HLMP-CW15/16/23/30/31/70, HLMP-KW50 and HLMP-FW00

White LEDs

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 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 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:

$T_J(°C) = T_A(°C) + \theta_{JA} P_{AVG}$

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 0.43eV(reference MIL-HDBK-217.

Table 1. Life Tests

Demonstrated Performance

					Point Typical Performance	
Colors	**Stress Test Conditions**	**Total Device Hours**	**Units Tested**	**Total Failed**	**MTBF**	**Failure Rate (% /1 K Hours)**
InGaN White	TA = 55°C I_F = 30 mA	84,000	84	0	84,000	1.19
InGaN White	TA = 25=°C I_F= 30 mA	84,000	84	0	84,000	1.19
InGaN White	TA = -40°C I_F = 30 mA	84,000	84	0	84,000	1.19

Table 2. (I_F = 30 mA[4])

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance [1] in Time		Performance in Time [2] (90% Confidence)	
		MTBF [1]	Failure Rate (%/1K Hours)	MTBF[2]	Failure Rate (%/1K Hours)
95	175	28,000	3.544	12,000	8.160
85	165	36,000	2.749	16,000	6.329
75	155	47,000	2.107	21,000	4.851
65	145	63,000	1.595	27,000	3.672
55	135	84,000	1.190	36,000	2.741
45	125	114,000	0.876	50,000	2.017
35	115	158,000	0.634	68,000	1.460
25	105	222,000	0.451	96,000	1.039

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 failure, one failure is assumed for this calculation.
2. The 90% Confidence MTBF represents the minimum level of reliability performance that is expected from 90% of all samples. This confidence interval is based on the statistics of the 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 that is open, shorted, or failed to emit light
4. Calculated from data generated at 55°C biased at 30mA.

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:

(0.631% / 1K hours) x 0.25 x (8760 hours/year) = 1.382% per year

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

(2.455% / 1K hours) x 0.25 x (8760 hours/year) = 5.376% per year

Table 3. Environmental Tests

Test Name	MIL-STD-883 Ref.	JIS C 7021 Ref.	Test Conditions	Units Tested	Units Failed
Temperature Cycle	1010	Method A-4	-40°C to +100°C, 15 min dwell, 5 min transfer, 100 cycles	1500	0
Resistance to Soldering Heat	2003	Method A-1 Condition A	260°C for 10 sec	30	0
Solderability	2003	Method A-2	230°C for 5 sec, 1 to 1.5mm from body, 95% solder coverage of immersed area	30	0
Pulse Test	Agilent Req.	Agilent Req.	55°C, 100mA Peak, Freq 1kHz, DF 10%, 1,000 hours	84	0
High Temp Life	Agilent Req.	Agilent Req.	85°C, If=10mA, 1,000 hours	84	0
Humidity Life	Agilent Req.	Agilent Req.	85°C/85%RH, If=10mA, 1,000 hours	84	0
Humidity Reverse Bias	Agilent Req.	Agilent Req.	85°C/85%RH, 5Vbr, 1,000 hours	48	0
High Temperature Humidity Storage	1005	Method B-10	85°C/85%RH for 1,000 hours	84	0
High Temperature Storage	1005	Method B-10	100°C for 1,000 hours	84	0
Low Temperature Storage	1005	Method B-12	-40°C for 1,000 hours	84	0

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