

# Projected Long Term HTOL Light Output Degradation of Precision Optical Performance AlInGaP LEDs

## Application Brief I-018

### Projected Long Term Degradation

High temperature operating life, HTOL, testing is used to project long term light output degradation. HTOL testing is performed in an ambient of +55°C using an uninterrupted dc current to drive the LED devices under test.

The projected long term average light output degradation characteristic for Precision Optical Performance AlInGaP LED lamps is shown in Figure 1. The lamps under test exhibit a positive degradation characteristic out to the 1000 hour point. From the 1000 hour time point, the light output degrades gradually as a logarithmic function of time. Based on 16,000 hour HTOL data at -13 1/2%, the average long term light output degradation at the 100,000 hour point is projected to be about -27%.

This projection, based on the following assumptions, predicts the combined average light output performance for all AlInGaP colors, spread over many LED wafer lots, with the 20 mA dc electrical drive current and the +55°C (+131°F) ambient temperature remaining constant out to the 100,000 hour point.

- The lamps under test were assembled with AlInGaP LED chips made with 1996 semiconductor processing.
- The projection is an estimate only, extrapolated from HTOL test data.
- The projection assumes light output degradation is a logarithmic function of operating on-time.

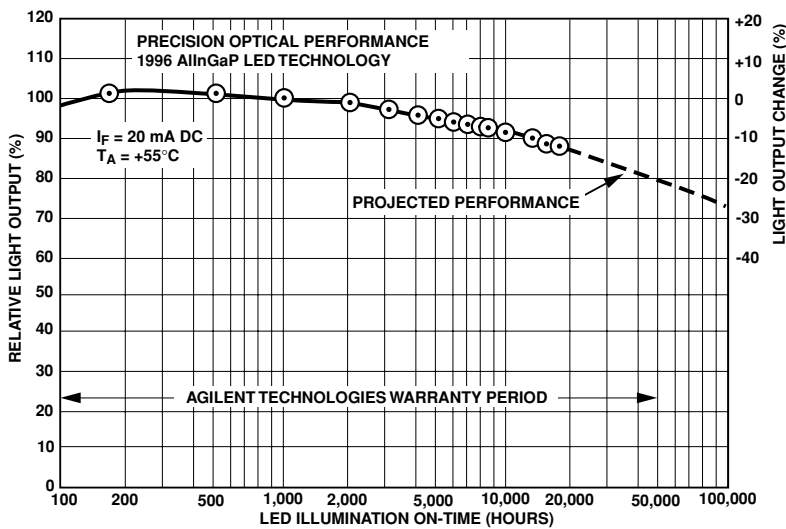


Figure 1. Projected Average Light Output Degradation Performance for Precision Optical Performance AlInGaP LED Lamps, based on 16,000 hour HTOL data

For projected long term performance under various dc and pulsed drive current conditions and a discussion of the Avago Technologies LED warranty, please refer to Avago Technologies Application Brief I-024.

### **Data Correlation**

As with any extrapolation from HTOL data, there is no assurance that this long term projection is accurate. Also, there is limited correlation between HTOL data and actual long term performance in LED traffic signals and LED Variable Message Signs (VMS). However, using this information, transportation engineers can gain an appreciation for the dependability and projected long term average light output performance of Precision Optical Performance AllnGaP LED lamps used in LED traffic signals and LED VMS.

### **MTBF for Precision Optical Performance AllnGaP LED Lamps**

The long term dependability of Precision Optical Performance AllnGaP LED lamps is an important consideration for those who specify LED traffic signals and LED variable message signs (VMS). Precision Optical Performance LED Lamps are T-1 3/4 plastic package devices that exhibit a nominal Mean Time Between (possible catastrophic) Failure, MTBF, greater than 1.2 million hours at the operating temperature of +74°C (+165°F). At operating temperatures below 0°C (32°F), MTBF is in excess of 10 million hours. Therefore, MTBF need not be a concern.

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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