

2, 3, & 4-Watt LED Modules in High Ambient Temperature Environments

Headquartered in Hawai'i, in the middle of the Pacific Ocean, the Beachside Lighting family knows about extreme environments. Highly corrosive salt air, ocean spray, and lots of sunshine are facts of life on our island. So when we design our products, durability and longevity are given high priority to ensure years of trouble-free operation in any environment.

To ensure we achieve those goals, we build relationships with suppliers who share our same high standards and who utilize the best quality materials available. The LED modules custom-built for us are available in 2, 3, and 4 Watts (LPH-1, LPH-3 and LPH-7, respectively). These modules are used throughout our Ocean Modern family of fixtures, including the E1, E1-S, E2, E3-series, E4, E8 and its variants, MB1, and Z1.

Junction Temperature and Life Expectancy

The hotspot of an LED is the junction between its semiconductors, represented by Junction Temperature (T_j), and calculated from the Ambient and Solder joint temperatures. The Cree XPG2 LEDs have a max T_j of 150°C. But with today's technology and more thermally efficient components, heat is not as critical a factor to the latest Cree LEDs as it was several years ago. The latest generation of Cree's XPG2 LED has a thermal resistance coefficient that is significantly improved from the older generation XPE/XPG LEDs.

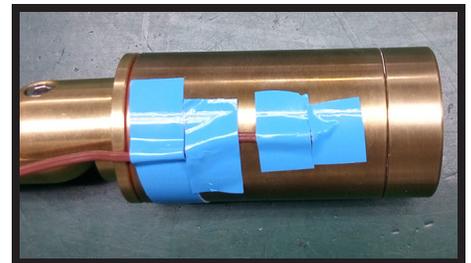
After the LED, the weakest link of the other components is the electrolytic capacitor. The Panasonic capacitors—considered the best in the industry—that are used in Beachside's modules have a maximum temperature rating of 105°C, far above normal ambient conditions. Additionally, the LPH module housings are solid 6063-grade aluminum and designed to provide ample thermal transfer outward to the fixture, thereby allowing the process of conduction and convection to occur for the release of heat. They also feature a cool MOSFET and materials such as graphite to further enhance thermal management of the driver circuit and heat transfer from within the LPH components outward.

The following page shows environmental test results for a complete E8 directional fixture equipped with a 4-Watt LPH-7 module with a driving current of 805mA. At 40°C ambient, T_j is below 60°C. At this level, Cree's LM-80 test reports project LED lifetime to be over 60,500 hours (L70). Since Cree bases that life expectancy on a 1000mA current, Beachside's modules will perform even better in hot conditions.

The E8 design forms the basis of many of our Ocean Modern fixtures and the results are representative of the performance expected of the entire line.



E8 with LPH-7 module – tested



Fixture surface temperature measurement



LPH housing temperature measurement



LED board temperature measurement

E8-4W Thermal Test Report

Model: E8-4W with LPH-7T21-BP-805 Light Plugz

Power: 3.8W

Chamber Ambient Temperature	40 °C	50 °C	60 °C	Notes
E8-4W Fixture Measured Surface Temperature	41.7 °C	50.9 °C	60.6 °C	Measured on brass cylinder exterior
LPH-7x21-BP-805 Housing Measured Surface Temperature	43.4 °C	53.5 °C	62.6 °C	Measured on aluminum housing exterior
LED Board Measured Temperature	47.7 °C	57.7 °C	67.8 °C	Test point is approx. 5mm from the LED on MCPCB
Driver Board Measured Temperature	51.4 °C	60.6 °C	71.0 °C	Test point is approx. 5mm from hottest component on driver PCB
Estimated LED Board Solder Joint Temperature (T_s)	48.7 °C	58.7 °C	68.8 °C	Based on LED Board Temperature
Estimated LED Junction Temperature (T_j)	58.4 °C	68.4 °C	78.5 °C	Based on Cree XPG-2 Thermal Resistance formula
Projected LED Life Expectancy (Hours, L70)	>60,500	>54,400	>54,400	Based on 1000mA current. Actual results should exceed hours listed.
Projected Capacitor Life Expectancy (Hours)	64,000 (7+ yrs at 24hr operation, 20+ yrs at 8hr/day)	45,000 (4+ yrs at 24hr operation, 15+ yrs at 8hr/day)	24,000 (3.5 yrs at 24 hr operation, 12 yrs at 8hr/day)	Based on Panasonic Capacitor data

Conclusions:

The E8-4W estimated lifetime is the lowest value between LED life expectancy and capacitor life expectancy.

At 40 °C ambient, the E8-4W fixture estimated lifetime is **60,500+ Hours**.

At 50 °C ambient, the E8-4W fixture estimated lifetime is **45,000+ Hours**.

At 60 °C ambient, the E8-4W fixture estimated lifetime is **24,000+ Hours**.

Notes:

1. The test was carried out in a controlled thermal chamber environment.
2. Values were recorded after reaching the ambient temperature for 2 hours.
3. Expected lifetime hours do not account for external influences such as vandalism, voltage/current spikes, exposure to unusual environmental conditions, etc.