ASMT-QWBB/QYBB

Super 0.5W Cool/Warm White Power PLCC-4
Surface Mount LED Indicator

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)**
Cool & Warm White	T_A = 55°C, I_F = 150 mA	84,000	28	0	91,700	1.09

Table 2. Reliability Prediction

Cool and Warm White (I_F = 150mA)

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance in Time [1 - 5] (60% Confidence)		Performance in Time [1 - 5] (90% Confidence)	
		MTTF	Failure Rate (%/1K Hours)	MTTF	Failure Rate (%/1K Hours)
110	122	68700	1.46	27300	3.66
105	121	69500	1.44	27700	3.61
100	121	70400	1.42	28000	3.57
95	120	71200	1.40	28400	3.52
90	120	72100	1.39	28700	3.48
85	120	73000	1.37	29100	3.44
80	119	73900	1.35	29400	3.40
75	119	74800	1.34	29800	3.36
70	119	75800	1.32	30200	3.31
65	118	76700	1.30	30500	3.28
60	118	77700	1.29	30900	3.24
55	113	91700	1.09	36500	2.74
50	108	108600	0.92	43200	2.31
45	103	129300	0.77	51500	1.94
40	98	154700	0.65	61600	1.62
35	93	185900	0.54	74000	1.35

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 150mA.
5. Junction temperature is calculated based on θ_{JA} = 110°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 35°C ambient temperature is (60% confidence level) :

(0.54% / 1K hours) x 0.24 X (8760 hours/year) = 1.13 % per year

Similarly, 90% confidence level failure rate per year at 35°C:

(1.35% / 1K hours) X 0.24 X (8760 hours/year) = 2.83 % per year

Table 3. Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	Avago Req.	-40/110°C 15 min dwell, 5 min transfer, 100 cycles	8694	0
Pulse Test	Avago Req.	T_A = 25°C, Duty factor = 10%, 200 mA, Frequency = 1kHz, 1000 hours	28	0
Temperature Humidity Cycle	MIL-STD-883 Ref. 1004	-10°C to 65°C, 80-98% RH, 10hrs dwell, 2 hrs transfer, 50 cycles	28	0
High Temperature Storage	JESD 22-A103	110°C for 1000 hours	28	0
Low Temperature Operating Life	JESD 22-A108	T_A = -40°C, I_F = 150 mA for 1000 hours	28	0
Temperature Humidity Reverse Bias	JESD 22-A101	T_A = 85°C, 85%RH, V_F = 4V for 1000 hours	28	0
Temperature Reverse Bias	Avago Req.	T_A = 110°C, V_F = 4V for 1000 hours	28	0
Low Temperature Storage Life	JESD22-A119	T_A = -40°C for 1000 hours	28	0

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