



AH110 QUALIFICATION REPORT

I. SUMMARY

This report summarizes the reliability qualification of the AH110, a 0.2W HBT amplifier. 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 10% or 2) a decrease in gain of at least 1.8 dB from values initially measured prior to stress testing. Qualification test results are presented in Section IV and discussed in Section VI.

II. SCOPE

The AH110 is manufactured at an outsourced fabrication facility and packaged in a SOT-89 package by an independent plastic package assembly house.

For Temp Cycle and Unbiased Autoclave, a packaged AH110 die variant was the qualification vehicle for one lot of qualification parts. The other two qualification lots consisted of the production AH110 die. These two parts can constitute a complete qualification by similarity because:

- a) both die use combinations of identical elements (active diodes, resistors, etc)
- b) both die meet design requirements regarding current density, temperature and die layout. Typical current density of the AH110 is 26 kA/cm².
- c) both die are produced by the same fab facility with the same manufacturing processes
- d) both die are packaged by the same assembly house in the same package.

This shows the AH110 and its variant satisfy the definition of qualification family presented in JESD-47A.

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 MSI 3 Sn-	High Temp. Storage Life 24 hrs @+125°C	N/A	3 Lots (469	0	4/03	JSTD-020-B	AH110



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(satisfies MSL3 Sn-Pb)	@+125°C Temp. & Humidity Test 168 hrs. @ +30°C/ 60%RH 3 cycles at reflow temp >= 235C		(469 Total Units)		8/03		
Temperature Cycle	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C) Dwell time = 15 min.	500 cycles	1 Lot of 77 units	0	3/03	JESD22-A104-B	AH110 Variant
			2 Lots of 45 units	0	9/03		AH110
Unbiased Autoclave	Test Condition D Temp. 121°C (+/-1°C) Pressure = 15 +/-1psig Relative Humidity = 100%	168 (-, +5) hours	1 Lot of 77 units	0	3/03	JESD22-A102-C	AH110 Variant
			2 Lots of 45 units	0	9/03		AH110
ESD	Human Body Model (HBM)	N/A	15	0 (up to Class 1B)	2/03	JESD22-A114	AH110
Highly-Accelerated Temperature and Humidity Stress Test (HAST)	Test Condition A Temp. 130°C (+/- 2°C) Pressure = 33.3 +/-1psig Relative Humidity = 85%	96 (-0, +2) hours	3 Lots of 45 units each	0 (see Section VI.5)	5/03	JESD22-A110-A	AH110
High Temperature Operating Life (HTOL)	Temp. 125C	1000 hours	3 Lots of 45 units each	0	7/03	JESD22-A108B	AH110

V. STRESS TEST METHODOLOGY

All qualification tests were performed on loose parts tested in fixtures, with the exception of HAST and HTOL, for which parts were mounted as part of an application circuit on a PCB.

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

The AH110 was measured at 1900MHz. The AH110 variant was measured at 2000MHz.

Failures are defined as 1) a change in bias current of at least 10% or 2) a decrease in gain of at least 1.8 dB 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, Autoclave, or HAST, the parts are classified as MSL3 (235C).

2. Temperature Cycle



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1 lot (77 units per lot) of AH110 variants and 2 lots (45 units per lot) of AH110s, all preconditioned as specified in Section VI.1, completed Temp Cycle without failure per the conditions listed in Section IV.

Bias current deltas ranged from -2.9 to 1.8%. Worst-case gain delta was -0.52dB.

3. Unbiased Autoclave

1 lot (77 samples per lot) of AH110 variants and 2 lots (45 units per lot) of AH110s, all preconditioned as specified in Section VI.1, completed Unbiased Autoclave without failures per the conditions listed in Section IV.

Bias current deltas ranged from -0.6 to 1.6%. Worst-case gain delta was -0.4dB.

4. ESD (Human Body Model)

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 units passed exposure to levels of at least 600V, the AH110 is classified as a Class 1B HBM device.

5. Highly Accelerated Temperature and Humidity (HAST)

3 AH110 lots of 45 samples, all preconditioned as specified in Section VI.1, each underwent HAST per the conditions listed in Section IV. Two units exceeded the bias current failure threshold. In both cases, failure of the qualification circuit caused failure of the part. Failure of the output blocking capacitor isolated the AH110 from its 50 ohm load. Without a load on the output, the AH110 can oscillate, damaging the transistor's junctions and resulting in higher bias current. However, WJ considers the AH110 to have successfully completed HAST, since the test is intended to stress the part and not the circuit.

Bias current deltas ranged from -6 to 5%. Worst-case gain delta was -1.6dB.

6. High Temp Op Life (HTOL)

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

Bias current deltas ranged from -4.7 to 4.1%. Worst gain delta was -1.2dB.

VII. CONCLUSIONS



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The data presented demonstrates the AH110 0.2W HBT amplifier 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 support the full qualification of the AH110.



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