ASMC-QxB2-Txxx

Envisium 0.5W Power PLCC-4
Surface Mount LED Indicator

Reliability Datasheet

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 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 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 1. Life Tests

Demonstrated Performance

					Point Typical Performance	
Test Name	**Stress Test Conditions**	**Total Device Hours**	**Units Tested**	**Total Failed[3]**	**MTBF**	**Failure Rate (% /1 K Hours)**
High Temperature Operating Life	TA = 100°C, 60 mA	56,000	56	0	61,000	1.64

Table 2. Reliability Predictions

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance [1] in Time		Performance in Time [2] (90% Confidence)	
		MTBF [1]	Failure Rate (%/1K Hours)	MTBF[2]	Failure Rate (%/1K Hours)
100	122	61100	1.64	24300	4.12
95	122	61600	1.62	24500	4.08
90	122	62000	1.61	24700	4.05
85	122	62500	1.60	24900	4.02
80	121	63000	1.59	25100	3.98
75	121	63500	1.57	25300	3.95
70	121	63900	1.56	25500	3.92
65	121	64400	1.55	25600	3.91
60	116	75900	1.32	30200	3.31
55	111	89700	1.11	35700	2.80
50	106	106500	0.94	42400	2.36
45	101	127000	0.79	50600	1.98
40	96	152300	0.66	60600	1.65
35	91	183400	0.55	73000	1.37
30	86	222100	0.45	88400	1.13
25	81	270400	0.37	107600	0.93

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, dim or parametric failure.

[4] Junction temperature is calculated based on θ_{JA} = 130°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:

(1.11% / 1K hours) x (0.25) x (8760 hours/year) = 2.43% per year

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

(2.80% / 1K hours) x (0.25) x (8760 hours/year) = 6.13% per year

Table 3. Environmental Tests

Test Name	MIL-STD-JEDEC Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	JESDA104	-40°C/100°C, 15 min dwell, 5 min transfer, 1000 cycles	800	0
Low Temperature Operating Life	JESDA108	Ta=-40°C, If= 150mA, 1000hrs	56	0
High Temperature Operating Life	JESDA108	Ta=85°C, If= 100mA, 1000hrs	56	0
High Temperature Operating Life	JESDA108	Ta=65°C, If= 150mA, 1000hrs	56	0
Temperature Humidity Operating Life	JESDA101	Ta= 85°C, RH = 85%RH, If= 100mA, 1000hrs	56	0
Temperature Humidity Storage Life	JESDA101	Ta= 85°C, RH = 85%RH, 1000hrs	56	0
High Temperature Storage Life	JESDA103	Ta = 100°C, 1000hrs	56	0
Low Temperature Storage Life	JESDA108	Ta = -40°C, 1000hrs	56	0
Pulse Test	Avago Req	Ta= 25°C, Ip= 300mA, Duty Cycle = 10%, 1000hrs	56	0
High Temperature Reverse Bias	Auto Req	Ta = 100°C, 5VRB, 1000hrs	56	0
Temperature Humidity Reverse Bias	Auto Req	Ta= 85°C, RH = 85%RH, 5VRB, 1000hrs	56	0
Power Temperature Cycle	Auto Req	-40°C/85°C, 18 min dwell, 42 min transfer, 5 mins on/off, If= 100mA, 1000 cycles	56	0
Power Temperature Humidity Cycle	Auto Req	25°C/65°C, 3hrs dwell, 6hrs transfer, RH = 95%, 5 mins on/off, If= 150mA, 100 cycles	56	0

Table 4. 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	30	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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