ALM-GA001

Reliability Data Sheet

Description

This document describes the reliability performance of ALM-GA001 based on a series of reliability test conducted.

Avago Technologies' ALM-GA001 is a Low Voltage LNA module operates from 0.9GHz to 3.5GHz, designed for FPS/ISM/WiMax mobile applications. It is housed in a miniature 1.5x1.2x0.5mm^3 uDFN module. The LNA uses Avago Technologies' proprietary GaAs Enhancement-mode PHEMT process to achieve high gain with very low noise figure and high linearity.

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 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	Tj=150°C; Vdd=Vsd =2.7V	90	45,000	0/90

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

Channel Temp. (°C)	Point Typical Performance MTTF [1] (hrs)	90% Confidence MTTF (hrs)	Point Typical Performance FIT	90% Confidence FIT
150	2.21×10^4	9.59×10^3	45224	104241.4
125	4.92×10^5	2.13×10^5	4687.1	2033.4
100	1.66×10^7	7.19×10^6	60.3	139.1
85	1.73×10^8	7.751×10^7	5.8	13.3

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.

NOTE: THESE DEVICES ARE ESD SENSITIVE. THE FOLLOWING PRECAUTIONS ARE STRONGLY RECOMMENDED. ENSURE THAT AN ESD APPROVED CARRIER IS USED WHEN UNITS ARE TRANSPORTED FROM ONE DESTINATION TO ANOTHER. PERSONAL GROUNDING IS TO BE WORN AT ALL TIMES WHEN HANDLING THESE DEVICES. THE MANUFACTURER ASSUMES NO RESPONSIBILITY FOR ESD DAMAGE DUE TO IMPROPER STORAGE AND HANDLING OF THESE DEVICES.

Table 3. Operation Life Tests Results:

Stress	Conditions	Duration	Failures / Number tested
High Temperature Operating Life (HTOL)	Tj =150°C; Vdd=Vsd =2.7V JESD22-A108	500 hours	0/90
Wet High Temperature Operating Life (WHTOL)	85ºC/85%RH; Vdd=Vsd =2.7V EIA/JESD22-A101	500 hours	0/96

Table 4. Environmental Stress Test Results:

Stress	Conditions	Duration	Failures / Number tested
Low Temperature Storage Life	-40°C JESD22-A119	500 hours	0/90
High Temperature Storage Life	125°C JESD22-A103	500 hours	0/90
Wet & High Temperature Storage Life	85°C/85%RH JESD22-A113	500 hours	0/90
Thermal Cycle	-55/125°C, 15mins dwell, 10min transfer JESD22-A104	500 cycles	0/90
Thermal Shock	-65°C /150°C, 5mins dwell, 10secs transfer JESD22-A106	500 cycles	0/90

Table 5. Mechanical Test Results

Test	Test Condition	Test point	Results
Drop Test	1500Gs, pulse duration 0.5ms JESD22-B111	30 drops	0/30
Cycle Bending Test	Amplitude ±1.0mm, bending rate 80mm per min JESD22-B113	30x	0/30
Shear Test	force 10N for 60 sec IEC60068-2-21-Ue3	4 sides	0/10
Bending Test	Bend up to 5 mm with 1mm increment. Maintained in bend state for 5 +/- 1s IEC60068-2-21-Ue1	Every increment	0/30
Solderability (Pb Free)	Steam age 1hr, 245°C, dip for 5sec JESD22-B102	2x	0/66

Table 6. Thermal Resistance Information:

Stress	Product	Theta Jc
Thermal Resistance	Vdd=Vsd =2.7V	190°C/W

Table 7. Electrostatic Discharge (ESD) Ratings:

ESD test	Reference	Results
Human Body Model (HBM)	EIA/JESD22-A114	250V (Class1A)
Machine Model (MM)	EIA/JESD22-A115	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.

Handling Precautions

Note: The device is classified as ESD sensitive. Pre-caution has to be taken as follow:

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, ESD classification and mechanical test.

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

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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