



QUALIFICATION REPORT

AH115, AH116, AH215, AH312

I. SUMMARY

This report summarizes the reliability qualification of an AHxxx (AH115, AH116, AH215, and AH312) series of WJ HBT amplifiers. The reliability data are obtained through the performance of specified accelerated stress tests described in this document. Unless otherwise noted, the parameters monitored for the qualification tests were DC bias current and gain. Failures are defined as 1) a change in bias current of at least 15% or 2) a decrease in gain of at least 1.5dB from values initially measured prior to stress testing. Qualification test results are presented in Section IV and discussed in Section VI.

II. SCOPE

These members of WJs AHxxx HBT amplifier family are manufactured at an outsourced fabrication facility and packaged in a downset SOIC8 package by an independent plastic package assembly house. The table below lists characteristics of these parts:

Amplifier	Typical P1dB [W]	Typical DC Power Dissipation [5V]	Typical Current Density [5V] (kA/cm ²)
AH115	0.5W	1.25W	32.5
AH116	0.5W	1.25W	32.5
AH215	1.0W	2.25W	29.3
AH312	2.0W	4.0W	26.0

For HTOL, the AH116 was the qualification vehicle. For other tests, the AH115, AH116, and AH215 were the qualification vehicles. These parts are interchangeable when qualifying this HBT AHXXX family by similarity because:

- a) all members use combinations of identical elements (active diodes, resistors, etc)
- b) all members satisfy design requirements regarding current density, temperature and die layout
- c) all members are produced by the same fab facility with the same manufacturing processes
- d) all members are packaged by the same assembly house in the same package.

This shows this AHXXX series of HBT amplifiers satisfies the definition of qualification family presented in JESD47A.



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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	Part Tested
Preconditioning (satisfies MSL3 Sn-Pb)	High Temp. Storage Life 24 hrs @+125°C Temp. & Humidity Test 168 hrs. @ +30°C/ 60%RH 3 cycles at reflow temp >= 235C	NA	405 (3 Lots)	0	4/03 8/03	JSTD-020-B	AH115 AH116 AH215
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 of 45 units each	0	9/03	JESD22-A104-B	AH115 AH116 AH215
Unbiased Autoclave	Test Condition D Temp. 121°C (+/-1°C) Pressure = 15 +/-1psig Relative Humidity = 100%	168 (-1, +5) hours	3 Lots of 45 units each	0	9/03	JESD22-A102-C	AH115 AH116 AH215
ESD	Human Body Model (HBM)	N/A	45 (15 of each model)	0 (up to Class 1B)	2/03	JESD22-A114	AH115 AH215 AH312
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 (-0, +10) hours	3 Lots of 45 units each	0	6/03	JESD22-A108-B	AH116
1000 Hr 85/85 Steady State Temperature and Humidity Bias Life Test	Test Condition: Temp: 85°C (+/-2°C) Relative Humidity = 85% Preconditioned MSL3 245°C	1000 Hrs	4 lots of 45 units each, and one mixed Lot PWB	0	02/04	JESD22-A101-B	AH115

V. STRESS TEST METHODOLOGY

All qualification tests were performed on loose parts tested in fixtures, with the exception of 85/85 and HTOL, for which parts were mounted as part of an application circuit on a PCB. The application circuit used matches the circuit depicted on the device datasheet.

Prior to each electrical test, control units were measured to ensure proper system calibration.

Measurements for the 85/85 test using the AH115 were at 1900MHz, all other AH115 and AH215 measurements were made at 2140MHz. Measurements for the AH116 were made at 900MHz.



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Failures are defined as 1) a change in bias current of at least 15% or 2) a decrease in gain of at least 1.5dB from values initially measured prior to stress testing. Acceptance criteria consists of having 0 failures out of 45 parts to meet WJ's requirement of LPTD =5 for each test.

VI. DISCUSSION OF RESULTS

1. Pre-Conditioning

Preconditioning conditions of units that underwent Temperature Cycle, Autoclave and HAST satisfied the requirement for MSL3 Sn-Pb profiles as defined in J-STD-020B. Because no units failed Temp Cycle or Autoclave, the parts are classified as MSL3 (235C).

2. Temperature Cycle

1 lot of 45 AH115s, 1 lot of 45 AH116s, and 1 lot of 45 AH215s (all preconditioned as specified in Section VI.1) passed 500 cycles of Temp Cycle per the conditions listed in Section IV.

Bias current deltas ranged from -3.4 to 10.2%. Worst-case gain delta was -0.6dB.

3. Unbiased Autoclave

1 lot of 45 AH115s, 1 lot of 45 AH116s, and 1 lot of 45 AH215s (all preconditioned as specified in Section VI.1) passed Unbiased Autoclave per the conditions listed in Section IV.

1 sample was lost during handling.

Bias current deltas ranged from -4.8 to 9.5%. Worst-case gain delta was -0.6dB.

4. ESD (Human Body Model)

For the AH115, AH215, and AH312, different sets of three units were exposed to ESD voltages of 250, 500, 600, 1000, and 2000V. Any unit that deviated in bias current by more than 5% failed the entire set of three for that voltage level. Since 600V was the highest level at which all three units of a set pass, these AHxxx family members are classified as Class 1B HBM devices.



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5. High Temp Op Life (HTOL)

3 lots of 45 samples each passed HTOL per the conditions listed in Section IV.

Bias current deltas ranged from -13.9 to 10.4%. Worst-case gain delta was -1.1dB.

6. Steady State Temperature/Humidity Bias Life Test (85/85)

Three Lots of 45 parts each, mounted on qualification PWB's, 15 parts per PWB for a total of 12 PWB's were run in this test, with an additional PWB containing parts from all three of the lots, to be used for validation. After the 1000Hr 85/85 exposure, 100% of the devices passed all requirements, with little degradation in performance on any of them.

The worst-case bias current delta was -3.2%. Worst-case gain delta was -0.8dB.

VII. CONCLUSIONS

The data presented demonstrates this AHXXX HBT series of amplifiers meets WJ's rigorous quality standards and conforms to WJ's long history of producing high quality products. The test results described in this document meet the requirements set forth by JEDEC for establishment of reliability through accelerated life testing, and support the full qualification of the AH115, AH116, AH215, and AH312.



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