

Reliability Data Sheet

Description

This document describes the reliability performance of MGA-621P8, MGA-622P8 based on a series of reliability test conducted.

The Avago Technologies MGA-621P8/622P8 is a GaAs MMIC Low Noise Amplifier (LNA). The LNA has low noise and high linearity achieved through the use of Avago Technologies' proprietary 0.25 μm GaAs Enhancement-mode pHEMT process.

MGA-621P8/622P8 is housed in the miniature 2.0 x 2.0 x 0.75 mm³ 8-pin DFN package.

The reliability performances of MGA-621P8 were leveraged on MGA-622P8 based on similarity on wafer fabrication and packaging process.

Reliability Prediction Model

Failure rate predictions are based on HTOL test results. The prediction uses an exponential cumulative failure function (constant failure rate) as the reliability prediction model to predict failure rate and mean time to failure (MTTF) at various temperatures as shown in [Table 2](#). The wear out mechanisms is therefore not considered. The Arrhenius temperature de-rating equation is used. We assume no failure mechanism change between stresses and use conditions. Bias and temperature are alterable stresses and must be considered with the thermal resistance of the devices when determining the stress condition. The failure rate has a direct relationship to the life stress. Using bare PHEMT die, the process was tested to determine activation energy of 1.8 eV. Confidence intervals are based upon the chi-squared prediction method associated with exponential distribution.

Table 1 Life Prediction: Demonstrated Performance

Test Name	Stress Test Condition	Total Units Tested	Total Device Hours	No. of Failed Units
DC-High Temperature Operating Life (DCHTOL)	T _j = 150 °C; V _{dd} = 4 V, V _{pwrdown} = 0 V, JESD22-A108	75	75000	0/75

Table 2 Performance Estimated for Various Channel Temperatures

Channel Temperature (°C)	Point Typical Performance MTTF ^a (yrs)	90% Confidence MTTF (yrs)	Point Typical Performance FIT	90% Confidence FIT
150	8.56	3.71	13,333.33	30,733.33
125	190.28	82.55	599.52	1,381.88
100	6,413.84	2,782.58	17.79	41.00
85	67,014.29	29,073.45	1.70	3.92
60	5,352,988.67	2,322,337.82	0.02	0.05

- a. Point MTTF is simply the total device hours divided by the number of failures. However, in cases for which no failures are observed, the point estimate is calculated under the assumption that one unit failed.

Table 1 Operation Life Tests Results

Stress	Conditions	Duration	Failures/ Number Tested
DC-High Temperature Operating Life (DCHTOL)	Tj = 150 °C; Vdd = 4 V, Vpwrdown = 0 V, JESD22-A108	1000 hours	0/75
Wet High Temperature Operating Life (WHTOL)	85 °C/85% RH; Vdd = 4 V, Vpwrdown = 0 V/3.3 V, Cycle bias 1 hr On/Off, EIA/JESD22-A101	1000 hours	0/75

Table 2 Environmental Tests Results

Stress	Conditions	Duration	Failures/ Number Tested
Low Temperature Storage Life (LTSL)	–40 °C, JESD22-A119	1000 hours	0/75
Wet High Temperature Storage Life (WHTSL)	85 °C/85%RH	1000 hours	0/75
High Temperature Storage Life (HTSL)	150 °C, JESD22-A103	1000 hours	0/75
Thermal Cycle (TMCL)	–55 °C/125 °C, 15 min dwell, 10 min transfer, JESD22-A104	1000 cycles	0/75
Liquid Thermal Shock (LTMSK)	–65 °C/150 °C, 5 min dwell, 0 min transfer, JESD22-A106	1000 cycles	0/75

Table 3 Mechanical Tests Results

Stress	Conditions	Duration	Failures/ Number Tested
Bending Test	Bend up to 5 mm with 1 mm increment, Maintained in bend state for 5 ± 1s, IEC 68-2-21-Ue1	Every Increment	0/30
Shear Test	Force = 10N for 60 sec, IEC 68-2-21-Ue3	4 sides	0/30
Solderability	8 hr steam aging, Solder dipping at 245 °C Pb free solder, JESD22-B102	1x	0/66

Table 4 Thermal Resistance Information

Product	Conditions	Theta Jc
MGA-621P8	Vdd = 4 V, Vpwrdown = 0 V	59.4 °C/W
MGA-622P8	Vdd = 4 V, Vpwrdown = 0 V	43 °C/W

Table 5 MGA-621P8 Electrostatic Discharge (ESD) Ratings

ESD Test	Reference	Results
Human Body Model (HBM)	JS-001	800 V (Class 1B)
Machine Model (MM)	EIA/JESD22-A115	80 V (Class A)

Table 6 MGA-622P8 Electrostatic Discharge (ESD) Ratings

ESD Test	Reference	Results
Human Body Model (HBM)	JS-001	300 V (Class 1A)
Machine Model (MM)	EIA/JESD22-A115	60 V (Class A)

- HBM:
 - Class 0A is ESD voltage level <125 V.
 - Class 0B is voltage level between 125 V and 250 V.
 - Class 1A is voltage level between 250 V and 500 V.
 - Class 1B is voltage level between 500 V and 1000 V.
 - Class 1C is voltage level between 1000 V and 2000 V.
 - Class 2 is voltage level between 2000 V and 4000 V.
 - Class 3A is voltage level between 4000 V and 8000 V.
 - Class 3B is voltage level ≥ 8000 V.
- MM:
 - Class A is ESD voltage level <200 V.
 - Class B is voltage level between 200 V and 400 V.
 - Class C is voltage level ≥ 400 V.

NOTE The device is classified as ESD sensitive. Follow these precautions:

1. Ensure Faraday cage or conductive shield bag is used when the device is transported from one destination to another.
2. At SMT assembly station, if the static charge is above the device sensitivity level, place an ionizer near to the device for charge neutralization purpose.
3. Personal grounding has to be worn at all time when handling the device.

Moisture Sensitivity Level: Level 1

Preconditioning per JESD22-A113 level 1 was performed on all devices prior to reliability testing except for Solderability and ESD classification.

MSL 1 Preconditioning (JESD22-A113): HTSL 125 °C for 24 hrs + WHTSL 85 °C/85%RH for 168 hrs + 3x Pb Free Reflow, 260 °C max.

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