Silicon Power Transistors

Reliability Data

Description

The following cumulative test results have been obtained from testing performed at Avago Technologies in accordance with the latest revision of MIL-STD-750. Data was gathered from the product qualifications, reliability monitor, and engineering evaluation.

For the purpose of this reliability data sheet, a failure is any part which fails to meet the electrical and/or mechanical specification listed in the product data sheet.

B. Failure Rate Prediction

The failure rate will depend on the junction temperature of the device. The estimated life at different temperatures is calculated using activation energy of 1.1 eV.

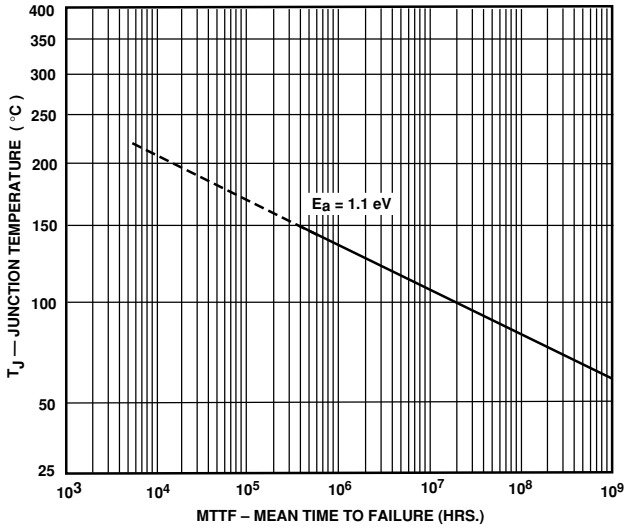
1. Life Test

A. Demonstrated Performance

Test Name	Test Conditions	Units Tested	Total Device Hrs.	Total Failed	Failure Rate (%/1K Hours)
High Temperature Operating Life (O.L.)	Biased at T_J = 150°C	333	333,000	0	0
High Temperature Reverse Bias (HTRB)	Biased at 80% of V_{CBO}, T_J = 150°C	355	355,000	1	0.3

Junction Temp. T_J(°C)	Point(1)		90% Confidence Level(2)	
	MTTF* (hours)	FIT(3)	MTTF (hours)	FIT(3)
150	3.3×10^5	3030	1.43×10^5	6969
125	2.2×10^6	454	9.56×10^5	1044
100	1.9×10^7	53	8.26×10^6	122
75	2.2×10^8	4.5	9.56×10^5	10.4

*MTTF data is calculated from High Temperature Operating Life tests.



Notes:
1. The point MTTF is simply the total device hours divided by the number of failures.
2. This MTTF and failure rate represent the performance level for which there is a 90% probability of the device doing better than the stated value. The confidence level is based on the statistics of failure distribution. The assumed distribution is exponential. This particular distribution is commonly used in describing useful life failures.
3. FIT is defined as Failure in Time, or specifically, failures per billion hours. The relationship between MTTF and FIT is as follows: FIT = 10^9/(MTTF).

C. Example of Failure Rate Calculation

At 100°C with a device operating 8 hours a day, 5 days a week, the percent utilization is:

% Utilization = (8 hours/day) x (5 days/week) / (168 hours/week) ≅ 25%

Then the point failure rate per year is:

(53 x 10^{-9} per hour) x (25%) x (8760 hours/year) = 1.16 x 10^{-2} % per year

Likewise, the 90% confidence level failure rate per year is:

(122 x 10^{-9} per hour) x (25%) x (8760 hours/year) = 2.6 x 10^{-2} % per year

2. Environmental Tests (1 = AT-38043, 2 = AT-38086, 3 = AT-31625, 4 = AT-33225, 5 = AT-36408)

Test Name	MIL-STD-750 Reference	Test Conditions	Number Failed / Sample Size				
			1	2	3	4	5
Thermal Shock	1056	-65˚C/150˚C, 200 cycles, 5 min. dwell	0/75	0/74	0/51	0/81	0/80
Temperature Cycling	1051	-65˚C/150˚C, 200 cycles, 10 min. dwell	0/74	0/72	0/51	0/81	0/80
Moisture Resistance	AvagoGSS	85% RH/85°C, Biased, 1000 hrs.	0/72	0/74	0/51	0/81	0/78
Autoclave	AvagoGSS	121°C, 15 psig, 100% RH, 96 hrs.	0/72	0/74	0/51	0/81	0/80
Resistance to Solder Heat	2031	260°C, 10 seconds	–	0/22	–	0/22	0/30
Resistance to Solvent	1022	3 solvent groups	–	–	–	0/22	–
Solderability	2026	245°C, 5 seconds, 8 hrs steam aging	–	–	–	0/22	–

Note: Electrical overstress failures, mechanically damaged and missing devices are excluded from the Sample Count.

3. Flammability Test

(MIL-STD-202, Method 111): Meets Needle Flame test per UL Category D (Flaming Time <3 sec.) under Material Classification 94VO.

4. DOD-HDBK-1686 ESD

Classification: Class I

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

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