Application Note for Testing of VCSEL arrays
PCW-CW-CE or C-#### and PQCW-CE or C-####

Princeton Optronics High Power VCSEL arrays on copper carrier

1. Scope of the document

The purpose of this document is to establish the guidelines for safe and correct operation and handling of High Power VCSEL arrays developed at Princeton Optronics. This document gives general overview of the device, describes the main operation aspects, sets equipment requirements and handling precautions. Following the guidelines will avoid unwanted device stressing or damaging during the testing, operating and handling.

2. General overview

The Device is a semiconductor laser made from VCSEL array. It consists of VCSEL array chip, submount, carrier, wire bonds and electric leads. The two copper strips are for electric connection and two through holes for mounting with screws. The device is electro-static sensitive and requires ESD precautions during handling and testing. From Princeton Optronics, devices are shipped with electrical leads shorted with aluminum foil or special jumper, which should be removed before use. The top surface of the array chip is the light emitting surface Chemical or dust contamination on and physical contact with the light-emitting surface will cause damage to the device. device should be stored in the closed ESD-safe container and exposed to the air just for the period of operation.
To remove contaminations from the chip surface only very weak airflow can be used.
When the device is not in use, the terminals should be connected together (shorted) to avoid ESD-induced damage.

3. Thermal management and mounting

Efficient thermal management is critical to obtain good performance and reliability. The thermal resistance along the path of heat dissipation from VCSEL chip to the heat sink should be kept as low as possible. To achieve this goal device should be attached with screws directly to the heat sink or cold plate. The chosen heat sink or cold plate should have sufficient cooling capacity for the device. For better heat transfer from device to heat sink the mounting surfaces should be flat and smooth. To fill the gap between backside of the device (back side of the copper carrier) and the contact surface of the heat sink thermal interface material with high thermal conductivity should be used. A thermal interface material such as graphite sheet or metal-alloy foils, thermal epoxy adhesives or thermal greases can be used. Princeton Optronics recommends to use a graphite sheet and controlled torque on mounting screw to achieve the good repeatability and reliability.

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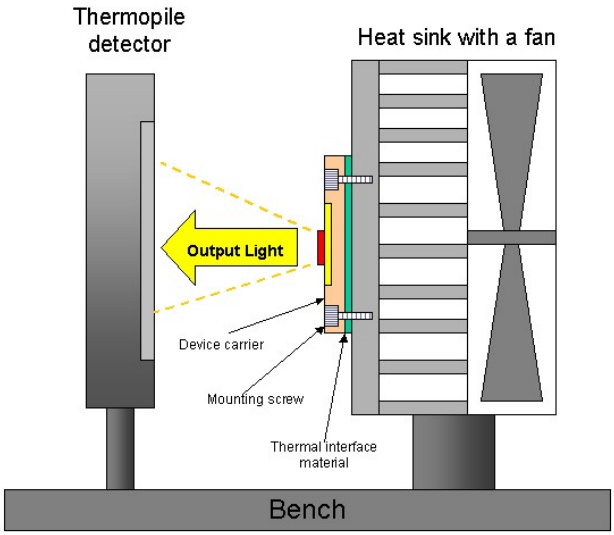

Figure 1. Figure represents the schematic of the suggested mounting and testing setup configurations. To reduce possible dust contamination and for eye safety reason during testing, the device recommended to mount in a vertical orientation, as illustrated (the normal to the chip surface should be horizontal).

Figure 2. Actual C-mount attached to a CPU heat sink.

4. Electrical connections

For the electrical connection the device has two copper strip leads, one for positive and one for negative contacts. Positive lead or anode should be connected to the positive output of the current source and negative lead or cathode to the negative output of the current source. Please refer to device specification to identify leads polarity. Reverse biasing will destroy the device or degrade its performance and reliability.

To make reliable electrical contacts between device and current source, leads can be soldered to output cable of the current supply or connected mechanically using appropriate socket or with bolt-screw clamping method. For soldering of the electrical leads, please keep the processing temperature below the maximum allowed value, which is specified in the data sheet. When mount the device and making the electric connection, cautions should be taken to limit the mechanical stress on electric leads such that the solder joint between leads and laser chip are not distorted or fractured.

5. Power supply

Constant current source ("CCS"; with an upper current limit set according to the device specification) designed for laser diode operation should be used. The voltage source is not recommended since the device has very low differential resistance and a small variation in operating voltage could cause a drastic change in current through the diode and damage the device. Some power supplies, especially those not designed for use with laser diodes, have voltage- current overshoot issues, usually during ON/OFF action. These overshoots will irreversibly damage the device. commercially available Lased Diode Drivers from Directed Energy, ILX and Newport have been used at Princeton Optronics.

6. Optical power measurements

For optical power measurements any optical power meter and detector or integrating sphere with power limit according to device specification could be used. The chosen detector should be suitable for the device wavelength. To collect all the light emitted from the device, the size of the detector or the opening of the integrating sphere should be chosen based on the chip size and the far-field laser beam divergence, which are specified in the data sheet. Princeton Optronics recommends using high-power thermopile detectors from Ophir and Coherent. These detectors are wavelength insensitive and have large sensor area.

7. Operating precautions and Safety

Extreme care must be exercised during the device operation. Only persons familiar with the appropriate safety precautions should operate a laser product. Directly viewing the laser beam or exposure to specular reflections must be avoided.

Serious injury may result if any part of the body is exposed to the beam. The eye is extremely sensitive to the infrared radiation and therefore, proper eye-wear must be worn at all times. Use of optical instruments with these products may increase eye hazard. Always wear eye protection when operating.