



I. SUMMARY

The AH201 is 1-Watt driver amplifier that offers excellent dynamic range in a 6 x 6 mm 10 pin QFN surface-mount package. The parameters monitored for the qualification tests were Supply Current, Gain and OIP3. Failures are defined as any variation of 10% or greater from the initial pre-stressed testing. The results of the individual qualification tests are located in Section V.

II. SCOPE

This report summarizes the reliability qualification of the AH201 amplifier. It is produced at the WJ Communications' GaAs fabrication facility in Milpitas, CA and assembled in a 6 x 6 mm QFN surface mount plastic package. 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	Date	Reference Document
Preconditioning Level 1	External visual 40x High temp storage life: 24 hrs @+125°C Temp. & Humidity Test 168 hrs. @ +85°C / 85% RH Infrared Solder Reflow (IR) test 3 cycles w/flux immersion, peak temp: 235°C	N/A	4 lots, a total of 1,220 parts	N/A	Q2 2002	JESD22-A113 JESD22-A101 JESD22-B101 JESD22-103 JESD22-A112.4
Temperature Cycle	Test Condition C Temp. -65°C to +150°C Dwell time = 10 to 15 min.	1000 cycles	3 lots, a total of 240 parts	0	Q2 2002	JESD22-A104-B
Unbiased Autoclave	Test Condition C Temp. 121°C, 15 psig, RH = 100%	96 hours	3 lots, a total of 220 parts	0	Q3 2002	JESD22-A102-C
Unbiased High Temperature Storage	Temp. 150°C	1000 hours	1 lot, a total of 90 parts	0	Q3 2002	JESD22-A108-B
ESD Complete details are given in section V	Charged Device Model (CDM)	N/A	1 lot, a total of 21 parts	0 failures thru 750 volts	Q3 2002	JESD22-C101-A
	Human Body Model (HBM)	N/A	1 lot, a total of 21 parts	0 failures thru 750 volts	Q3 2002	JESD22-A114
Physical Dimensions	N/A	N/A	1 lot, a total of 10 parts	0	Q3 2001	JESD22-B100-A
Solderability	N/A	N/A	1 lot, a total of 3 parts	0	Q3 2002	JESD22-B102
Highly-Accelerated Temperature and Humidity Stress Test (HAST)	Test Condition A Temp. 130°C, 33.3 psig, RH = 85%	96 hours	3 lots, a total of 240 parts	1	Q3 2002	JESD22-A110-A
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 hours	3 lots, a total of 240 parts	1	Q3 2002	JESD22-A108-B

V. DISCUSSION OF RESULTS

1. Testing procedures

All of the qualification tests were performed with the AH201 mounted to a PCB except for the following tests: ESD, Physical Dimensions and Solderability, which were performed on loose parts. The PCB layout is the same as the 900 MHz Application Circuit published in the WJ Communications Data Sheet, including the recommended via pattern. The application circuit was duplicated fifteen times on one large PCB for the qualification testing. A control board consisting of fifteen AH201's was tested before and after each set of the stressed devices to ensure measurement accuracy and repeatability.



2. Pre-Conditioning

Four lots of 305 devices for a total of 1,220 AH201 devices completed pre conditioning.

3. Temperature Cycle

Devices from three lots for a total of 240 AH201 devices completed 1000 temperature cycles with no failures

4. Unbiased Autoclave

Devices from three lots for a total of 220 AH201 devices completed 96 hours of Autoclave with no failures.

5. Unbiased High Temperature Storage

A total of 90 AH201 devices from one lot completed 1000 hours of Unbiased High Temperature Storage with no failures.

6. ESD

A total of 42 AH201 devices completed CDM and HBM ESD testing at a variety of different voltage level with no unexpected failures. The AH201 device has been classified as a **Class 1B device** (Highest Voltage Level Passed between 500V and 1000V) for Human Body Model (HBM) testing according to JEDEC Standard JESD22-A114 and as a **Class III device** (Highest Voltage Level Passed between 500V and 1000V) for Charged Device Model (CDM) testing according to JEDEC Standard JESD22-C101.

3 units were subjected at each test voltage for both CDM and HBM ESD testing. The CDM test voltages were 100, 250, 500, 750, 1,000 and 2,000 volts. The HBM test voltages were 50, 100, 150, 250, 500, 750, and 1,000 volts. Failures occurred at 1,000 volts or greater for both CDM and HBM ESD tests. The failed devices displayed a complete loss of functionality as opposed to partial degradation of RF characteristics. If any one of the three devices failed at a given voltage level, the device was said to fail at that level. The classification level was assigned according to the last voltage level at which all three parts passed post-ESD RF testing according to the test specifications set by WJ Communications.

7. Physical Dimensions

A total of 10 AH201 devices completed inspection with no failures.

8. Solderability

A total of 3 AH201 devices completed testing with no failures.

9. Highly Accelerated Temperature and Humidity Stress Test (HAST)

Devices from three lots for a total of 240 AH201 devices completed 96 hours of HAST. For the three lots, only one device failed. The catastrophic failure manifested itself as excess current. The failed part was visually inspected and then X-rayed, but no cause of the failure could be found. The part was then decapped; but because the part was badly damaged from the excess current, no root cause could be determined. Although root cause was not found for this part, the one failure, from a single lot sample of 80 parts, meets the WJCI requirement of LTPD=5 for this test. The other two lot samples had no failures.

10. High Temp Op Life (HTOL)

Devices from three lots for a total of 240 AH201 devices completed HTOL testing. For the three lots, only one part failed. The catastrophic failure was traced to poor bond adhesion, and the lot was recalled. During bonding, the edges of the leadframe array were not supported properly, causing the leadframe to shift slightly when bonded. This resulted in a weakening of the wedge bond at the interface to the bonding surface due to sheer movement during formation of the wedge or ball. As a corrective action, the leadframe array was redesigned to include the required edge support. In addition, open leadframe inspections are performed at WJ on all first run parts to insure the assembly process meets the requirements specified by WJ assembly and quality documentation. Sample bond pull, X-Ray, and other SPC inspections are performed, by our package assembly vendors, and provided to WJ on a regularly scheduled basis. The one failure, from a single lot sample of 80 parts, meets the WJCI requirement of LTPD=5 for this test. The other two lot samples had no failures.

VI. CONCLUSIONS

The Reliability Qualification Data demonstrates that the AH201 amplifier fabricated at the WJ Communications Milpitas facility and assembled in a QFN surface-mount package demonstrates high reliability and quality levels.