



RELIABILITY QUALIFICATION REPORT FOR LEAD-FREE / RoHS-COMPLIANT / GREEN AH11-G / AH22S-G / AH103A-G

I. SUMMARY

The AH103A-G packaged in the SOIC-8 with the exposed backside copper has been lead-free/RoHS qualified to a maximum reflow profile of 260°C, and the MSL rating at this reflow profile is level 2. The lead finish is NiPdAu. The AH103A-G High Gain, High Linearity Amplifier was selected to qualify the MESFET amplifier family of devices in the SOIC-8 package because it has the highest gain, the highest RF output power and the highest current density in the MESFET amplifier SOIC-8 amplifier family. The parameters monitored for the qualification tests were Supply Current, Gain and IP3. Failures are defined as any variation of 10% or greater for Supply Current, a variation of 1 dB or greater for Gain and a variation of 2 dB or greater for IP3 as compared to the initial pre-stressed testing.

II. SCOPE

This report summarizes the reliability qualification of the AH103A-G, and by similarity the AH11-G and AH22S-G. The Application Note "453654 Solderability Test Report for WJ Products With Lead-Free Package Finish" has a detailed description of the lead-free solderability tests; results of the solderability testing are shown in Section IV. The reliability data are obtained through the performance of specified accelerated stress tests described in this document.

III. APPLICABLE DOCUMENTS

All the test procedures and test methods are consistent with industry standards. The standards referenced in this document are JEDEC standard 22.

IV. QUALIFICATION TEST PLAN

Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
Preconditioning Level 2 Lead Free	External visual 40x Temp. Cycle, -40 to 60°C, 5 cycles High Temp. Storage Life 24 hrs @ +125°C Temp. & Humidity Test 168 hrs. @ +85°C/ 60% RH Convection Solder Reflow test 3 cycles, peak temperature 260°C	N/A	3 lots, a total of 780 parts	0	JESD22-A113D JESD22-A101-B JESD22-B101A JESD22-A103C J-STD-020C	AH103A-G
Temperature Cycle	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C) Dwell time = 10 to 15 min.	500 cycles	3 lots, a total of 135 parts	0	JESD22-A104-B	AH103A-G



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Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
Highly-Accelerated Temperature and Humidity Stress Test (HAST)	Test Condition A Temp. 130°C (+/- 2°C) Pressure = 33.3 +/-1psia Relative Humidity = 85%	96 (-0, +2) hours	3 lots, a total of 135 parts	0	JESD22-A110-B	AH103A-G
Solderability Lead-Free solder	Lead-Free Solder: Sn96Ag4 Flux Type: R145 Solder Bath Requirements: 260°C	N/A	1 lot, a total of 10 parts, 80 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003	AH103A-G
Solderability Lead solder	Lead-Free Solder: Sn63Pb37 Flux Type: R145 Solder Bath Requirements: 245°C	N/A	1 lot, a total of 10 parts, 80 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003	AH103A-G
Moisture/Reflow Sensitivity (MSL) MSL level 2 lead free	Electrical test External Visual C-SAM Die, Paddle and leads Dry Bake 125°C, 24 hours 85°C/60 RH, 168 hours Convection reflow 260°C, 3X External Visual Electrical test C-SAM Die, Paddle and leads	N/A	1 lot, a total of 77 parts	0	J-STD-20C	AH103A-G
Electrostatic Discharge (ESD)	Charged Device Model (CDM) Human Body Model (HBM)	N/A N/A	15 parts 15 parts	Class III Class 1B	JESD22-C101-A JESD22-A114	AH103 AH103
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 (-0, +10) hours	3 lots, a total of 135 parts	0	JESD22-A108-B	AH103A-G
High Temp Storage Life (HTB)	Test Condition B Temp. 150°C (+10, -0°C)	1,000 (-0, +10) hours	3 lots, a total of 135 parts	0	JESD22-A103C	AH103A-G

V. DISCUSSION OF RESULTS

1. Testing procedures

The production test station was used for all of the testing, and the production test fixture was used on the loose parts. All of the qualification tests were performed using loose parts except HAST and the HTOL which were mounted to a PCB. The PCB layout is the same as the application circuit published in the WJ Communications AH103 Data Sheet (Sept 2003 revision), including the recommended via pattern. The application circuit was duplicated 15 times on one large PCB for the qualification testing. A control board consisting of 15 devices was tested before and after each set of the stressed devices to ensure measurement accuracy and repeatability.

Components are considered to have failed if any of the following occurs after being tested post-stress and compared to respective pre-stressed testing parameters for the AH103A-G: any variation of 10% or greater for Supply Current, a variation of 1 dB or greater for Gain and a variation of 2 dB or greater for OIP3. Acceptance criterion consists of having zero failures out of 45 parts to meet WJ's requirement of LTPD=5 for each test.

2. Pre-Conditioning

Three lots of 260, a total of 780 AH103A-G devices, completed pre-conditioning with no electrical failures. 30 of the 780 devices underwent pre and post stress Scanning Acoustic Microscope inspection with no failures.

3. Temperature Cycle

A total of 135 AH103A-G devices from three lots completed 500 temperature cycles with no failures.



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4. Unbiased Autoclave

A total of 135 AH103A-G devices from three lots completed Autoclave with no failures.

5. Highly Accelerated Temperature and Humidity (HAST)

A total of 135 AH103A-G devices from three lots completed HAST with no failures.

6. Solderability

See Solderability Test Report for WJ Products with Lead-Free Packaging Finish on the WJ web site.

7. Moisture/Reflow Sensitivity Classification (MSL)

A total of 77 AH103A-G devices from one lot completed MSL level 2 lead free testing with no failures. The MSL results are confirmed by the pre and post preconditioning Scanning Acoustic Microscope testing of 30 preconditioned AH103A-G devices underwent (MSL level 2 lead free profile, 260 °C peak Temperature).

8. Physical Dimensions

A total of 2 AH103A-G devices from two lots completed Inspection with no failures.

9. Electrostatic Discharge (ESD)

CDM: A total of 15 AH103 devices were tested at levels of 100, 200, 500, 1000, and 2000 Volts 3 devices per voltage. There was no degradation of performance up to and including the 500V exposure. At 1000 and 2000 Volts, high current and highly degraded RF performance caused device failure. The resulting CDM ESD JEDEC Standard JESD22-C101 classification for the AH103 is a **Class III device** (Highest Voltage Level Passed between 500V and 1000V).

HBM: A total of 15 AH103 devices were tested at levels of 100, 200, 500, 1000, and 2000 Volts 3 devices per voltage. There was no degradation of performance up to and including the 500V exposure. At 1000 and 2000 Volts, high current and highly degraded RF performance caused device failure. The resulting HBM ESD JEDEC Standard JESD22-A114 classification for the AH103 is a **Class 1B device** (Highest Voltage Level Passed between 500V and 1000V).

10. High Temp Op Life (HTOL)

A total of 135 AH103A-G devices from three lots completed 1,000 hours of HTOL with no failures.

11. High Temp Storage Life (HTB)

A total of 135 AH103A-G devices from three lots completed 1,000 hours of HTB with no failures.

VI. CONCLUSIONS

The Reliability Qualification Data demonstrates that the AH103A-G device assembled in a lead-free/RoHS-compliant/green SOIC-8 surface-mount package demonstrates high reliability and quality levels. The entire MESFET family is also qualified in the lead-free green SOIC-8 package by similarity. This includes the following device models: AH11-G and AH22S-G.



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