HEDS-90xx ,91xx,92xx & HEDS-55xx/65xx 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 Standard. 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 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 of0.43eV (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**	**MTTF**	**Failure Rate (% /1 K Hours)**
High Temperature Operating Life	V_{CC}= 5.5V Va=Vb = 3.5V T_A=100°C 1000hours	868,000	868	0	948,634	0.105

Table 2.

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance [1] in Time		Performance in Time [2] (90% Confidence)	
		MTTF [1]	Failure Rate (% / 1K Hours)	MTTF [2]	Failure Rate (% /1K Hours)
100	110	948,634	0.105	376,573	0.266
90	100	1,347,060	0.074	534,733	0.187
80	90	1,944,699	0.051	771,974	0.130
70	80	2,874,361	0.035	1,141,015	0.088
60	70	4,335,257	0.023	1,7201,937	0.058
50	60	6,706,842	0.015	2,662,369	0.038
40	50	10,672,131	0.009	4,236,443	0.024
30	40	17,483,322	0.006	6,940,234	0.014

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) = 0.24

The point failure rate per year (8760 hours) at 50°C ambient temperature is:

(0.015% / 1K hours) x 0.24 X (8760 hours/year) = 0.032% per year

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

(0.04% / 1K hours) X 0.24 X (8760 hours/year) = 0.08% per year

Table 3. Environmental Tests

Test Name	Test Conditions	Units Tested	Units Failed
Temperature Cycle	-40°C to 100°C, 15minutes dwell time, 5minutes transfer, 1000 cycles	757	0
Solder Heat Resistance	Pb Free solder 260°C Peak 10sec, 20 Temperature cycles at -40/100°C	10	0
High Temperature Storage	T_A=105°C	77	0
Wet High Temperature Operating Life	T_A=85°C, RH=85% V_{CC}=5.5V, Va =Vb = 3.5V 1000 hours	841	0

Table 4. Mechanical Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
Mechanical Shock	Mil-Std-883C 2002	5 blows; X,Y,Z axes, 1500g, 0.5msec	12	0
Vibration Test	Mil-Std-883C 2007	4 minutes each X, Y, Z axes, 20g minimum.		
		4 cycles, 20 to 2000 Hz	10	0
		3 cycles, 20 to 2000Hz	26	0
		3 cycles, 5 to 1000Hz	10	0
Terminal Strength	Mil-Std-883C 2004	1 lb. for 30seconds	15	0
Lead Fatigue	Mil-Std-883C 2004	3 bends, 15°C minimum	15	0

Table 5. Electrical Tests

Test Name	Reference	Test Conditions	Units Tested	Units Failed
ESD- Human Body Model	HBM-JESD22-A114D	1.5kΩ, 100pF, 5 positive and negative discharges per pin. VZ = 3.0 KV	35	0

Avago assures the form, fit, function, quality and reliability of above-mentioned parts as outlined in above-mentioned conditions of this reliability data sheet. If customer runs the parts outside of such specifications, no assurance of form, fit, function, quality and reliability is provided.

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

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