ASMC-PRB9-TV005
Envisium Power PLCC-4 Surface Mount LED

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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.

Table 1. Life Tests
Demonstrated Performance

Part Number	Stress Test Conditions	Total Device Hrs.	Units Tested	Units Failed[3]	Point Typical Performance	
					MTBF	Failure Rate (%/1K Hours)
ASMC-PRB9-TV005	T_A = 25°C, If = 70 mA	168000	168	0	168000	<0.55
ASMC-PHB9-TW005	T_A = 55°C, If = 70 mA	168000	168	0	168000	<0.55
ASMC-PAB9-TV005	T_A = 85°C, If = 50 mA	168000	168	0	168000	<0.55
	T_A = -40°C, If = 70 mA	84000	84	0	84000	<1.09
	T_A = 100°C, If = 35 mA	168000	168	0	168000	<0.55
	T_A = 85°C/85%RH, If = 50 mA	168000	168	0	168000	<0.55

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 0.43 eV (reference MIL-HDBK- 217).

Table 2. Reliability Prediction

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance in Time[1] (60% Confidence)		Performance in Time[2] (90% Confidence)	
		MTBF [1]	Failure Rate (%/1K Hours)	MTBF[2]	Failure Rate (%/1K Hours)
100	125	126700	0.79	50400	1.98
95	124	129900	0.77	51700	1.93
90	124	133300	0.75	53000	1.89
85	123	136700	0.73	54400	1.84
80	122	140200	0.71	55800	1.79
75	121	143900	0.69	57300	1.75
70	120	147600	0.68	58800	1.70
65	120	151500	0.66	60300	1.66
60	119	155500	0.64	61900	1.62
55	114	183300	0.55	73000	1.37
50	109	217000	0.46	86400	1.16
45	104	258100	0.39	102800	0.97
40	99	308500	0.32	122800	0.81
35	94	370400	0.27	147400	0.68
30	89	447000	0.22	177900	0.56
25	84	542300	0.18	215900	0.46

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 which 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 failures is any LED which is open, shorted, or failed to emit light.
4. Calculated from data generated at 55°C biased at 70 mA.

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 55°C ambient temperature is:

(0.55 %/1K hours) X 0.25 X (8760 hours/year) = 1.205% per year

Similarly, 90% confidence level failure rate per year at 55°C:

(1.37/1K hours) X 0.25 X (8760 hours/year) = 3.000% per year.

Table 3. Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	Avago Required	-55/100°C 15 min dwell 5 min transfer, 100 cycles	2224	0
Resistance to Solder Heat	MIL-Std-883 Ref 2003	260°C for 10 seconds	70	0
Solderability	MIL-Std-883 Ref 2003	240°C for 5 seconds, > 90% solder coverage to lead	40	0
Pulse Test	Avago Required	T_A = 25°C, Duty Factor = 10%, 200 mA Freq = 1 kHz, 1000 hours	196	0
Temperature Shock	Avago Required	-55/100°C 30 min dwell. <0 sec transfer, 100 cycles	500	0
High Temperature Storage	MIL-Std-883 Ref 1005	100°C for 1000 hours	196	0
High Humidity, High Temperature Reverse Bias		85°C/85%RH, 5VRB	64	0
Moisture Sensitivity Test	EIA/JESD 22-A112: Level 2a		28	0

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