HLMP-PB00-N0000 / HLMP-PM00-N0000 HLMP-QB00-S0000 / HLMP-QM00-S0000

High Power InGaN Subminiature Lamps

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Avago Technologies in accordance with the latest revision of MIL-STD-883.

Avago Technologies tests parts at the absolute maximum rated conditions recommended for the device. The actual performance you obtain from Avago Technologies parts depends on the electrical and environmental characteristics of your application but will probably be better than the performance outlined in Table 1.

Failure Rate Prediction

The failure rate of semiconductor devices is determined by the junction temperature of the device. The relationship between ambient temperature and actual junction temperature is given by the following:

T_J (°C) = T_A (°C) + θ_{JA} P_{AVG}

where

T_A = ambient temperature in °C

θ_{JA} = thermal resistance of junction-to-ambient in °C/watt

P_{AVG} = average power dissipated in watts

The estimated MTBF and failure rate at temperatures lower than the actual stress temperature can be determined by using an Arrhenius model for temperature acceleration. Results of such calculations are shown in the table on the following page using an activation energy of 0.43 eV (reference MIL-HDBK-217).

Table 1. Life Tests Demonstrated Performance

					Point Typical Performance	
Colors	**Stress Test Conditions**	**Total Device Hrs.**	**Units Tested**	**Units Failed**	**MTBF**	**Failure Rate (%/1K Hours)**
Dome (Blue)	T_A = 55°C I_F = 30 mA	56,000	56	0	56,000	≤1.79
Dome (Green)	T_A = 55°C I_F = 30 mA	56,000	56	0	56,000	≤1.79

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Table 2. Reliability Predictions (I_F = 30 mA) for InGaN devices
Demonstrated Performance

		Point Typical Performance in Time [1] (60% Confidence)		Performance in Time [2] (90% Confidence)	
Ambient Temperature (°C)	Junction Temperature (°C)	MTBF [1]	Failure Rate (%/1K Hours)	MTBF [2]	Failure Rate (%/1K Hours)
85	109	18,000	5.436	8000	12.517
75	99	26.000	3.826	11,000	8.810
65	89	38,000	2.642	16,000	6.082
55	79	56,000	1.786	24,000	4.112
45	69	85,000	1.180	37,000	2.716
35	59	132,000	0.760	57,000	1.750
25	49	210,000	0.477	91,000	1.098

Notes:
1. The point typical MTBF (which represents 60% confidence level) is the total device hours divided by the number of failures. In the case of zero failures, one failure is assumed for this calculation.
2. The 90% Confidence MTBF represents the minimum level of reliability performance which is expected from 90% of all samples. This confidence interval is based on the statistics of the distribution of failures. The assumed distribution of failures is exponential. This particular distribution is commonly used in describing useful life failures. Refer to MIL-STD-690B for details on this methodology.
3. A failure is any LED which does not emit light or maximum % Iv degradation is more than 50%.

Example of Failure Rate Calculation

Assume a device operating 8 hours/day, 5 days/week. The utilization factor, given 168 hours/week is:

(8 hours/day) x (5 days/week) / (168 hours/week) = 0.25

The point failure rate per year (8760 hours) at 25°C ambient temperature is:

(0.086% / 1K hours) x (0.25) x (8760 hours/year) = 0.188% per year

Similarly, 90% confidence level failure rate per year at 25°C:

(0.197% / 1K hours) x (0.25) x (8760 hours/year) = 0.431% per year

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Table 3. Environmental Tests

Test Name	Reference	Test Conditions		Units Tested	Units Failed
Temperature Cycle	JESD22-A104	-55°C to 100°C, 15 min. dwell 5 min. transfer			
			5 cycles	625	0
			20 cycles	625	0
			50 cycles	625	0
			100 cycles	625	0
Humidity Life	JESD22-A101	85°C / 85%RH, 10mA, 1000hrs		56	0
Humidity Storage Life	JESD22-A101	85°C / 85%RH, 1000hrs		56	0
Low Temperature Life	JESD22-A108	-40°C, 30mA, 1000hrs		56	0
Low Temperature Storage LIfe	JESD22-A103	-40°C, 1000hrs		56	0
Room Termperature Life	JESD22-A108	25°C 30mA, 1000hrs		56	0

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