

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 characteristics of your rated conditions recommended for the device. The actual performance you obtain from Avago parts, depend on the electrical and environmental 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:

$$T_J(^{\circ}\text{C}) = T_A(^{\circ}\text{C}) + \theta_{JA}P_{AVG}$$

Where,

T_A = ambient temperature in $^{\circ}\text{C}$

θ_{JA} = thermal resistance of junction-to-ambient in $^{\circ}\text{C}/\text{Watt}$

P_{AVG} = average power dissipated in Watt

**Table 1. Life Tests
Demonstrated Performance**

Test Name	Stress Test Conditions	Total Device Hours	Units Tested	Total Failed	Point Typical Performance	
					MTTF	Failure Rate (% / 1 K Hours)
High Temperature Operating Life	Vcc=5.5V, TA=120°C 500hours	15,000	30	0	16393	6.10

Table 2.

Ambient Temperature (°C)	Junction Temperature (°C)	Point Typical Performance ^[1] in Time (60% Confidence)		Performance in Time (90% Confidence)	
		MTTF ^[1]	Failure Rate (% / 1K Hours)	MTTF ^[2]	Failure Rate (% / 1K Hours) ^[2]
120	165	16,393	6.100	6,508	15.367
110	155	21,393	4.674	8,492	11.775
100	145	28,275	3.537	11,224	8.909
90	135	37,886	2.639	15,040	6.649
80	125	51,516	1.941	20,450	4.890
70	115	71,167	1.405	28,251	3.540
60	105	100,010	1.000	39,700	2.519
50	95	143,166	0.698	56,832	1.760
40	85	209,092	0.478	83,002	1.205
30	75	312,097	0.320	123,891	0.807
25	70	384,653	0.260	152,693	0.655

Notes:

1. The 60% or 90% confidence MTTF represents the minimum level of reliability performance which is expected from 60% or 90% of all samples. The confidence level is established based on the chi-square distribution.
2. Failure rate (%/1K hours) is $1/\text{MTTF} \times 10^5$, assuming the failures are exponentially distributed.
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:

$$(8 \text{ hours/day}) \times (5 \text{ days/week}) / (168 \text{ hours/week}) = 0.25$$

The point failure rate per year (8760 hours) at 60°C ambient temperature is:

$$(1.000\% / 1\text{K hours}) \times 0.25 \times (8760 \text{ hours/year}) = 2.19\% \text{ per year}$$

Similarly, 90% confidence level failure rate per year at 60°C:

$$(2.519\% / 1\text{K hours}) \times 0.25 \times (8760 \text{ hours/year}) = 5.52\% \text{ per year}$$

Table 3. Environmental Tests

Test Name	Reference	Test Conditions	Units Tested	Unit Failed
Temperature Cycle	Avago Req.	-40°C to 120°C, 30min dwell time. 5 min transfer. 500 cycles	30	0
Temperature Humidity Storage Life	Avago Req.	T _A =85°C, RH=85% 500 hours	30	0
Low Temperature Operating Life	JESD22-A108	V _{cc} - 5.5V, T _A =-40°C 500 hours	30	0
High Temperature Storage Life	JESD22-A103	T _A =120°C 500 hours	5	0
Temperature Humidity Operating Life	JESD22-A101	V _{cc} =5.5V, T _A =85°C, RH=85% 500 hours	30	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- Human 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
Mechanical Shock Test	IEC68-2-21	15, 20, 30, 50g 11ms, 5 successive shocks in each direction of 3 perpendicular axes of units	5	0
Vibration Test	IEC68-2-27	15, 20, 30g 5Hz to 2000Hz 10 cycles for each g per 3 perpendicular axes of units	5	0

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