

Qualification Report

MMA500 RoHS Compliant and Lead Free

I. SUMMARY

This report summarizes the reliability qualification of our newly released MMA500 High Gain Darlington Amplifier. These devices are produced by Aeroflex-Metelics in Sunnyvale, CA and assembled in a SOT-89 surface-mount plastic package. The reliability data are obtained through the performance of specified accelerated stress tests described in this document.

The MMA devices are high performance gain blocks that offer high dynamic range in a low-cost surface-mount SOT-89 package. This series of gain block uses the MMA die 603 and by similarity 606, 612 and 614 die that only differ with the values of passive components. In addition the active devices are all the same type and size. They are processed using the same process flow and are all packaged in the lead-free SOT-89. 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 on any of these parameters.

II. QUALIFICATION TEST PLAN & RESULTS

No.	Stress or Test / Reference Standard	Method / Conditions	Device Hours / Cycles	Sample Size	Failed Units	Date
1	Preconditioning Level 3 JESD22-A113	External Visual 40X High temp storage life: 24 hrs @+125°C Temp. & Humidity Test 168 hrs @+85°C / 85% RH Solder Reflow test 3 cycles W/flux immersion, peak temp: 235°C	N/A	150	0	12/04
2	Temperature Cycle JESD22-A104-A	Temp. -55°C to +150°C 10 min. at each extreme (MIL-STD 750-1051)	10 cycles	24	0	11/04
		Test Condition C Temp. -65°C to +150°C 10 min. at each extreme	10 cycles	32	0	09/04
				150	0	11/04
3	Autoclave JESD22-A102-B	Test Condition C Pressure = 15 PSI	96 hrs	32	0	09/04
				32	0	01/02
				32	0	01/03
4	High Temp Op Life (HTOL) JESD22-A108-B	Test Condition B Tj = 145°C (+/-5°C) Die MMA612	1000 hrs	20	0	07/03
5	Unbiased High Temperature Storage JESD22-A108-B	Temp. 125°C (MIL-STD 750-1032)	24 hrs	24	0	11/04
		Temp. 150°C	1000 hrs	50	0	12/04
6	HAST / JESD22-A118	Test Condition A Temp. 130°C, RH = 85%	96 hrs	50	0	12/04
7	HBM-ESD/ JESD22-A114-B	Class 1B / HBM 500V Die MMA603	N/A	11	0	10/04
8	Moisture Sensitivity/ J-STD-020B	Level 1 Sensitivity Temp. 85°C, RH = 85%	168 hrs	77	0	09/04
9	Thermal Shock JESD22-A106-A	Test Condition C Temp. 0°C to +150°C 5 min. at each extreme	15 cycles	32	0	09/04
10	Moisture Soak	Pre-Bake = 24 hrs	168 hrs	32	0	09/04
11	Solderability JESD22-B102D	Temp. 240°C Steam Aging = 8 hours	N/A	32	0	09/04
				32	0	01/03
12	Mark Permanency	30 strokes Soak Time=3 min.	N/A	32	0	09/04
				32	0	01/02
13	Open / Short	N/A	N/A	32	0	09/04

III. APPLICABLE DOCUMENTS

All of the test procedures and methods are consistent with industry standards. The standards referenced in this document are JEDEC standard 22 and MIL-STD 750 / 883.

IV. DISCUSSION OF RESULTS

1. Pre-Conditioning

A total of 150 devices completed pre conditioning.

2. Temperature Cycle

A total of 206 devices completed 10 temperature cycles with no failures. MIL-STD 750-1032 was used as the standard reference for 24 of these units that were 100% tested and passed a temperature range of -55°C to $+150^{\circ}\text{C}$ with no failures. JESD22-A104-A was used as the standard reference for the remaining 182 units that passed a temperature range of -55°C to $+150^{\circ}\text{C}$ with no failures.

3. Unbiased Autoclave

A total of 96 devices completed 96 hours of Autoclave with no failures.

4. High Temp Op Life (HTOL)

A total of 20 devices completed 1000 hours of HTOL testing with no failures.

5. Unbiased High Temperature Storage

A total of 74 devices completed 1000 hours of Unbiased High Temperature Storage with no failures. 50 devices referenced JESD22-A108-B method, where 25 pieces passed an accelerated 175°C and 25 pieces passed an accelerated 185°C temperature. An additional 25 pieces are in process at 150°C for 1000 hours. 24 devices referenced to MIL-STD 750-1032 method and passed 125°C for 24 hours.

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

A total of 50 devices completed 96 hours of HAST testing with no failures. The HAST test was performed by Wyle Labs and parts were tested to Aeroflex/Metelics' RF specifications.

7. ESD

MMA603 die completed HBM ESD testing at a variety of different voltage level and its product family 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. The units were tested using one pulse per each step with 250V step increments from 250V up to 3000V maximum. The failed devices displayed a complete loss of functionality as opposed to partial degradation of RF characteristics. If any device 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 Aeroflex/Metelics.

V. CONCLUSIONS

The Reliability Qualification Data illustrates that the Darlington Amplifier MMA500 from Aeroflex-Metelics, assembled in a lead-free SOT-89 surface-mount package, demonstrates high reliability and quality levels. MMA500 series utilizes eutectic die attach and all gold bonding system for superior thermal conductivity with maximum reliability. All devices undergo temperature cycle and thermal shock to ensure a high quality product is shipped. This document also demonstrates the high reliability and quality levels of MMA704 & 705 by similarity.