Using PhotonTec Berlin High Power Laser Diodes Package

Application Note

Introduction

High power laser from PhotonTec Berlin are efficient radiation source for cw operation. Though optimized coupling and mounting technique high power, high brightness and reliability have been reached. Integrated thermsitor and photodiode allow temperature and power monitor.

This article gives some proposals for using PhtonTec Berlin high power laser diodes in metal package.

Safety Instructions

Products incorporating these laser diodes is normally classified as **class IV laser products** according to IEC 60825-1 in a normal operation mode. Direct exposure of the human eye with laser radiation is therefore hazardous and must be strictly avoided.

Testing and maintenance of these products shall be performed only by personnel who are trained in laser safety. For details please refer to relevant local safety regulations and to the manufacturers requirements according to IEC 60825-1.

Persons working with high power diode lasers must wear suitable laser protection glasses.

Storage and Shipping

Storage must be in a clean and dry atmosphere in a temperature range of -20° to 80°C with relative humidity of less than 80%.

ESD protection measurements must be taken during storage and shipping.

Unpacking and Handling

The high power diode lasers are shipped in a conductive ESD shipping case. The shipping case may be opened only in a clean environment and non-humid atmosphere.

Diode lasers are electrostatic sensitive devices. Thus their handling requires strict precautions against electrostatic charges. Every person and each tool that might get into contact with the diode laser must be continuously ESD protected. Therefore the devices should only be handled in ESD protected areas (EN 100 015 former CECC 000 15).

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The high power laser diodes have output optical fiber. Fiber damage shall be prevented from pulling and tight bending. Long term minimum bend radius of an optical bare fiber is normally about 300 times of the fiber cladding diameter.

Fiber core Diameter (μm)	Fiber cladding diameter (μm)	Long term minimum bend radius (mm)	Short term minimum bend radius (mm)
105	125	40	15
200	220	70	25
400	440	130	50

Table 1. Minimum bend radius of different optical bare fibers

Special attention must be paid not to scratch the bottom surface of diode lasers. Scratches will increase the thermal resistance of the mounted device and reduces heat dissipating capacity, which might result in reduced efficiency and thermal overload of the diode lasers.

Mounting

Appropriate cooling of the diode lasers is necessary. To achieve appropriate cooling the diode lasers shall be tightly screwed onto a flat mount surface through four mounting holes with appropriate screws. The torque force is about 0.4N m. The mount surface should be finely milled or lapped with a roughness as small as possible, clean and free of scratch.

Depending on the heat dissipated from the diode lasers the mount plate can be either conduction cooled or water cooled. The thermal interface between bottom plate of the diode lasers and mount cooling plate can be pyrolytic graphite or thin indium film. The dissipated heat of the diode lasers can be calculated with following formula:

dissipated heat = operating current x operating voltage – optical power

The cooling capacity of the mount cooling plate is recommended to be 50% more of the dissipated heat to keep the temperature of either the bottom plate of the diode lasers or integrated thermistor to typically 25°C. The maximum operating temperature of the diode lasers is 30°C for cooling plate and 35°C for integrated thermistor. For wavelength stabilized diode lasers the operating temperature range is limited by the power and optimal wavelength stabilization performance.

The temperature can be read and controlled by integrated thermistor.
$R_T=R_0*\exp(B*(1/T-1/T_0))$
R_0=10kΩ @25°C, T_0=25°C, B=3477±3%

Temperature°C	Resistance kΩ	Temperature °C	Resistance kΩ
15	14.99	26	9.62
16	14.38	27	9.25
17	13.79	28	8.90
18	13.24	29	8.57
19	12.71	30	8.25
20	12.20	31	7.94
21	11.72	32	7.65
22	11.26	33	7.37
23	10.82	34	7.11
24	10.40	35	6.85
25	10.00		

Table 2: Resistance of the integrated thermistor vs. temperature of the diode laser

Operating conditions

Before operating the diodes, diode lasers should be kept for enough time in the rooms where the diodes will be operated to achieve thermal equilibrium.

Diode lasers must be operated with a suitable power supply with current and voltage limit function in regulated current mode only, because even short current or voltage spikes and overshoot may destroy them. Precautions against spiking and overshoot during switching on and off the power supply must be assured.

Correct polarity of the power supply must be assured, even small reverse voltage can cause irreversible damage of the diode laser.

Before switching on the power supply it must be assured that the current is preset to zero. Then, switch on the power supply and increase the current slowly.

Please refer to the operating current and voltage in the test sheet of each diode laser. Ask supplier for maximum operating current of each diode laser model.

Diode lasers can be damaged by back reflection from downstream reflection surfaces and components. Check and make sure to keep the total back reflection as low as possible.