Reliability Data Sheet

SnapLED 150 Emitter

HPWS-TH00/FH00/TL00/FL00

Description

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

Table 1: Life Tests

Demonstrated Performance

					Point Typical Performance	
Colors	Stress Test Conditions	Total Device Hours	Units Tested	Units Failed	MTBF	Failure Rate (% /1K Hours)
TS AlInGaP Amber and Red-Orange	T_A = 55°C, I_F = 150 mA	168,000	168	0	168,000	≤ 0.595
TS AlInGaP Amber and Red-Orange	T_A = 55°C, I_F = 160 mA	48,000	48	0	48,000	≤ 2.08
TS AlInGaP Amber and Red-Orange	T_A = 55°C Pulse 50% Duty Factor, 2Hz I_F = 200 mA	48,000 56,000	48 (1 Hz) 56 (2 Hz)	0 0	48,000 56,000	≤ 2.08 ≤ 1.786

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
θ_{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 Arrhenius model for temperature acceleration. Results of such calculations are shown in the table on the following page using an activation energy of 0.43 eV (reference MIL-HDBK-217).

Table 2: Failure Rate Prediction (IF - 150mA)

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance in Time [1] (60% Confidence) MTBF [1]	Failure Rate (%/1K Hours)	Performance in Time [2] (90% Confidence) MTBF [2]	Failure Rate (%/1K Hours)
85	138	65,000	1.548	28,000	3.565
75	128	87,000	1.144	38,000	2.634
65	118	120,000	0.832	52,000	1.916
55	108	168,000	0.595	73,000	1.371
45	98	239,000	0.418	104,000	0.963
35	88	347,000	0.288	151,000	0.663
25	78	515,000	0.194	223,000	0.447

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 and max. % I_V degradation is > 50%.

[4] Assuming 115°C/W of θ_{JA}

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 25°C ambient temperature is:

(0.060% / 1K hours) x (0.25) x (8760 hours/year) = 0.131% per year

Similarly, 90% confidence level failure rate per year at 25°C:

(0.137% / 1K hours) x (0.25) x (8760 hours/year) = 0.300% per year

Table 3: Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	MIL-STD-883 Method 1010	-55°C to 100°C, 15 min. dwell, 5 min. transfer		
		20 cycles	4480	0
		100 cycles	4480	0
Temperature Cycle	MIL-STD-883 Method 1010	-40°C to 120°C, 15 min. dwell, 5 min. transfer		
		20 cycles	952	0
		100 cycles	952	0
Power Temperature Cycle	Internal Reference	-40°C to 85°C, 18 min. dwell, 42 min. transfer, 115 mA, 5 min on/off		
		100 cycles	48	0
Power Temperature Cycle	Internal Reference	-40°C to 85°C, 18 min. dwell, 42 min. transfer, 150 mA, 5 min on/off		
		100 cycles	56	0

Electrostatic Discharge (ESD) Test

The SnapLED 150 has been tested for ESD and has passed with minimal change in flux, forward voltage, and dominant wavelength. Units were subjected to 16kV ESD with the human body model profile, and 400V with the machine model profile. Results of the test are shown in Table 4 below.

Table 4: Electrostatic Discharge (ESD) Test

Test	Test Conditions	Results
Human Body Model	16 KV, 3 positive pulses, 3 negative pulses	95 units / 0 failures
Machine Model	400 V, 3 positive pulses, 3 negative pulses	100 units / 0 failures

* No appreciable change in flux, forward voltage, and dominant wavelength

LUMILEDS

Company Information

Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Lumileds has R&D development centers in San Jose, California and Best, The Netherlands. Production capabilities in San Jose, California and Malaysia.

Lumileds is pioneering the high-flux LED technology and bridging the gap between solid state LED technology and the lighting world. Lumileds is absolutely dedicated to bringing the best and brightest LED technology to enable new applications and markets in the lighting world.

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