

AH202-F QUALIFICATION REPORT

I. INTRODUCTION

The AH202-F is a 1-Watt driver amplifier that offers excellent dynamic range in a low-cost, lead-free/RoHS-compliant 6x6 mm 28-pin QFN surface-mount package. The product is targeted for use as a driver amplifier for wireless infrastructure or CATV applications where high linearity and medium power is required.

II. SCOPE

This report summarizes the reliability qualification of the AH202-F amplifier. The reliability data are obtained through the performance of specified accelerated and stress tests described in this document. The qualification of the AH202-F is by similarity to the AH201 and CV210-1F qualifications. The active elements of AH202-F and AH201 are identical. The difference between the two dies includes an addition of a passive resistor and increased thickness of the silicon nitride layer in AH202-F. The addition of the passive element to the AH201 die does not warrant a qualification effort for the die change. Changes to the passive circuitry adhere to the design guidelines of the MESFET amplifier process technology, and do not change the inherent reliability of the amplifier die.

Similarly, AH202-F package is qualified by similarity to CV210-1F package. The CV210-1F uses the same 28-pin lead-free, RoHS 6x6mm QFN package.

As a result, AH202-F is qualified by similarity to AH201 and CV210-1F.

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. STRESS AND TEST METHODOLOGY

For this qualification, components used in unbiased stresses, Temperature Cycle and Autoclave, were tested as loose parts. Components used in biased stresses, HTOL and HAST, were mounted on qualification boards. Prior to each electrical test, a control unit was measured to ensure proper test system calibration. The testing was performed on an in-house production test station.

The parameters monitored for the AH201 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 parameters monitored for the CV210-1F qualification were Supply Current, Conversion Gain, OIP3 and OIP2. Failures are defined as any variation of 10% or greater for Supply Current, a variation of 2 dB or greater for OIP3 and OIP2 and a variation of 1 dB or greater for Conversion Gain.



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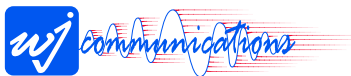
V. QUALIFICATION TEST PLAN/RESULTS

DIE TEST PLAN

Stress or Test	Procedures / Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
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	JESD22-C101-A	AH201
	Human Body Model (HBM)	N/A	1 lot, a total of 21 parts	0 failures thru 750 volts	JESD22-A114	AH201
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	JESD22-A108-B	AH201

PACKAGE TEST PLAN

Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
Preconditioning Level 1 Lead Free	External visual 40x High Temp. Storage Life 24 hrs @+125°C Temp. & Humidity Test 168 hrs. @ +85°C/ 85% RH Convection Solder Reflow test 3 cycles w/flux immersion, peak temperature 260°C	N/A	3 lots, a total of 660 parts	0	JESD22-A113C JESD22-A101-B JESD22-B101 JESD22-A103-B J-STD-020B	CV210-1F
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	CV210-1F
Unbiased Autoclave	Test Condition C Temp. 121°C (+/-1°C) Pressure = 15 +/-1psig Relative Humidity = 100%	96 (-1, +5) hours	3 lots, a total of 135 parts	0	JESD22-A102-C	CV210-1F
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, a total of 135 parts	0	JESD22-A110-B	CV210-1F
Solderability Lead-Free solder	Lead-Free Solder: Sn96Ag4 Flux Type: R145 Solder Bath Requirements: 260°C	N/A	3 lot, a total of 30 parts, 840 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003)	CV210-1F
Solderability Lead solder	Solder: Sn63Pb37 Flux Type: R145 Solder Bath Requirements: 245°C	N/A	3 lot, a total of 30 parts, 840 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003)	CV210-1F
Moisture/Reflow Sensitivity (MSL) MSL level 1 lead free	Electrical test External Visual C-SAM Die, Paddle and leads Dry Bake 125°C, 24 hours 85°C/85 RH, 168 hours Convection reflow 250°C, 3X External Visual Electrical test C-SAM Die, Paddle and leads	N/A	3 lot, a total of 300 parts	0	J-STD-20B	CV210-1F



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Unbiased High Temperature Storage (HTB)	Temp. 150°C (+ 5°C, -0°C)	1000 hours	1 lot, a total of 80 parts	0	JESD22-A103-B	CV210-3
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VI. DISCUSSION OF RESULTS

1. ESD

A total of 42 AH201 devices completed CDM and HBM ESD testing at a variety of different voltage level with no 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.

2. 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. It should be noted that the device failed due to mechanical problem. 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/JEDEC requirement of LTPD=5 for this test. The other two lot samples had no failures.

3. Pre-Conditioning

Three lots of 220, a total of 660 CV210-1F devices, completed pre-conditioning with no electrical failures. Sixty of the 660 devices underwent pre and post stress Scanning Acoustic Microscope inspection with no failures.

4. Temperature Cycle

135 CV210-1F devices from three lots completed 500 temperature cycles with 0 failures.

5. Unbiased Autoclave

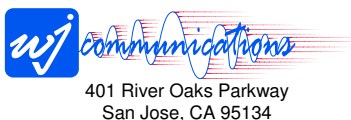
135 CV210-1F devices from three lots completed Autoclave with 0 failures.

6. Highly Accelerated Temperature and Humidity (HAST)

135 CV210-1F devices from three lots completed HAST with 0 failures.

7. Solderability

30 CV210-1F devices from three lots completed Lead-Free and Lead solderability testing with 0 failures. The samples were subjected to the solderability test in accordance with IPC/EIA/JEDEC J-STD-002B The temperature of the solder bath was maintained at 260°C, and usage was made of a lead-free solder Sn96Ag4 for this test. The solderability test involved an 8-hour steam aging step to verify the durability of the finish plating.



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It should be noted that the terminal finish for this lead-free QFN package is matte-tin over copper. The Application Note "[453654 Solderability Test Report for WJ Products With Lead-Free Package Finish](#)" on the WJ website has a detailed description of the lead-free solderability tests.

8. Moisture/Reflow Sensitivity Classification (MSL)

300 CV210-1F devices from three lots completed MSL level 1 lead free testing with no failures. The MSL results are confirmed by the pre and post preconditioning Scanning Acoustic Microscope testing that the 60 pre-conditioned CV210-1F devices underwent (MSL level 1 lead free profile, 260 °C peak Temperature).

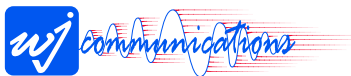
The MSL rating of the QFN 6X6 28-pin package is MSL 2, 260°C. While the package did pass MSL 1 preconditioning, it is being rated MSL 2 so that the parts will be baked out and dry packed. This will also force better handling of the device at contract manufacturers, and should improve the robustness of the device.

9. Unbiased High Temperature Storage (HTB)

A total of 80 CV210-3 devices from one lot completed 1000 hours of Unbiased High Temperature Storage with 0 failures.

V. CONCLUSIONS

The AH202-F amplifier in the Lead-Free RoHS-compliant, 28-pin 6x6mm QFN package is reliable product that has passed industry standard qualification testing.



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