Silicon Bipolar Monilithic Amplifiers

Reliability Data

MSA Series

Description

The following cumulative test results have been obtained from testing performed at Hewlett-Packard in accordance with the latest revision of MIL-STD-750. Data was gathered from the product qualification, 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 Communications Components Designer's Catalog.

1. Life Test

A. Demonstrated Performance

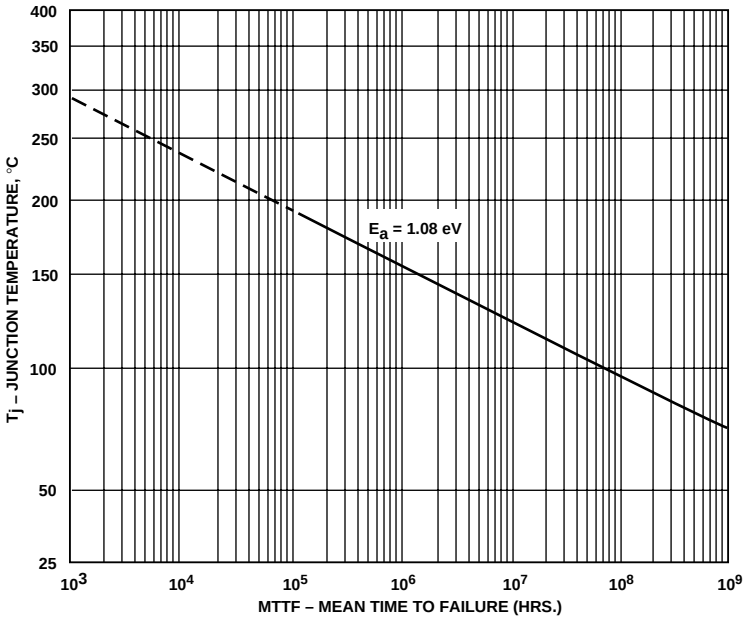
Test Name	Test Condition	Units Tested	Total Device Hrs.	Total Failed	Failure Rate (%/1K Hours)
High Temperature Operating Life (O.L.)	$T_A = 125°C, (T_J = 160)$	258	516,000	0	0
High Temperature Operating Life (O.L.)	$T_A = 150°C, (T_J = 183)$	190	188,000	2	1.06
High Temperature Storage (HTS)*	$T_A = 150°C$	350	350,912	1	0.28

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 the Arrhenius plot with activation energy of 1.1eV, and the device thermal resistance of the stress board is 130°C/W, and listed in the following table.

Junction Temp. TJ (°C)	Point(1)		90% Confidence Level(2)	
	MTTF* (hours)	MTTF FIT(3)	MTTF (hours)	FIT(3)
183	9.5×10^4	1.05×10^4	3.57×10^4	2.80×10^4
160	7.4×10^5	1.35×10^3	3.21×10^5	3.11×10^3
125	9.9×10^6	1.0×10^2	4.3×10^6	2.3×10^2
100	8.0×10^7	12.5	3.5×10^7	28

*MTTF data 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 hrs/day x 5 days/wk) ÷ 168 hrs/wk ≅ 25%

Then the point failure rate per year is:

(12.5 x 10^{-9}/hr) x (25%) x (8760 hrs/yr) = 2.7 x 10^{-3} % per year

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

(8.0 x 10^{-7}/hr) x (25%) x (8760 hrs/yr) = 1.8 x 10^{-1}% per year

2. Environmental Tests

Test Name	MIL-STD 750 Reference	Test Conditions	Units Tested	Units Failed
Solderability	2026	215°C, 5 seconds post 8 hr steam aging	22	0
Solder Heat	2031	260°C, 10 seconds	22	0
Resistance to Solvents	1022	4 Solvent Groups	15	0
Autoclave	HP GSS 12-109	121°C, 16 PSIG, 96 hrs	549	0
Thermal Shock	1056	-65/150°C, 5 min dwell, 200 cycles	460	0
Temperature Cycle	1051	-55 to 150°C min dwell, 200 cycles	643	0
Lead Integrity		2.0 Pounds Minimum	15	0

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