HEDL-5500, HEDL-5600, HEDL-6500, HEDL-9x00 Series

Motion Sensing Products, Optical Encoder Modules

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Avago Technologies Malaysia in accordance with the latest revisions 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.

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 Watt

The estimated MTTF 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 an activation energy of 0.43eV (reference MIL-HDBK-217).

Table 1. Life Tests

Demonstrated Performance

					Point Typical Performance	
Test Name	**Stress Test Conditions**	**Total Device Hours**	**Units Tested**	**Total Failed [3]**	**MTTF**	**Failure Rate (% /1 K Hours)**
High Temperature Operating Life	Vcc=5.0V, T_A=100°C	30,000	30	0	32,700	3.06

Table 2.

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance in Time [1] MTTF(1)	Failure Rate (% / 1K Hours)	Performance in Time [2] (90% Confidence) MTTF(2)	Failure Rate (% /1K Hours)
100	110	32,700	3.06	13,020	7.68
90	100	46,300	2.15	18,460	5.42
80	90	67,000	1.49	26,680	3.75
70	80	98,900	1.01	39,390	2.54
60	70	149,400	0.66	59,470	1.68
50	60	231,100	0.43	92,060	1.08
40	50	367,800	0.27	146,400	0.68

Notes:
1. The point typical MTTF (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 MTTF 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.
3. Failures are catastrophic or parametric. Catastrophic failures are open, short, no logic output, no dynamic parameters while parametric failures are failures to meet an electrical characteristic as specified in product catalog such as output voltage, duty or state errors.

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 50°C ambient temperature is:

(0.43% / 1K hours) x 0.25 X (8760 hours/year) = 0.94% per year

Similarly, 90% confidence level failure rate per year at 50°C:

(1.08% / 1K hours) X 0.25 X (8760 hours/year) = 2.36% per year

Table 3. Environmental Tests

Test Name	Test Conditions	Units Tested	Unit Failed
Storage Temperature Cycle	-40°C to 100°C, 15min dwell time. 5 min transfer. 1000 cycles	90	0
Wet High Temperature Storage life	T_A=85°C, RH=85%, 1000 hours	90	0
Low Temperature Storage Life	T_A=-40°C, 1000 hours	90	0

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

AV01-0682EN - December 19, 2006