HSMW-B191/C191, HSMW-B197/C197, HSMW-B120/C120, HSMW-C130 and HSMW-B265/C265
Surface Mount LED Indicator

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Agilent Technologies in accordance with the latest revision of MIL-STD-883. Agilent tests parts at the absolute maximum rated conditions recommended for the device. The actual performance you obtain from Agilent parts depends on the electrical and environmental characteristic of your application but will probably be better than the performance outlined in Table 1.

Failure Rate Prediction

The failure rate of semiconductor devices is determined by the junction temperature of the device. 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)

$\theta_{JA} =$ thermal resistance of junction-to ambient in °C/watt

$P_{AVG} =$ average power dissipated in watts

The estimated MTBF and failure rate at temperatures lower than the actual stress temperature can be determined by using an e Arrhenius model for temperature acceleration. Results of such calculations are shown on the following page using an activation energy of 0.43eV (reference MIL-HDBK-217)

Table 1. Life Tests

Demonstrated Performance

Colors	Stress Test Conditions	Total Device Hrs.	Units Tested	Units Failed	Point Typical Performance	
					MTBF	Failure Rate (%/1K Hours)
White and Bluish white	$T_A = 25°C$ $I_F = 20$ mA	196,000	392	0	196,000	≤0.51%
White and Bluish white	$T_A = 55°C$ $I_F = 20$ mA	182,000	364	0	182,000	≤0.55%
White and Bluish white	$T_A = 40°C$ $I_F = 20$ mA	168,000	336	0	168,000	≤0.60%

Table 2. Failure Rate Prediction (I_F = 20mA)

Demonstrated Performance

Ambient Temperature (°C)	Junction Temperature (°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)
85	96	216.700	0.46	86,300	1.16
75	97	210,500	0.48	83,800	1.19
65	97	204,400	0.49	81,400	1.23
55	98	198,600	0.50	79,000	1.27
45	88	288,100	0.35	114,700	0.87
35	78	427,000	0.23	170,000	0.59
25	68	647,500	0.15	257,800	0.39

Notes:

1. The point typical MTBF (which represents 60% confidence level) is the total device hours divided by the number of failures. In the case of zero failures, one failure is assumed for this calculation.
2. The 90% Confidence MTBF represents the minimum level of reliability performance which is expected from 90% of all samples. This confidence interval is based on the statistics of the distribution of failures. The assumed distribution of failures is exponential. This particular distribution is commonly used in describing useful life failures. Refer to MIL-STD-690B for details on this methodology.
3. A failure is any LED which does not emit light .

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 25º C ambient temperature is:
(0.15 % / 1K hours) x 0.25 X (8760 hours/year) = 0.33 % per year

Similarly, 90% confidence level failure rate per year at 25º C:
(0.39 % / 1K hours) X 0.25 X (8760 hours/year) = 0.85 % per year

Table 3. Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	JESD22-A104	-40°C to 85°C, 15 min. dwell 5 min. transfer air to air storage 100 cycles	11,192	0
Solderability	JESD22-B102	8 hours aging and solder dip at 245°C for 5 seconds	10	0
Low Temperature Storage	JESD22-A103	-40°C 1000hrs	364	0
Humidity Storage	JESD22-A101	60°C/90% RH, 1000hrs	840	0
Humidity forward bias	JESD22-A101	60°C/90% RH, 10 mA 500hrs	56	0

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