AEDB-9340 Series

1250 / 2500 CPR Commutation Encoder Modules
With Codewheel

AVAGO TECHNOLOGIES

Reliability Data Sheet

Description

The following cumulative test results were obtained from testing procedures performed at Avago Technologies Malaysia. It is in accordance with the latest revisions of MIL-STD-883. Avago test parts are at absolute maximum rated conditions which are recommended for the device. The actual performance you obtain from Avago parts, depend on the electrical and environmental characteristics of your application. The actual results are more likely to perform better than the performance results as 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**	**MTTF**	**Failure Rate (%/1k Hours)**
High Temperature Operating Life	Vcc=5.0V TA=85 C 1000 hours	64,000	64	0	64,000	1.56
Low Temperature Operating LIfe	Vcc=5.0V TA=-40 C 1000 hours	48,000	48	0	48,000	2.08
Wet High Temperature Operating LIfe	Vcc=5.0V TA=85 C RH=85% 1000 hours	48,000	48	0	48,000	2.08

Table 2.

		Point Typical Performance[1] in Time		Performance in Time[2] (90% Confidence)	
Ambient Temperature (°C)	Junction Temperature (°C)	MTTF [1]	Failure Rate (%/1k Hours)	MTTF [2]	Failure Rate (%/1k Hours)
85	130	64,000	1.56	27,770	3.60
75	120	87,680	1.14	38,050	2.63
65	110	122,200	0.81	53,010	1.88
55	100	173,200	0.58	75,170	1.33
45	90	250,500	0.40	108,700	0.92
35	80	369,700	0.27	160,400	0.62
25	70	558,300	0.18	242,200	0.41

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 failure distribution. 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. 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 55º C ambient temperature is:

(0.58% / 1K hours) x 0.25 X (8760 hours/year) = 1.27% per year

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

(1.33% / 1K hours) X 0.25 X (8760 hours/year) = 2.91% per year

Table 3. Environmental Tests

Test Name	Test Conditions	Units Tested	Unit Failed
Temperature Cycle	-40°C to 85°C 15 min dwell time 5 min transfer 1000 cycles	25	0
Low Temperature Storage Life	-40°C, 1000 Hrs	25	0

Table 4. Electrical Tests

Test Name	Reference	Test Conditions	Units Tested	Unit Failed
ESD- Human Body Model	HBM-JESD22-A114-A	Up to 8kV applied to all pins versus ground	9	0
MM- Machine Body Model	MM-JESD22-A115-A	Up to 300V applied to all pins versus ground	9	0

Table 5. Mechanical Tests

Test Name	Reference	Test Conditions	Units Tested	Unit Failed
Vibration Test	IEC68-2-27	15,20.30g 5-2kHz 10cycles for each g per 3 perpendicular axes of units	5	0
Mechanical Shock Test	IEC68-2-21	15,20.30,50g 11nms,5 successive shocks in each direction of 3 perpendicular axes of units	5	0

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