

GaAs MMIC Amplifiers

Reliability Data

MGA-81563
MGA-82563
MGA-86563
MGA-87563
IAM-91563

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 Hewlett-Packard Communications Components Designer's Catalog.

1. Life Test

A. Demonstrated Performance

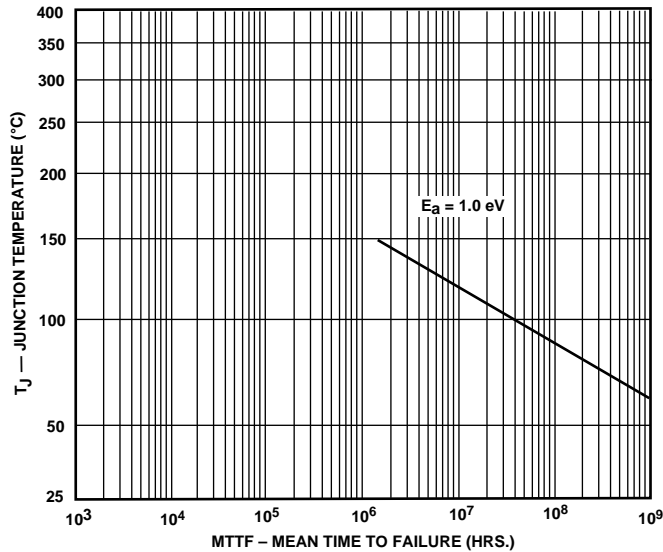
Test Name	Test Conditions	Units Tested	Total Device Hrs.	Total Failed	Failure Rate (%/1K Hours)
High Temperature Operating Life (O.L.)	$V_d = 5.0\text{ V}$ ($I_d = 10\text{ mA}$) $T_J = 150\text{ }^\circ\text{C}$ 1000hrs.	76	76,000	0	0

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 1.0 eV, and the device thermal resistance of the stress board is 130 °C/W, 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	1.0×10^6	1000	4.4×10^5	2272
125	8.0×10^6	125	3.5×10^6	285
100	5.0×10^7	20	2.2×10^7	45
55	4.0×10^9	0.25	1.7×10^9	0.58

*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:

$$(20 \times 10^{-9}) \times (25\%) \times (8760 \text{ hrs/yr}) = 4.3 \times 10^{-5} \% \text{ per year}$$

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

$$(45 \times 10^{-9}) \times (25\%) \times (8760 \text{ hrs/yr}) = 9.85 \times 10^{-5} \% \text{ per year}$$

2. Environmental Tests

Test Name	MIL-STD-883 Reference	Test Conditions	Units Tested	Units Failed
Thermal Shock	M1011	-65°C to 150°C, 10 min dwell, 200 cycles	306	0
Autoclave	HP GSS 12-109	121°C, 15 PSIG, 96 hrs	152	0
85°C/85%RH	M1004	85°C/85%RH biased, 1000 hrs	64	0
Solder Heat	MIL-STD-750 M2031	260°C, 10 sec dwell	17	0
Solderability	M2003	8 hrs steam aging, 245°C, 5 sec dwell	22	0
Terminal Strength	M2004	8 ounce pull/pin	22	0
Popcorning	HP GSS	24 hrs bake at 125°C, 168 hrs 85/85, IR-REFLOW	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