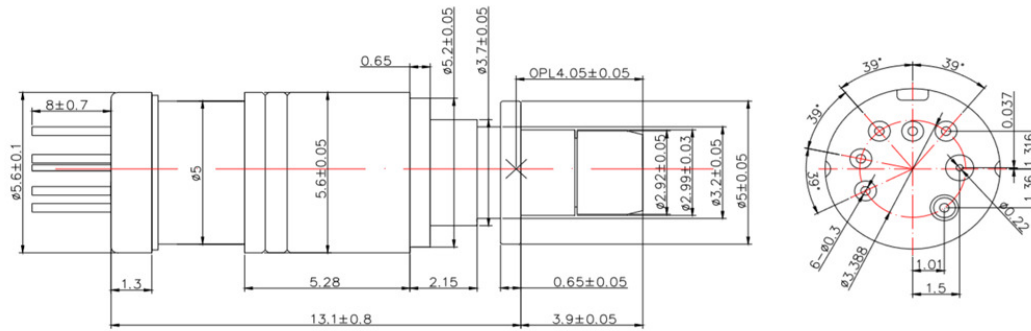
Parameter	Symb	Condition	Min	Max	Units
Operating Case Temperature	T <sub>C</sub>	continuous	20	+60	°C
Storage Case Temperature	T <sub>STG</sub>	continuous	-40	+85	°C
Laser Forward dc Current	-	continuous	-	600	mA
Photodiode Reverse Voltage	V <sub>R,MPD</sub>	continuous	-	10	V
Laser Reverse Voltage	-	continuous	-	2	V
TEC Current	I <sub>TEC</sub>	continuous	-	1.7	A
Maximum Laser Output Power	P <sub>max</sub>	Continuous	-	27	dBm
ESD	-	HBM: R = 1500 Ω, C = 100 pF	-500	500	V
Relative Humidity	RH	Non condensing			

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## Electrical/Optical Characteristics

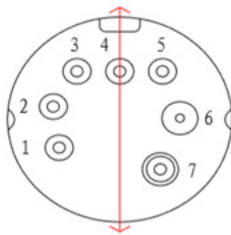
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operating Case Temperature	$T_C$	Measured at the bottom of the package	20		+60	$^{\circ}\text{C}$
Optical Output Power	$P_O$	$T_{OP}, I_{OP} = 200 \text{ mA}$	14	15	-	dBm
Operating Current	$I_{OP}$	-	-	200	250	mA
Operating Laser Temperature	$T_{OP}$	Laser temperature setpoint (thermistor reading) to align $\lambda_{OP}$ with a designated wavelength channel, for $I_{OP} = 200 \text{ mA}$	37		53	$^{\circ}\text{C}$
Laser Bias Forward Voltage	$V_{OP}$	$T_{OP}, I_{OP} = 250 \text{ mA}$	1.0	-	1.8	V
Wavelength	$\lambda_{OP}$	$T_{OP}, I_{OP} = 200 \text{ mA}$	1550 $\pm$ 10			nm
Wavelength change over life	$\Delta\lambda$	$T_{OP}, I_{OP} = 200 \text{ mA}, 10,000 \text{ hours}$	-0.1		+0.1	nm
Frequency Noise @ 100 kHz	$\Delta\nu$	$T = T_{OP}, I_F = I_{OP}$	-	-	32	$\text{kHz}^2/\text{Hz}$
Optical Isolation	ISO	-	40	50	-	dB
Threshold Current	$I_{TH}$	$T_{OP}$	-		40	mA
Sidemode Suppression Ratio	SMSR	$T_{OP}, I_{OP} = 200 \text{ mA}$	50	-	-	dB
Polarization Extinction Ratio	PER	$T_{OP}, I_{OP} = 200 \text{ mA}$	17	-	-	dB
Wavelength Tuning with Bias Current	$d\nu/dI$	$T_{OP}, I_{OP} = 200 \text{ mA}$ , bias current modulation with a triangle wave @50KHz, for >1 GHz tuning	100	-	350	MHz/mA
Wavelength thermal tuning coefficient	$d\lambda/dT$			0.08		nm/ $^{\circ}\text{C}$
Monitor PD Current	$I_{MPD}$	$I_{OP} = 200 \text{ mA}, V_{MPD} = -5 \text{ V}$	100	-	2500	$\mu\text{A}$
Monitor PD Dark Current	$I_D$	$I_{OP} = 0 \text{ mA}, V_{MPD} = -5 \text{ V}$	-	-	0.2	$\mu\text{A}$
Thermistor Resistance <sup>1</sup>	$R_{TH}$	$T_{OP} = 25 \text{ }^{\circ}\text{C}$	9.0	10.0	11.0	$\text{K}\Omega$
TEC Current <sup>2</sup>	$I_{TEC}$	$T_{OP}, I_{OP} = 200 \text{ mA}$	-1.0	-	+0.8	A
TEC Voltage <sup>2</sup>	$V_{TEC}$	$T_{OP}, I_{OP} = 200 \text{ mA}$	-2.5	-	+2.2	V

1. Thermistor temperature-resistance formula:  $1/T = A + B \cdot \ln(R) + C \cdot (\ln(R))^3$  where T is temperature in Kelvin, R is resistance in Ohm,  $A=1.129 \times 10^{-3}$ ,  $B=2.341 \times 10^{-4}$ ,  $C=8.775 \times 10^{-8}$ .
2. Values for steady state operation. Maximum cooling  $\Delta T < 30 \text{ }^{\circ}\text{C}$ , Maximum heating  $\Delta T < 40 \text{ }^{\circ}\text{C}$



## Pin Assignments

TOSA output polarization direction



Pin	Description
1	Laser Cathode (-)
2	Thermistor
3	MPD Cathode (+)
4	Thermo-electric Cooler (-)
5	Thermo-electric Cooler (+)
6	Laser Anode (+)
7	Case Ground/MPD Anode (-)/Thermistor