ASMT-MW00

1W Cool White LED

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/JEDEC standards.

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 board temperature and actual junction temperature is given by the following:

$T_J(°C) = T_B(°C) + \theta_{Jb}P_{AVG}$

Where

T_B = board temperature in °C

θ_{Jb} = thermal resistance of junction-to-board 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	
Test Name	**Stress Test Conditions**	**Total Device Hours**	**Units Tested**	**Total Failed**	**MTTF (60% Confidence)**	**Failure Rate (% /1 K Hours)**
High Temperature Operating Life	Tb= 93°C, 350mA	80000	80	0	88200	1.13

Table 2. Reliability Predictions (Cool White)

Board Temperature (°C)	Junction Temperature (°C)	Point Typical Performance [1] in Time (60% Confidence)		Point Typical Performance[2] in Time (90% Confidence)	
		MTTF [1]	Failure Rate (%/1K Hours)	MTTF [2]	Failure Rate (%/1K Hours)
95	105	88200	1.13	35100	2.85
90	103	97000	1.03	38600	2.59
85	98	116000	0.86	46200	2.16
80	93	139500	0.72	55500	1.80
75	88	168500	0.59	67100	1.49
70	83	204700	0.49	81500	1.23
65	78	250100	0.40	99500	1.01
60	73	307300	0.33	122300	0.82
55	68	379800	0.26	151200	0.66
50	63	472500	0.21	188100	0.53
45	58	591600	0.17	235500	0.42
40	53	746000	0.13	296900	0.34
35	48	947400	0.11	377100	0.27
30	43	1212300	0.08	482600	0.21
25	38	1563700	0.06	622400	0.16
20	33	2033800	0.05	809500	0.12

Notes:
1. The 60% or 90% confidence MTBF 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 (%/1K hours) is 1/MTBF x 10^5, assuming the failures are exponentially distributed. MTBF is calculated based on the 93°C, 350mA data.
3. Failure criteria: open, short, or dim.
4. Junction temperature is calculated based on θ_{Jb} = 15°C/W, typical forward voltage= 3.6V

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 board temperature(60% confidence level) is:

(0.26% / 1K hours) x (0.25) x (8760 hours/year) = 0.57% per year

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

(0.66% / 1K hours) x (0.25) x (8760 hours/year) = 1.44% per year

Table 2. Environmental Tests

Test Name	MIL-STD/JEDEC Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	Avago Requirement	-40°C/120°C, 30 min dwell, 5 min transfer, 200 cycles	1320	0
Low Temperature Operating Life	Avago Requirement	Tb=-40°C, If=350mA, 1000hrs	40	0
High Temperature Operating Life	Avago Requirement	Tb=95°C, If= 286mA, 1000hrs	40	0
Temperature Humidity Operating Life	Avago Requirement	Tb= 85°C, RH = 85%RH, If= 350mA, 1000hrs	40	0
Temperature Humidity Storage Life	JESDA101	Tb= 85°C, RH = 85%RH, 1000hrs	100	0
High Temperature Storage Life	JESDA103	Tb = 120°C, 1000hrs	40	0
Low Temperature Storage Life	JESDA108	Tb = -40°C, 1000hrs	80	0
UV Weathering test	Avago Req	UVB at 313nm, UV temperature: 60°C, 4hrs Condensation temperature: 50°C, 4hrs	40	0

Table 3. Mechanical Tests

Test Name	MIL-STD/JEDEC Reference	Test Conditions	Units Tested	Units Failed
Resistance to Solder heat	JESDB106	260+/- 5°C, 6+/-1 second, immersion depth 1.5 mm from case	50	0
Mechanical shock	JESDB104	5 shocks each X1, X2, Y1, Y2, Z1, Z2, 1500G, 0.5msec pulse	30	0
Vibration	JESDB103	4 cycles, 4 mins each X, Y and Z at 0.06inch @ 20Hz-100Hz, 50g @ 100Hz-2000Hz	30	0

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