Low Noise Silicon MMIC Amplifiers

Reliability Data

INA-51063
INA-52063

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

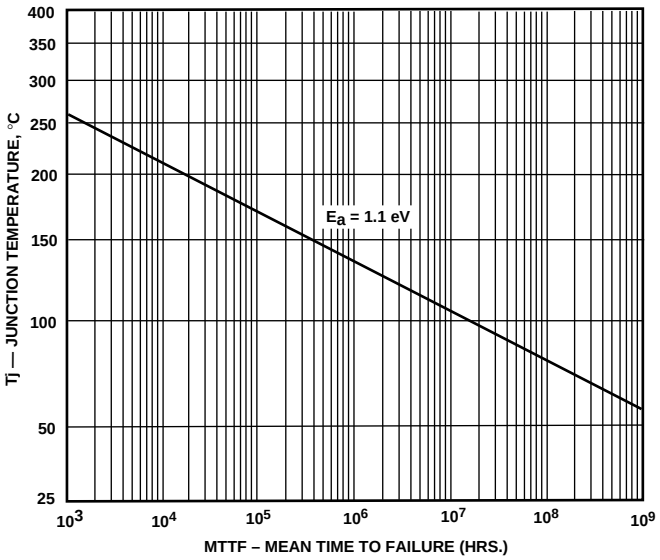
Test Name	Test Condition	Units Tested	Total Device Hrs.	Total Failed
High Temperature Operating Life (O.L.)	$V_d = 5\,V$ ($I_d = 11$ mA) $T_J = 150°C$ 1000 hrs.	56	56,000	0

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 1.1eV, and is listed in the following table.

Junction Temp. T_J (°C)	Point(1)		90% Confidence Level(2)	
	MTTF* (hours)	FIT(3)	MTTF (hours)	FIT(3)
150	3.9×10^5	2564	2.01×10^5	4975
125	2.6×10^6	385	1.34×10^6	746
100	2.0×10^7	50.0	1.03×10^7	97.0
55	2.0×10^9	0.5	1.03×10^9	0.97

*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:

$$\%\,\text{Utilization} = (8\ \text{hrs/day}) \times (5\ \text{days/wk}) \div 168\ \text{hrs/wk} = 25\%$$

Then the point failure rate per year is:

$$(50 \times 10^{-9}) \times (25\%) \times (8760\ \text{hrs/yr}) = 1.10 \times 10^{-2}\ \%\ \text{per year}$$

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

$$(97 \times 10^{-9}) \times (25\%) \times (8760\ \text{hrs/yr}) = 2.12 \times 10^{-2}\ \%\ \text{per year}$$

2. Environmental and Mechanical Tests

Test Name	MIL-STD-883 Reference	Test Conditions	Units Tested	Total Failed
Thermal Shock	M1011	-65°C to 150°C, 5 min. dwell, 200 cycles	66	0
85°C/85%RH	M1004	85°C/85%RH biased, 500 hrs.	56	0
Temperature Cycles	M1010	-65°C to 150°C, 10 min. dwell, 200 cycles	69	0
Autoclave	HP GSS 12-109	121°C, 15 PSIG, 96 hrs	58	0
Solderability	M2003	8 hrs. steam aging, 245°C, 5 sec. dwell	22	0
Popcorning	HP-GSS	125°C, 24 hrs. bake, 85°C/85%RH 168 hrs, IR reflow	22	0
Solder Heat	MIL-STD 750 M2031	260°C, 10 sec. dwell	17	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