TECH NOTE

Minimum Temperature Range of the LDM-4405

PURPOSE
This technical note describes the minimum temperature for a given heat load when using the LDM-4405 TO-Can Laser Diode Mount.

BACKGROUND
The LDM-4405 is designed to provide temperature control and convenient mounting for 5.6mm and 9mm TO-Can laser diodes with up to 4 pins. Temperature control is provided by an integrated thermoelectric module (TEC) with power ratings of 3.9A and 3.7V. A calibrated 10kΩ thermistor imbedded in the nickel plated cold plate is used for temperature feedback to a thermoelectric temperature controller. The heat generated by the TEC and laser diode is removed by a finned heat sink on the LDM-4405 through natural convection. The LDM-4405 temperature range is specified as 10°C to 85°C for heat loads up to 500mW.

MEASUREMENT SETUP
Testing was performed in a typical laboratory environment and room temperature was measured at 20°C using a calibrated 10kΩ thermistor with an accuracy of ±0.2°C. A LDX-3210 precision current source was used to control a 48Ω resistor mounted on the cold plate of the LDM-4405 to act as the heat load. An LDT-5980 high power temperature controller was used to maintain temperature of the cold plate; temperature feedback was from the calibrated thermistor embedded in the LDM-4405 cold plate. The LDT-5980 was used for the high temperature stability and accuracy. The power applied to the resistive dummy load was varied and minimum stable temperature under full cooling effort at each power level was recorded.

RESULTS
The following graph shows minimum temperature versus heat load.

LDM-4405 Minimum Temperature vs. Power
20°C Ambient
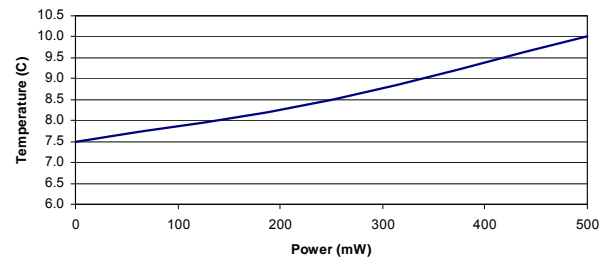
From the above graph lower temperature can be achieved at lower operating power. To determine the operating power of the laser you will need a few specifications such as operating current (I), operating voltage (V), and efficiency (η) of the laser diode. By using the following equation you can calculate the amount of heat that the LDM-4405 will need to dissipate and using the above graph can calculate the minimal temperature.

$$P_{Heat\ Sink} = (1-\eta)VI$$

Example: I = 200mA, V = 2.2V, η = 0.5
                $P_{Heat\ Sink}$ = 220mW

By using the graph you could control the temperature of the LDM-4405 to 8.5ºC.

If efficiency (η) of the laser diode is not given by the manufacturer it can be calculated by the following equation. Where P_{Output} is equal to the output of the laser diode.

$$\eta = \frac{(VI - P_{Output})}{VI}$$

CONCLUSION
The LDM-4405 can achieve a temperature range of 10°C to 85°C at the maximum rated power of 500mW. Lower heat loads will allow the LDM-4405 to achieve lower temperature rating.

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