



This report summarizes the reliability qualification of the AH114-89 and AH118-89 HBT Amplifiers. In this qualification, the AH114-89 was used as the device under test as discussed in section II. Reliability data is obtained through the performance of Accelerated Life Tests as specified in section IV. The parameters monitored for these qualification tests were Supply Current, Gain (S21), P1dB, and OIP3. Failures are defined as follows: any variation of 10% or greater in Supply Current, S21 decrease greater than 1.8dB, OIP3 decrease greater than 3dBm, P1dB decrease greater than 1.5dBm. Changes are referenced to baseline pre-stress test data. No failures occurred as a result of the Accelerated Life Tests performed for this qualification effort. See Section V for a discussion of results.

II. SCOPE

The AH114-89 and AH118-89 are InGaP HBT Amplifiers with typical ¼ Watt output P1dB, operating from a +5V supply. They are designed as driver amplifiers offering excellent dynamic range and high gain in a simple SOT 89 style semiconductor surface mount package. The devices are manufactured at an outsource fabrication facility and are assembled by an independent semiconductor package assembly house. This qualification effort establishes a reliability level consistent with the requirements of JEDEC. In this qualification, the AH114-89 was used as the device under test. The AH118-89 can be considered qualified by similarity because it is very closely related to the AH114-89 as follows: 1) contains same amplifier architecture 2) produced at the same fabrication facility 3) uses the same fabrication processes 4) assembled into the same package style 5) by the same assembly house 6) power dissipation is spread over a larger area resulting in a lower junction temperature. These points satisfy the definition of a qualification family as specified in JESD 47A.

The AH114-89 underwent operating qualification test only, since close mechanical association to the AH110 in the SOT 89 package that passed a full qualification (see AH110 Qualification Report accessible at www.wj.com and Table 1 for AH110-89 Qualification Details) satisfies the mechanical qual. The qualification tests performed are listed in Table 1. They constitute the necessary operational accelerated environmental exposures to establish reliability of the electrical characteristics of the AH114-89.

III. APPLICABLE DOCUMENTS

The following standards are referenced: JEDEC Standard 22; JESD 47A.

IV. QUALIFICATION TEST PLAN

Stress or Test	Procedures / Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Date Done.	Reference Document	Test Device
Preconditioning Level 3	External visual 40x High temp storage life: 24 hrs @+125°C Temp. & Humidity Test 168 hrs. @ +30°C / 60% RH Convection Solder Reflow 3 cycles Peak temp: 235°C	N/A	3 lots, a total of 300 parts	N/A This stress is pre-exposure for the HAST test shown below.	Jan. 2004	JESD22-A113 JESD22-A101 JESD22-B101 JESD22-103 JESD22-A112.4	AH114
ESD Sensitivity Complete details are given in section V	Human Body Model (HBM)	N/A	30 parts	0 failures up to 500 volts 1 failure at 500V	Jan 2004	JESD22-A114	AH118
Physical Dimensions	N/A	N/A	1 lot, a total of 10 parts	0	Jan 2004	JESD22-B100-A	AH114
Solderability	N/A	N/A	1 lot, a total of 3 parts	0	Jan 2004	JESD22-B102	AH114
Highly-Accelerated Temperature & Humidity Stress Test (HAST)	Test Condition A Temp. 130°C, 33.3 psig, RH = 85%	96 hours	3 lots, a total of 135 parts	0	Feb 2004	JESD22-A110-A	AH114
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 hours	3 lots, a total of 135 parts	0	Feb 2004	JESD22-A108-B	AH114
Temperature Cycle	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C), Dwell time = 15 min.	500 cycles	3 lots, a total of 167 parts	0	March, Sept. 2003	JESD22-A104-B	AH110
Unbiased Autoclave	Test Condition D Temp. 121°C (+/-1°C), Pressure = 15 +/-1psig, Relative Humidity = 100%	168 (-1, +5) hours	3 lots, a total of 167 parts	0	March, Sept. 2003	JESD22-A102-C	AH110

Specifications and information are subject to change without notice.



The AH110-89 completed a full qualification, including both mechanical and operating tests. The highlighted portion of Table 1 lists those tests performed on the AH110-89 that were not performed on the AH114-89/AH118-89 qualification because of the close mechanical association discussed in section II.

V. DISCUSSION OF RESULTS

1. Testing Conditions and Procedures

All of the qualification tests were performed with the AH114-89's surface mount soldered to a qualification PCB except for the following: Pre-conditioning, ESD, Physical Dimensions and Solderability, which were performed on loose parts. The schematic layout for each individual device is the same as the 900 MHz Application Circuit published in the WJ Communications Data Sheet for the AH114-89, including the recommended heat sinking via pattern. The application circuit was duplicated fifteen times on a large PCB of which three were used for every test lot (a total of 45 units per lot). One of these PCB's was reserved as a control board, never exposed to any environmental stresses, to be tested along with the qualification devices ensuring measurement accuracy and repeatability. Electrical Tests were performed using the following equipment:

- HP8753D Network Analyzer with full 2-port calibration (S21, S11, S22)
- Rhode and Schwartz High Dynamic Range Spectrum Analyzer (OIP3)
- HP Digital Power Meter (P1dB)
- HP Digital Multimeter (Voltage and Current)
- HP Signal Sources (RF stimulus)

2. Pre-Conditioning

Three lots of 100 devices for a total of 300 AH114 devices completed pre conditioning.

3. ESD

Human Body Model Classification: Class 1A

A total of 30 AH118-89 devices completed Human Body Model (HBM) ESD testing with zero failures up to 500V and one failure occurring at the 500V level. Based on this result, the AH118-89 has been classified as **Class 1A** for HBM in accordance with JEDEC Standard JESD22-A114.

7. Physical Dimensions

A total of 10 AH114 devices completed physical dimension inspection with no failures.

8. Solderability

A total of 3 AH114 devices completed solderability testing with no failures.

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

Devices from three lots for a total of 135 AH114 devices completed 96 hours of HAST. For the three lots, all devices passed in accordance with the criteria set forth in the qualification effort.

10. High Temp Operating Life (HTOL)

Devices from three lots for a total of 135 AH114 devices completed HTOL testing. For the three lots, all devices passed in accordance with the criteria set forth in this qualification effort.

VI. CONCLUSIONS

These Qualification Results demonstrate that the AH114-89 amplifier has met the high standard of quality required by WJ Communications Inc, and the requirements of industry JEDEC Standards for reliability acceptance. Furthermore, the AH118-89 by the close association described in section II, also meets these high standards of quality required by WJ Communications Inc, and the requirements of industry JEDEC Standards for reliability acceptance.