Silicon Bipolar RFIC
900 MHz Driver Amplifier

Reliability Data

HPMX-3002

Description

The following cumulative test results have been obtained from testing performed at Hewlett-Packard in accordance with the relevant MIL-STD-883 or HP internal GSS methods. 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 Hewlett-Packard Communications Components Designer's Catalog, except that for Autoclave a failure is defined as a part which fails catastrophically.

1. Life Test

A. Demonstrated Performance

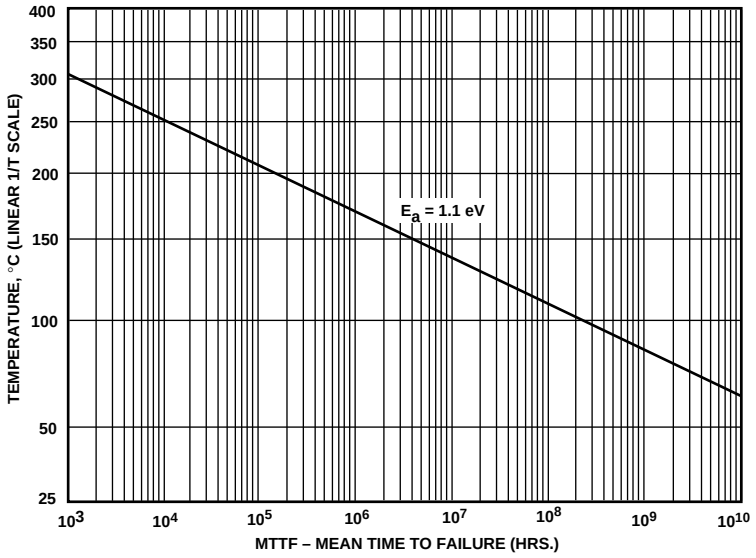
Test Name	Test Conditions	Units Tested	Total Device Hrs.	Total Failed
High Temperature Operating Life (O.L.)	$T_{J(max.)} = 150^\circ C$	90	180,000	0

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)
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

*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 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	Reference	Test Conditions	Units Tested	Units Failed
Temperature Cycle	M1010	-65°C to +150°C; 10 min. dwell; 200 cycles	116	0
Thermal Shock	M1011	-65°C to +150°C; 5 min. dwell; 100 cycles	178	0
Autoclave, unbiased	HP GSS 12-109	121°C; 15 PSIG, 96 hrs.	76	0
Resistance to Solvents	M2015	3 solvent groups	15	0
Solderability	M2003	260°C, 5 sec. dwell; 8 hours steam age	22	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