ASMT-Ax00

Aveon 1W Power LED Light Source

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Avago Technologies in accordance to the latest revision of 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.

Definition of Terms

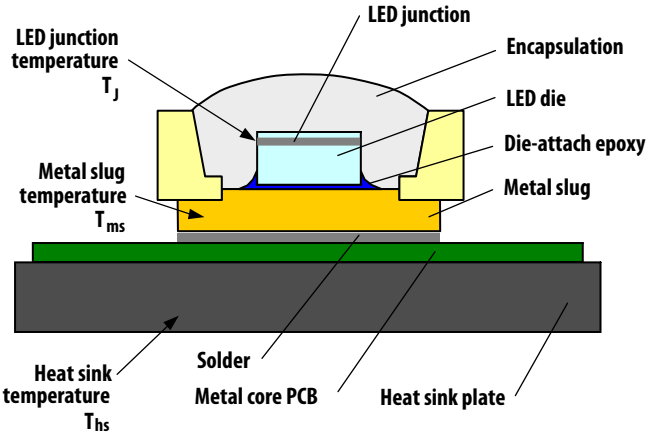

Table 1. Life Tests
Demonstrated Performance

InGaN (T_J = 135°C)

					Point Typical Performance	
Test Name	**Stress Test Conditions**	**Total Device Hrs**	**Units Tested**	**Units Failed[3]**	**MTBF[1]**	**Failure Rate (%/1K Hours)**
High Temperature Operating Life	T_{hs} = 118°C, 350mA	200,000	200	0	256,900	≤0.39

AlInGaP (T_J = 125°C)

					Point Typical Performance	
Test Name	**Stress Test Conditions**	**Total Device Hrs**	**Units Tested**	**Units Failed[3]**	**MTBF[1]**	**Failure Rate (%/1K Hours)**
High Temperature Operating Life	T_{hs} = 112°C, 350mA	160,000	160	0	193,400	≤0.52

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:

$T_J(°C) = T_{hs}(°C) + R\theta_{J\text{-}hs}P_{AVG}$

where

T_{hs} = heat sink temperature in °C

$R\theta_{J\text{-}hs}$ = thermal resistance of junction-to-heat sink in °C/Watt

P_{AVG} = average power dissipated in Watt

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 below using activation energy of 0.43eV.

Table 2. Reliability Predictions InGaN

	Point Typical Performance in Time [1] (60% Confidence)		Performance in Time [2] (90% Confidence)	
Heat Sink Temperature, T_{hs} (°C)	MTBF [1]	Failure Rate (%/1K Hours)	MTBF [2]	Failure Rate (%/1K Hours)
125	259900	0.38	103400	0.97
120	256900	0.39	102300	0.98
115	254100	0.39	101100	0.99
110	276900	0.36	110200	0.91
105	322800	0.31	128500	0.78
100	377900	0.26	150400	0.66
95	444100	0.23	176800	0.57
90	524100	0.19	208600	0.48
85	621300	0.16	247300	0.40
80	739700	0.14	294400	0.34
75	885000	0.11	352300	0.28
70	1063900	0.09	423500	0.24
65	1285600	0.08	511700	0.20
60	1561800	0.06	621700	0.16
55	1907900	0.05	759400	0.13
50	2344300	0.04	933100	0.11

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.
3. Failure criteria: open, short, or dim.
4. Junction temperature is calculated based on $R\theta_{J\text{-}hs}$ = 15°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) = 0.25

The point failure rate per year (8760 hours) at 55°C ambient temperature is:

(0.05%/1K hours) x (0.25) x (8760 hours/year) = 0.11% per year

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

(0.13%/1K hours) x (0.25) x (8760 hours/year) = 0.29% per year

Table 3. Reliability Predictions AlInGaP

	Point Typical Performance in Time [1] (60% Confidence)		Performance in Time [2] (90% Confidence)	
Heat Sink Temperature, T_{hs} (°C)	MTBF [1]	Failure Rate (%/1K Hours)	MTBF [2]	Failure Rate (%/1K Hours)
115	193400	0.52	77000	1.30
110	192000	0.52	76400	1.31
105	217700	0.46	86700	1.15
100	256100	0.39	102000	0.98
95	302600	0.33	120500	0.83
90	359100	0.28	143000	0.70
85	428100	0.23	170400	0.59
80	512900	0.19	204100	0.49
75	617400	0.16	245700	0.41
70	747000	0.13	297400	0.34
65	908800	0.11	361700	0.28
60	1111800	0.09	442600	0.23
55	1368200	0.07	544600	0.18
50	1694000	0.06	674300	0.15
45	2110900	0.05	840200	0.12
40	2648000	0.04	1054000	0.09

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.
3. Failure criteria: open, short, or dim.
4. Junction temperature is calculated based on $R\theta_{J\text{-}hs}$ = 15°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) = 0.25

The point failure rate per year (8760 hours) at 55°C ambient temperature is:

(0.07%/1K hours) x (0.25) x (8760 hours/year) = 0.16% per year

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

(0.18%/1K hours) x (0.25) x (8760 hours/year) = 0.40% per year

Table 4. Environmental Tests

Test Name	JEDEC Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	JESD22-A104	-40°C/120°C, 30 min dwell, 5 min transfer, 100 cycles	920	0
Room Temperature Operating Life	JESD22-A108	T_{hs} = 25°C, If= 350mA, 1000hrs	160	0
Low Temperature Operating Life	JESD22-A108	T_{hs} =-40°C, If=350mA, 1000hrs	160	0
High Temperature Humidity Operating Life	JESD22-A101	T_{hs} = 85°C, RH = 85%RH, If= 350mA, 1000hrs	240	0
High Temperature Humidity Storage Life	JESD22-A101	T_{hs} = 85°C, RH = 85%RH, 1000hrs	260	0
High Temperature Storage Life	JESD22-A103	T_{hs} = 125°C, 1000hrs	80	0
Low Temperature Storage Life	JESD22-A119	T_{hs} = -40°C, 1000hrs	80	0

Table 5. Mechanical Tests

Test Name	JEDEC Reference	Test Conditions	Units Tested	Units Failed
Resistance to Solder heat	JESD22-B106	260+/- 5°C, 10+/-1 second, 2x	40	0
Solderability	JESD22-B102	16 hours steam age, solder dip at 245°C, 5sec	40	0
Mechanical shock	JESD22-B104	5 shocks each X1, X2, Y1, Y2, Z1, Z2, 1500G, 0.5msec pulse	40	0
Vibration	JESD22-B103	10-2000-10Hz, log or linear sweep rate, 2G about 1min, 1.5mm, 3x/axis	40	0
UV	Avago Requirement	UVB at 313nm, UV cycle at 60°C for 4hrs, condensation cycle at 50°C for 4hrs	40	0

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

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