ASMT-MT00

Moonstone™ Tri-Color Power LED Light Source

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.

Definition of Terms

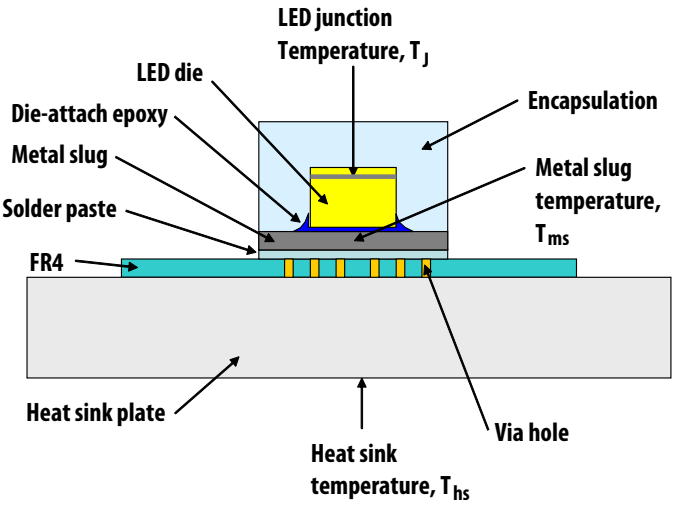

Table 1. Life Tests Demonstrated Performance

InGaN Blue

					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} = 100°C, 350mA	48,000	48	0	52400	≤1.91

InGaN Green

					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} = 100°C, 350mA	48,000	48	0	52400	≤1.91

AlInGaP Red

					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} = 100°C, 350mA	48,000	48	0	52400	≤1.91

Failure Rate Prediction

The junction temperature of the device determines the failure rate of semiconductor devices. The relationship between heat sink temperature and actual junction temperature is given by the following:

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

Where

T_{hs} = heat sink temperature in °C

$\theta_{J\text{-}hs}$ = 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 Blue & Green

Heat Sink Temperature, T_{hs} (°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)
125	62400	1.60	24800	4.03
120	60200	1.66	24000	4.17
115	58100	1.72	23100	4.33
110	56100	1.78	22300	4.48
105	54200	1.85	21600	4.63
100	52400	1.91	20800	4.81
95	61200	1.63	24300	4.12
90	71700	1.39	28500	3.51
85	84400	1.18	33600	2.98
80	99800	1.00	39700	2.52
75	118500	0.84	47200	2.12
70	141300	0.71	56300	1.78
65	169400	0.59	67400	1.48
60	204100	0.49	81200	1.23
55	247100	0.40	98300	1.02
50	300800	0.33	119700	0.84

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 $\theta_{J\text{-}hs}$ = 25°C/W
5. Thermal resistance is measured base on 3 dice turn on at same time.

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:

(0.40%/1K hours) x (0.25) x (8760 hours/year) = 0.88% per year

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

(1.02%/1K hours) x (0.25) x (8760 hours/year) = 2.24% per year

Table 3. Reliability Predictions – AlInGaP Red

Heat Sink Temperature, T_{hs} (°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)
125	50000	2.00	19900	5.03
120	50400	1.98	20100	4.98
115	50900	1.96	20300	4.93
110	51400	1.95	20500	4.88
105	51900	1.93	20700	4.83
100	52400	1.91	20800	4.81
95	61500	1.63	24500	4.08
90	72500	1.38	28900	3.46
85	85900	1.16	34200	2.92
80	102200	0.98	40700	2.46
75	122100	0.82	48600	2.06
70	146700	0.68	58400	1.71
65	177100	0.56	70500	1.42
60	214900	0.47	85600	1.17
55	262300	0.38	104400	0.96
50	321900	0.31	128100	0.78

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 $\theta_{J\text{-}hs}$ = 28°C/W,
5. Thermal resistance is measured base on 3 dice turn on at same time.

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:

(0.38%/1K hours) x (0.25) x (8760 hours/year) = 0.84% per year

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

(0.96%/1K hours) x (0.25) x (8760 hours/year) = 2.11% per year

Table 4. Environmental Tests

Test Name	MIL-STD/JEDEC Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	JESD22-A104	-40°C/120°C, 30 min dwell, 5 min transfer, 100 cycles	72	0
Low Temperature Operating Life	JESD22-A108	T_{hs} = -40°C, If=350mA, 1000hrs	24	0
High Temperature Storage Life	JESD22-A103	T_{hs} = 120°C, 1000hrs	12	0
Low Temperature Storage Life	JESD22-A108	T_{hs} = -40°C, 1000hrs	12	0
High Temperature High Humidity Operating Life	JESD22-A101	T_{hs} = 85°C, RH = 85%, If= 250mA, 1000hrs	24	0
High Temperature High Humidity Storage Life	JESD22-A101	T_{hs} = 85°C, RH = 85%, 1000hrs	24	0

Table 5. Mechanical Tests

Test Name	MIL-STD/JEDEC Reference	Test Conditions	Units Tested	Units Failed
Resistance to Solder Heat	JESD22-B106	260+/- 5°C, 10+/-1 second	10	0
Mechanical Shock	JESD22-B104	5 shocks each X1, X2, Y1, Y2, Z1, Z2, 1500G, 0.5msec pulse	30	0
Vibration	JESD22-B103	4 cycles, 4mins each X, Y and Z at 0.06inch @ 20Hz-100Hz, 50g @ 100Hz-2000Hz	30	0

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

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