HLMP-HM64, HLMP-HM65, HLMP-HB64, HLMP-HB65, HLMP-CB13, HLMP-CB14, HLMP-CM13, HLMP-CM14, HLMP-CB22, HLMP-CB25, HLMP-CM22, HLMP-CM25, HLMP-CB34, HLMP-CB35, HLMP-CM34, HLMP-CM35

5mm Oval & Round Through Hole Lamp

Green & Blue

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 and JEDEC.

Avago tests parts at the absolute maximum rated conditions recommended for the device. The actual performance you obtain from Avago 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 junction temperature of the device determines the failure rate of semiconductor devices. 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 Watt

The estimated MTTF 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 below using activation energy of 0.43eV (reference MIL-HDBK-217).

Table 1. Life Tests

Demonstrated Performance

					Point Typical Performance	
Colors	**Stress Test Conditions**	**Total Device Hours**	**Units Tested**	**Total Failed**	**MTTF (60% Confidence)**	**Failure Rate (% /1K Hours)**
Blue & Green	T_A = 55°C, I_F = 23 mA	224,000	224	0	242,200	0.41

Table 2. Reliability Prediction

		Point Typical Performance in Time [1 - 5] (60% Confidence)		Performance in Time [1 - 5] (90% Confidence)	
Ambient Temperature (°C)	Junction Temperature (°C)	MTTF	Failure Rate (%/1K Hours)	MTTF	Failure Rate (%/1K Hours)
85	107	199400	0.5	79400	1.26
80	106	205900	0.49	81900	1.22
75	105	212600	0.47	84600	1.18
70	104	219600	0.46	87400	1.14
65	103	226800	0.44	90300	1.11
60	103	234400	0.43	93300	1.07
55	102	242200	0.41	96400	1.04
50	101	250300	0.40	99600	1.00
45	100	258700	0.39	103000	0.97
40	99	267500	0.37	106500	0.94
35	95	302400	0.33	120400	0.83
30	90	364400	0.27	145000	0.69
25	85	441200	0.23	175600	0.57
20	80	537300	0.19	213900	0.47
15	75	657900	0.15	261900	0.38
10	70	810400	0.12	322600	0.31

Notes:
1. The 60% or 90% confidence MTTF represents the minimum level of reliability performance which is expected from 60% or 90% of all samples. The confidence level is established based on the chi-square distribution.
2. Failure rate (FIT) is 1/MTTF x 10^5, assuming the failures are exponentially distributed
3. A failure is any LED that is open, shorted or fails to emit light.
4. Calculated from data generated at 55°C biased at 23mA.
5. Junction temperature is calculated based on θ_{JA} = 630°C/W

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) = 0.24

The point failure rate per year (8760 hours) at 25°C ambient temperature is (60% confidence level) :

(0.301%/1K hours) x 0.24 X (8760 hours/year) = 0.63% per year

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

(0.758%/1K hours) X 0.24 X (8760 hours/year) = 1.59% per year

Table 3. Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	JESDA104	-40/100°C 30 min dwell, 5 min transfer 100 cycles	5560	0
Resistance to Soldering Heat	JESD 22-B106	260°C for 10 seconds, 2x	100	0
Pulse Test	Avago Req.	T_A = 25°C, Duty factor = 30%, 100 mA Frequency = 1kHz, 1000 hours	224	0
High Temperature Storage Life	JESD 22-A103	100°C for 1000 hours	224	0
Low Temperature Storage Life	JESD 22-A108	-40°C for 1000 hours	56	0
Low Temperature Operating Life	JESD 22-A108	T_A = -40°C I_F = 30 mA for 1000 hours	224	0
Temperature Humidity Operating Life	JESD 22-A101	T_A = 85°C, 85%RH 10mA for 1000 hours	56	0

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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