HEWLETT® PACKARD

Silicon Bipolar Active Mixer

Reliability Data

IAM-8XXXX

Description

The following cumulative test results have been obtained from testing performed at Hewlett-Packard in accordance with the latest revision of MIL-STD-883. 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

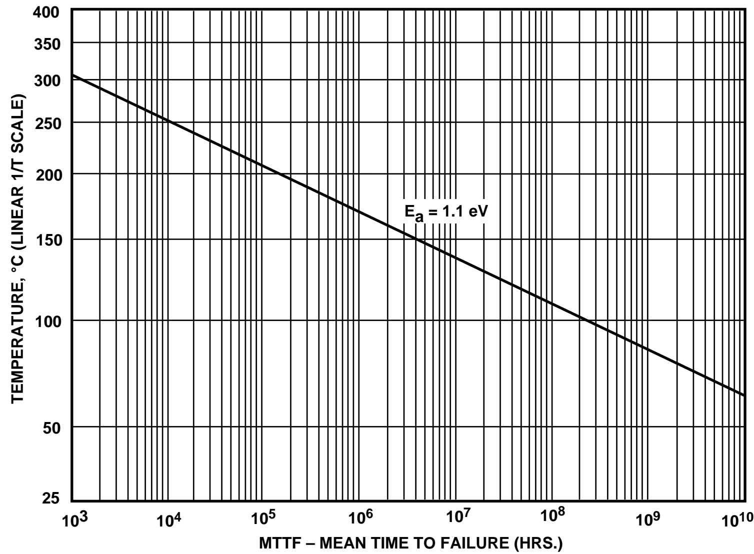
Test Name	Test Conditions	Units Tested	Total Device Hrs.	Total Failed
High Temperature Operating Life (O.L.)	$T_J = 200°C$	70	70,000	0
High Temperature Operating Life (O.L.)	$T_J = 150°C$	318	318,000	0
High Temperature Storage (HTS)*	$T_J = 150°C$	77	77,000	0

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 1.1 eV, and is listed in the following table.

Junction Temp. T_J(°C)	Point(1)		90% Confidence Level(2)	
	MTTF* (hours)	MTTF FIT(3)	MTTF (hours)	FIT(3)
200	1.6×10^5	6319	1.2×10^5	8278
175	7.1×10^5	1402	5.4×10^5	1836
150	3.8×10^6	260	2.9×10^6	341
125	2.6×10^7	39	2.0×10^7	51
100	2.2×10^8	5	1.7×10^8	6
75	2.6×10^9	<1	2.0×10^9	<1
50	4.4×10^{10}	<<1	3.3×10^{10}	<<1

*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℃ 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:

$(4.55 \times 10^{-9}) \times (25\%) \times (8760 \text{ hours/year}) \cong 1.0 \times 10^{-3}$ % per year

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

$(5.88 \times 10^{-9}) \times (25\%) \times (8760 \text{ hours/year}) \cong 1.3 \times 10^{-3}$ % per year

2. Environmental Tests

Test Name	MIL-STD-883 Method	Test Conditions	Units Tested	Units Failed
Temperature Cycle	1010	-65˚C to +150˚C; 10 min. dwell; 200 cycles, min.	450	1
Thermal Shock	1011	-65˚C to +150˚C; 5 min. dwell; 200 cycles, min.	448	0
Autoclave, unbiased	HP GSS 12-109	121˚C; 15 PSIG, 96 hrs., min.	327	1
Temperature Humidity, biased	HP GSS 12-107	85℃/85% RH; 1000 hrs., min.	131	0
Resistance to solvents	2015	3 solvent groups	15	0
Solderability	2003	260℃, 5 sec. dwell; Post 8 hours steam aging	82	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