AEDT-9140

High Temperature 115°C
Three-Channel Optical Incremental Encoder Modules
100 CPR to 1000 CPR

Reliability Data Sheet

Description

The following cumulative test results have been obtained from testing performed at Avago Technologies Malaysia

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 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 (% /1 K Hours)**
High Temperature Operating Life	Vcc= 5.5V, T_A=120°C 1000hours	64,000	64	0	64,000	1.56

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)
120	173	64,000	1.56	28000	3.57
110	163	83000	1.20	36000	2.78
100	153	108000	0.93	47000	2.13
90	143	143000	0.70	62000	1.61
80	133	193000	0.52	83600	1.20
70	123	260000	0.38	114000	0.88
60	113	360000	0.28	160000	0.63
50	103	510000	0.20	220000	0.45
40	93	740000	0.14	320000	0.31
30	83	1100000	0.09	470000	0.21

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:

(0.19% / 1K hours) x 0.25 X (8760 hours/year) = 0.41% per year

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

(0.44% / 1K hours) X 0.25 X (8760 hours/year) = 0.96% per year

Table 3. Environmental Tests

Test Name	Test Conditions	Units Tested	Unit Failed
Temperature Cycle	-40°C to 120°C, 1000 cycles	120	0
Wet High Temperature Operating Life	T_A=85°C, RH=85% Vcc=5.5V 500 hours	30	0
Low Temperature Operating Life	TA=-40°C, Vcc=5.5V 1000 hours	30	0

Table 4. Mechanical Test

Test Name	Reference	Test Conditions	Units Tested	Unit Failed
Vibration Test	IEC68-2-21	50Hz-2kHz 30g 10 cylces	5	0
Mechanical Shock	IEC68-2-27	30g, 11ms 1000 shocks	5	0

Table 5. Electrical Tests

Test Name	Reference	Test Conditions	Units Tested	Unit Failed
ESD- Human Body Model	HBM-JESD22-A114D	Up to 2kV applied to all pins versus ground	9	0
ESD- Machine Model	MM-JESD22-A115-A	Up to 200V applied to all pins versus ground	9	0

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

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