TECH NOTE

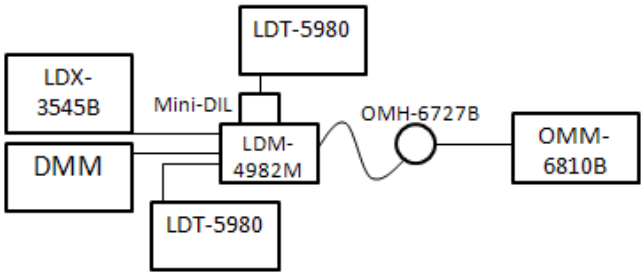
Temperature Stability and Thermal Resistance of the LDM-4982M

OVERVIEW

The LDM-4982M Laser Diode Mount is designed to accommodate 8-pin mini-DIL laser diodes. The mount comes standard with case temperature control, which can achieve temperatures of -5°C to 85°C with a maximum heat load of 1.5W. This technical note describes the temperature stability and thermal resistance of the LDM-4982M.

TEST SET UP

A standard LDM-4982M was mounted with a mini-DIL laser diode with an internal thermistor. The case temperature of the mount was controlled using an ILX Lightwave LDT-5980 Temperature Controller and the internal thermistor was monitored using a second LDT-5980. The laser diode was driven by an ILX Lightwave LDX-3545B Laser Diode Current Source. The voltage of the laser diode driver was monitored by an Agilent 34401A Multimeter. The optical output power was measured by an ILX Lightwave OMH-6727B InGaAs Power and Wavelength Measurement Head connected to an OMM-6810B Optical Power Meter.



TEMPERATURE STABILITY

To measure the temperature stability of the device, the case temperature was set to 45°C and the device current was set to 700mA.

The temperature of the device was measured every fifteen seconds for one hour. The procedure was repeated with the case temperature set to 25°C and 0°C. The figures below show the change in temperature over time.

The temperature of the device, being driven at 700mA, is several degrees higher than the set case temperature value due to thermal resistance of the mount and the device.

The increase in device temperature during the first few minutes of each test is the case temperature reacting to the laser current being set to 700mA.

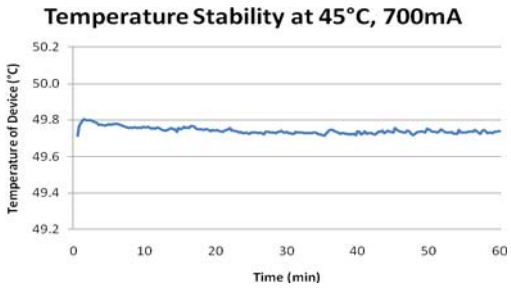


FIGURE 1: The one hour temperature stability of the device, being driven at 700mA, when the case temperature is set to 45°C.

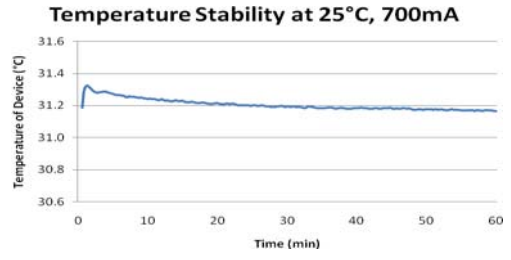


FIGURE 2: The one hour temperature stability of the device, being driven at 700mA, when the case temperature is set to 25°C.

ILX Lightwave®
A Newport Corporation Brand

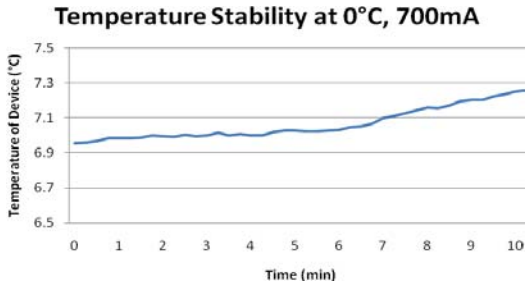


FIGURE 3: The ten minute temperature stability of the device, being driven at 700mA, when the case temperature is set to 0°C.

With a device being driven at 700mA the case temperature of the mount cannot maintain 0°C for longer than 6 minutes. After 6 minutes, the mount and the device enter thermal runaway.

THERMAL RESISTANCE

The thermal resistance between the device and the mount was calculated at case temperatures of 0°C, 10°C, 25°C and 45°C. The device temperature, input voltage, input current and output power was recorded every 5 seconds for 25 seconds.

$$W = (IV - P_o)$$

The waste heat in watts, W, is calculated by multiplying the input current in amps, I, by the input voltage in volts, V, and subtracting the power output in watts, P_O, from the laser. This equation does not account for effects of heat loss from radiation which is assumed to be negligible.

The thermal resistance, σ, was calculated using the waste heat.

$$\sigma = \frac{|T_C - T_D|}{W}$$

The absolute value of the case temperature, T_C, less the device temperature, T_D, divided by the waste heat gives the thermal resistance.

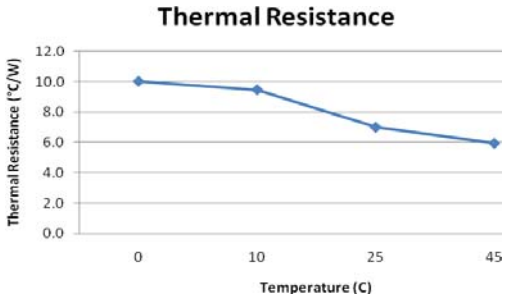


FIGURE 4: The thermal resistance as a function of the temperature.

The thermal resistance between the mount and the device decreases as the temperature increases due to radiation. As the case temperature is increased, the difference in temperature between the mount and the device decreases and therefore the amount of heat radiating from the device also decreases.

CONCLUSION

Typical temperature stability of a laser diode mounted in a LDM-4982M is better than 0.1°C for for one hour.

Thermal resistance between the mount thermistor and internal package thermistor was calculated to be between 10°C/W and 6°C/W depending upon temperature. Using devices with an internal thermistor will allow the user to monitor the temperature of the device to prevent the laser from being operated over the temperature limit.