

MGA-633P8, MGA-634P8 and MGA-635P8

Low Noise, High Linearity Low Noise Amplifier



Reliability Data Sheet

Description

This document describes the reliability performance of MGA-63xP8 series of devices based on a series of reliability tests conducted.

Avago Technologies' MGA-63xP8 series is an economical, easy-to-use GaAs MMIC Low Noise Amplifier (LNA). The LNA has low noise and high linearity achieved through the use of Avago Technologies' proprietary 0.25µm GaAs Enhancement-mode pHEMT process. This MGA63xP8 series of devices are designed for optimum use over a different range of frequencies, i.e. 450MHz-1.5GHz for MGA-633P8, and 1.5GHz -2.3GHz for MGA-634P8. These devices are housed in a standard QFN package where the packaging reliability performance has been tested reliable based on representative product in 8pin QFN 2x2X0.75mm package.

The reliability performance of MGA-634P8 was leveraged on MGA-633P8 based on same wafer fabrication process and design.

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. Avago Technologies assumes 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 will have a direct relationship to the life stress. Using bare PHEMT die, the process was tested to determine activation energy of 1.8eV. 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
High Temperature Operating Life	T _j = 150°C DC Bias	94	94000	0

Table 2. Estimated for Various Channel Temperatures are as follows:

Channel Temp. (°C)	Point Typical Performance MTTF hours [1]	90% Confidence MTTF hours	Point Typical Performance FIT	90% Confidence FIT
150	9.40 x 10 ⁴	4.07 x 10 ⁴	10638.29	24521.3
125	2.09 x 10 ⁶	9.07 x 10 ⁵	478.33	1102.6
100	7.05 x 10 ⁷	3.06 x 10 ⁷	14.19	32.7
85	7.36 x 10 ⁸	3.19 x 10 ⁸	1.36	3.1

1. 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 3. Operation Life Tests Results

Stress	Conditions	Duration	Failures / Number tested
High Temperature Operating Life (DC-HTOL)	$T_j = 150^\circ\text{C}$; $V_{dd} = 5\text{V}$, $V_{bias} = 5\text{V}$ JESD22-A108	1000 hours	0/94
Wet High Temperature Operating Life (WHTOL)	$85^\circ\text{C}/85\%\text{RH}$; $V_{dd} = 5\text{V}$, $V_{bias} = 5\text{V}$ (on/off for 1hour) cycle bias EIA/JESD22-A101	1000 hours	0/81

Table 4. Environmental Tests Results

Stress	Conditions	Duration	Failures / Number tested
Wet & High Temperature Storage	$85^\circ\text{C}/85\%\text{RH}$	500 hours	0/81
Thermal Cycle ^[1]	$-55/125^\circ\text{C}$, 15 minutes dwell, 10 minute transfer JESD22-A104	500 cycles	0/80
Thermal Shock ^[1]	$-65^\circ\text{C}/150^\circ\text{C}$, 5mins dwell, 10secs transfer JESD22-A106	1000 cycles	0/80
High Temperature Storage Life	125C JESD22-A103	1000 hours	0/98
Low Temperature Storage Life	-40°C JESD22-A119	1000 hours	0/120
Solderability (PbFree)	Steamage 8hours, 245°C , dip for 5sec JESD22-B102	1x	0/75

1. Data leverage to similar QFN 2x2mm package (MGA-632P8)

Table 5. Thermal Resistance Information

Product	Product	Theta Jc
MGA-633P8	$V_{dd} = 5\text{V}$, $I_{dd} = 50\text{mA}$ (typ)	$72^\circ\text{C}/\text{W}$
MGA-634P8	$V_{dd}=5\text{V}$, $I_{dd}=50\text{mA}$ (typ)	$62^\circ\text{C}/\text{W}$
MGA-635P8	$V_{dd}=5\text{V}$, $I_{dd}=50\text{mA}$ (typ)	$75^\circ\text{C}/\text{W}$

Table 6. Electrostatic Discharge (ESD) Ratings:**MGA-633P8**

ESD test	Reference	Results
Human Body Model (HBM)	EIA/JESD22-A114-B	600V (Class1B)
Machine Model (MM)	EIA/JESD22-A115-A	90V (Class A)

MGA-634P8

ESD test	Reference	Results
Human Body Model (HBM)	EIA/JESD22-A114-B	500V (Class1B)
Machine Model (MM)	EIA/JESD22-A115-A	70V (Class A)

MGA-635P8

ESD test	Reference	Results
Human Body Model (HBM)	EIA/JESD22-A114-B	500V (Class 1B)
Machine Model (MM)	EIA/JESD22-A115-A	50V (Class A)

HBM

Class 0 is ESD voltage level < 250V, Class 1A is voltage level between 250V and 500V, Class 1B is voltage level between 500V and 1000V, Class 1C is voltage level between 1000V and 2000V, Class 2 is voltage level between 2000V and 4000V, Class 3A is voltage level between 4000V and 8000V, Class 3B is voltage level > 8000V.

MM

Class A is ESD voltage level < 200V, Class B is voltage level between 200V and 400V, Class C is voltage level > 400V.

ESD Sensitivity

Note: This device is classified as ESD sensitive. The following precautions should be taken:

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 (JESD22-A113) per level 1: was performed on all devices prior to reliability testing except for solderability and ESD classification.

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

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