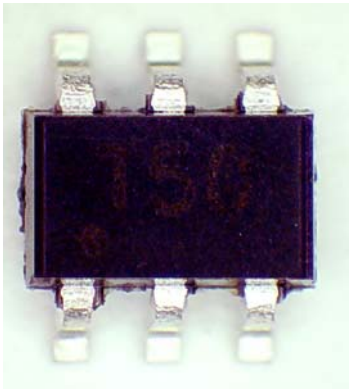
Reliability Qualification Report

STA-5063 - SnPb Plated

STA-5063Z - Matte Sn, RoHS Compliant



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Document RQR-103746 Rev B

STA-5063/5063Z
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I. Qualification Overview

The STA-5063/5063Z products have demonstrated reliable operation by passing all qualification testing in our product qualification test plan. These products have been subject to stresses such as humidity (autoclave), extreme hot and cold environments (temperature cycling), moisture sensitivity (MSL-1 and solder reflow testing), and have demonstrated reliable performance.

II. Introduction

Sirenza Microdevices' STA-5063/5063Z are general purpose class A amplifier which utilizes InGaP GaAs Heterojunction Bipolar Transistor (HBT) amplifier housed in a low cost surface-mountable plastic package. These products are specifically designed as a driver amplifier for 3.3-6.2GHzWLAN 802.11a and 5.8GHz ISM band applications. It can run from a fixed 3.0-3.6V supply with its on chip active bias network which includes a power up and down switch. On-chip impedance matching circuitry provides a 50Ω nominal RF input and output impedance. Its high linearity makes it an ideal choice for Multi-carrier and digital applications. Included in the active bias circuit is a power up and down control. Housed in an industry standard SOT-363 package, it has no blind solder joints and designed for low cost.

III. Fabrication Technology

These amplifiers are manufactured using a InGaP Heterojunction Bipolar Transistor (HBT) technology. This self-aligned emitter, double poly HBT process has been in production by our foundry since 1998. The process has been successfully used and deployed for a wide range of RFIC products.

IV. Package Type

The STA-5063/5063Z amplifiers are encapsulated SOT-363 package that is assembled using a highly reproducible automated assembly process. The die is mounted using an industry standard thermally and electrically conductive silver epoxy.

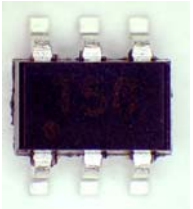

Figure 1: Image of SOT-363 Encapsulated Plastic Package

SIRENZA MICRODEVICES

V. Qualification Methodology

The Sirenza Microdevices qualification process consists of a series of tests designed to stress various potential failure mechanisms. This testing is performed to ensure that Sirenza Microdevices products are robust against potential failure modes that could arise from the various die and package failure mechanisms stressed. The qualification testing is based on JEDEC test methods common to the semiconductor industry. A FMEA approach is used to determine the test methods to be included in the qualification plan. The manufacturing test specifications are used as the PASS/FAIL criteria for initial and final DC/RF tests.

VI. Qualification By Similarity

A device can be qualified by similarity to previously qualified products provided that no new potential failure modes/mechanisms are possible in the new design.

VII. Operational Life Testing

Sirenza Microdevices defines operational life testing as a DC biased elevated temperature test performed at the maximum operational junction temperature limit. For the STA-5063/5063Z, the maximum operational temperature limit is 150°C. The purpose of the operational life test is to statistically show that the product operated at its maximum operational ratings will be reliable by operating devices up of 1000 hours. The results for this test are expressed in device hours that are calculated by multiplying the total number of devices passing the test by the number of hours tested.

VIII. Moisture Sensitivity Level - MSL Level 1 Device

STA-5063/5063Z has successfully completed 168 hours of moisture soak (85°C/85%RH), followed by three passes through a convection reflow oven at 270°C (Z versions), or at 235°C (non-Z versions). The successful completion of this test classifies the part as JESD 22-A113B Moisture Sensitivity Level 1 (MSL-1). MSL-1 indicates that no special dry pack requirements or time limits from opening of static bag to reflow exist for the STA-5063/5063Z. MSL-1 is highest level of moisture resistance that a device can be classified according to the above mentioned standard.

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IX. Electrostatic Discharge Classification

Sirenza Microdevices classifies Human Body Model (HBM) electrostatic discharge (ESD) according to the JESD22-A114 convention. All pin pair combinations were tested. Each pin pair is stressed at one static voltage level using 1 positive and 1 negative pulse polarity to determine the weakest pin pair combination. The weakest pin pair is tested with 3 devices below and above the failure voltage to classify the part. The Pass/Fail status of a part is determined by the manufacturing test specification. The ESD class quoted indicates that the device passed exposure to a certain voltage, but does not pass the next higher level. The following table indicates the JESD ESD sensitivity classification levels.

Class	Passes	Fails
0	0 V	<250 V
1A	250 V	500 V
1B	500 V	1000 V
1C	1000 V	2000 V
2	2000 V	4000 V

Part	Class
STA-5063/5063Z	1C

X. Operational Life Test Results

The results for STA-5063/5063Z High Temperature Operating Life Test are as follows

Test Duration	Junction Temperature	Quantity	Device Hours
1000 hours	**150˚C**	**40**	**40,000**
1000 hours	**150˚C**	**80**	**80,000**

Table 1: Summary of High Temperature Operational Life Test Cumulative Device Hours

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XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
A0	Preconditioning	MSL1 Reflow @ 235°C Peak JESD22-A113C (Non-Z version)	172 (1)	Pass
		MSL1 Reflow @ 270°C Peak JESD22-A113C (Z version)	310	Pass
A1a	Temperature Cycling	Air to Air, Soldered on PCB -65°C to 150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B (Non-Z version)	20 (2)	Pass
		Air to Air, Soldered on PCB -65°C to 150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B (Z version)	22	Pass
A1	Temperature Cycle	-65°C to +150°C 10 min dwell, 1 min transition 500 cycles JESD22-A104B (Non-Z version)	24	Pass
		-65°C to +150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B (Z version)	30	Pass

(1) 1 device removed from group due to an indeterminate test issue..

(2) 1 device removed for improper assembly. CAR#375. Reference FA04030.

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XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
A2	High Temperature Operating Life	Tj = 150°C 1000 hours JESD22-A108B (Non-Z version)	40	Pass
		Tj = 150°C 1000 hours JESD22-A108B (Z version)	80	Pass
B	HAST	Tamb=110°C, 85%RH Biased, 264 hours JESD22-A110B (Non-Z version)	13	Pass
		Tamb=110°C, 85%RH Biased, 264 hours JESD22-A110B (Z version)	15	Pass
C	Autoclave	Tamb=121°C, 100%RH Un-Biased, 96 hours JESD22-A102C (Non-Z version)	60	Pass
		Tamb=121°C, 100%RH Un-Biased, 96 hours JESD22-A102C (Z version)	30	Pass

XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
D	Power Temperature Cycle	-40°C to +85°C Cycled bias (5' on/5'off) 1000 cycles JESD22-A109A (Non-Z version)	10	Pass
		-40°C to +85°C Cycled bias (5' on/5'off) 1000 cycles JESD22-A109A (Z version)	20	Pass
E	High Temperature Storage	Tamb=150°C 1000 hours JESD22-A103B (Non-Z version)	40	Pass
		Tamb=150°C 1000 hours JESD22-A103B (Z version)	30	Pass
E2	Low Temperature Storage	Tamb=-65°C 1000 hours (Non-Z version)	30	Pass
		Tamb=-65°C 1000 hours (Z version)	30	Pass

XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
F	Tin Whisker	Tamb=60°C, 90%RH 1630 hours NEMI	10	Pass
G	Solderability	Dip & Look Steam Age Condition C Dip Condition A, 215°C JESD22-B102C (Z version)	15	Pass
		Dip & Look Steam Age Condition C Dip Condition A, 215°C JESD22-B102C (Z version)	15	Pass

XII. Junction Temperature Determination

One key issue in performing qualification testing is to accurately determine the junction temperature of the device. Sirenza Microdevices uses a 3um spot size emissivity corrected infrared camera measurement to resolve the surface temperature of the device at the maximum operational power dissipation. The results are displayed below for the STA-5063 running at operational current of Id= 45mA, a device voltage of 3.3V, lead temperature of 84.4°C, and no RF applied.

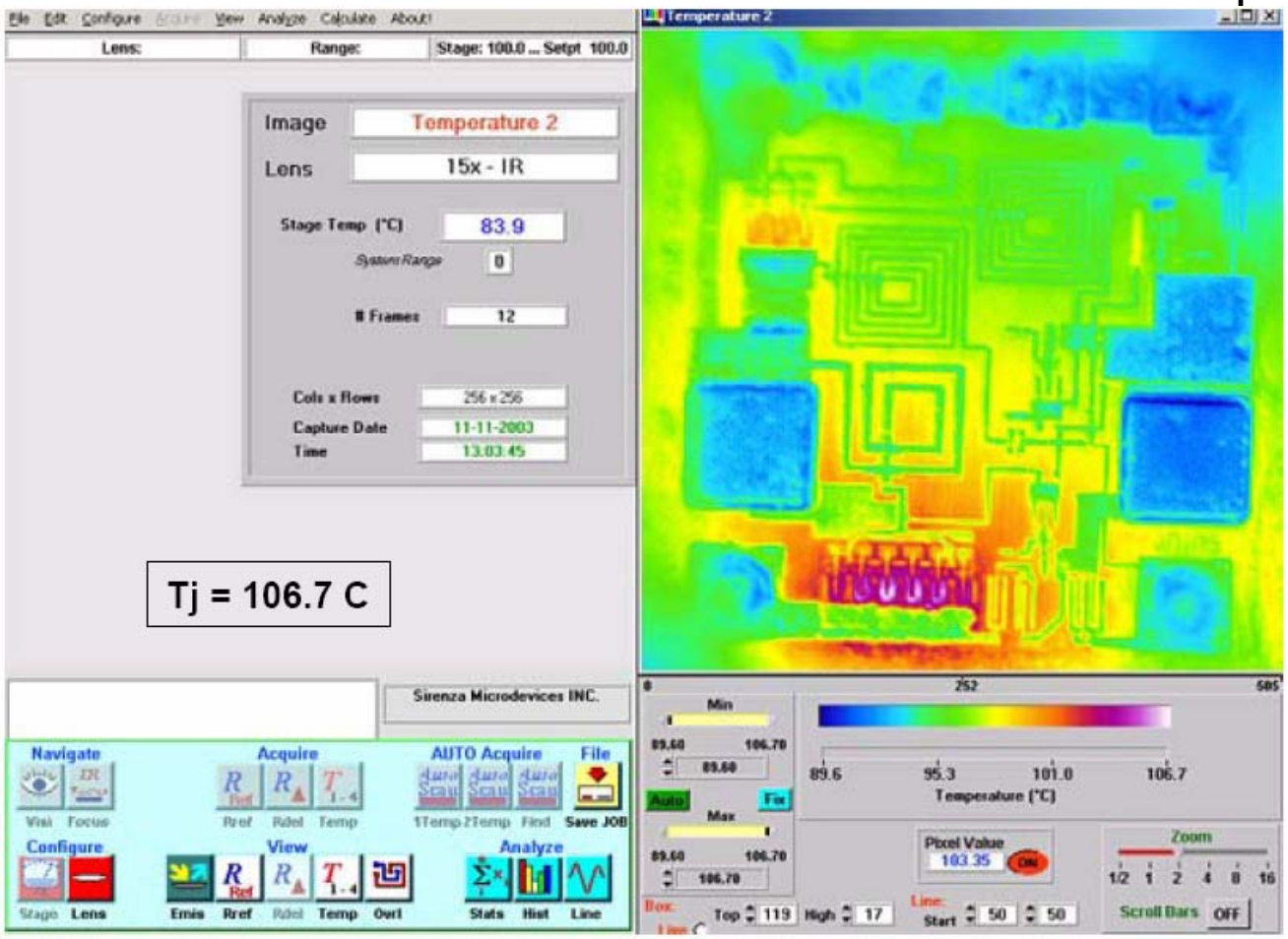

Figure 2: Infrared Thermal Image of STA-5063, Vbias= 3.3V, Id =45 mA, T lead = 84.4°C