

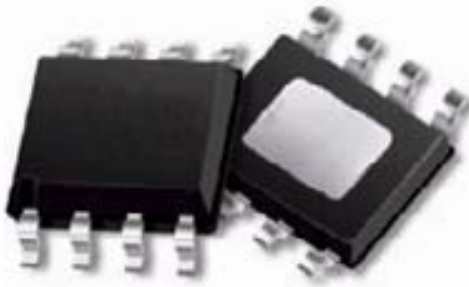


Reliability Qualification Report

SPA-2318 - SnPb Plated
SPA-2318Z - Matte Sn, RoHS compliant

Products Qualified by Similarity

SPA-1118	SPA-1218	SPA-1318	SPA-2118	SXA-3318B
SPA-1118Z	SPA-1218Z	SPA-1318Z	SPA-2118Z	SXA-3318BZ



The information provided herein is believed to be reliable at press time. Sirenza Microdevices assumes no responsibility for inaccuracies or omissions. Sirenza Microdevices assumes no responsibility for the use of this information, and all such information shall be entirely at the user's own risk. Data subject to change.

303 S. Technology Ct, Broomfield CO, 80021

Phone: (800) SMI-MMIC

<http://www.sirenza.com>

Document RQR-102057 Rev. F





SPA-2318/SPA-2318Z Reliability Qualification Report

I. Qualification Overview

The SPA-2318 family of products has demonstrated reliable operation by passing all qualification testing outlined in our product qualification test plan. The SPA-2318 has been subject to stresses such as humidity (autoclave), extreme hot and cold environments (temperature cycling), moisture sensitivity (MSL-1 and solder reflow testing), and demonstrated reliable operation.

II. Introduction

Sirenza Microdevices SPA-2318 is a high efficiency GaAs Heterojunction Bipolar Transistor (HBT) amplifier housed in a low-cost surface-mountable plastic package. These HBT amplifiers are fabricated using molecular beam epitaxial growth technology which produces reliable and consistent performance from wafer to wafer and lot to lot. This product is specifically designed for use as a driver amplifier for infrastructure equipment in the 1960 and 2140MHz bands. Its high linearity makes it an ideal choice for multi-carrier and digital applications.

III. Fabrication Technology

The SPA family of amplifiers are manufactured using a patented GaAs Heterojunction Bipolar Transistor (HBT) technology. The devices are fabricated using Molecular Beam Epitaxy (MBE) technology which produces consistent and reproducible performance from lot to lot. Through the use of an optimized MBE growth process as well as device profile design, excellent reliability with MTTF of greater than 1×10^7 hours at 150 deg C have been achieved.

IV. Package Type

The SPA-2318 power amplifier is packaged in a plastic encapsulated Epad-8 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. The die is mounted directly to the exposed paddle to provide a low thermal resistance path for heat conduction out of the package when soldered directly to the ground plane of a PCB.

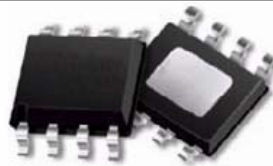


Figure 1 : Photograph of Exposed Pad 8 Encapsulated Plastic Package



SPA-2318/SPA-2318Z

Reliability Qualification Report

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. 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 provided that no new potential failure modes/mechanisms are possible in the new design. The following products have been qualified by similarity to SPA-2318/2318Z:

SPA-1118, SPA-1118Z, SPA-1218, SPA-1218Z, SPA-1318, SPA-1318Z, SPA-2118, SPA-2118Z, SXA-3318B, SXA-3318BZ

VII. Operational Life Testing

Sirenza Microdevices defines operational life testing as a DC biased elevated temperature test performed at the maximum junction temperature limit. For the SPA-2318 family, the absolute maximum temperature limit is 150°C. The purpose of the life test is to statistically show that the product operated at its maximum recommended ratings will be reliable by operating several devices at absolute maximum for a total time 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.



SPA-2318/SPA-2318Z Reliability Qualification Report

VIII. Moisture Sensitivity Level - MSL Level 1 Device

Sirenza Microdevices classifies moisture sensitivity levels (MSL) according to the JESD 22-A113 convention. Moisture sensitivity levels are ranked from level 1 (most resistive to moisture) to level 5 (least resistive to moisture). The moisture sensitivity level is determined by a moisture soak test (temperature and humidity) for various temperatures, humidity levels, and times according to the requirements for a particular level, followed by three passes through a convection reflow oven at 270°C (Z version), or at 235°C (non-Z version). This simulates stress from storage in high humidity environments and immediate assembly. For a device to be classified level 1 (MSL-1), the device must pass manufacturing test specifications following the moisture soak and reflow test. The results of the testing classify SPA-2318 as MSL-1, the most resistant to humidity, indicating that no special anti-moisture packaging or handling is required.

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 Number	HBM ESD Rating
SPA-2318/2318Z	Class 0
SXA-3318/3318Z	Class 1C

X. Operational Life Test Results

HTOL Completion Date	Test Duration	Junction Temperature	Quantity	Device-Hours
May 2002 (Non Z)	1000 hours	150°C	245	245,000
June 2005 (Z)	1000 hours	150°C	80	80,000



SPA-2318/SPA-2318Z Reliability Qualification Report

XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
B	Preconditioning	MSL1 Reflow @ 235°C Peak JESD22-A113C (Non-Z version)	645	Pass
		MSL1 Reflow @ 270°C Peak JESD22-A113C (Z version)	205	
B1a	Temperature Cycling	Air to Air, Soldered on PCB -65°C to 150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	22	Pass
B1b	High Temperature Operating Life	T _j = 150°C 1000 hours JESD22-A108B (Non Z version)	245	Pass
		T _j = 150°C 1000 hours JESD22-A108B (Z version)	80	
B1c	HAST	T _{amb} =110°C, 85%RH Biased, 264 hours JESD22-A110B	24	Pass
B1d	Power Temperature Cycle	-40°C to +85°C Cycled bias (5' on/5' off) 1000 cycles JESD22-A105	40	Pass



SPA-2318/SPA-2318Z Reliability Qualification Report

XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
B3	Temperature Cycle	-65°C to +150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	155	Pass
C	Autoclave	T _{amb} =121°C, 100%RH Un-Biased, 96 hours JESD22-A102C	50	Pass
E	High Temperature Storage	T _{amb} =121°C 500 hours JESD22-A103B	55	Pass
F	Tin Whisker	T _{amb} =60°C, 90%RH 3500 hours NEMI (Z version)	9	Pass
		T _{amb} =60°C, 90%RH 7000 hours NEMI (Z version)	20	
G	Solderability	Dip & Look Steam Age Condition C Dip Condition A, 215°C JESD22-B102C	45	Pass
		Dip & Look Steam Age Condition C Dip Condition B, 245°C JESD22-B102C	15	



SPA-2318/SPA-2318Z Reliability Qualification Report

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 SPA-2318 device running at operational current of $I_q = 384\text{mA}$, a device voltage of 5.1V , lead temperature of 85°C , and no RF applied.

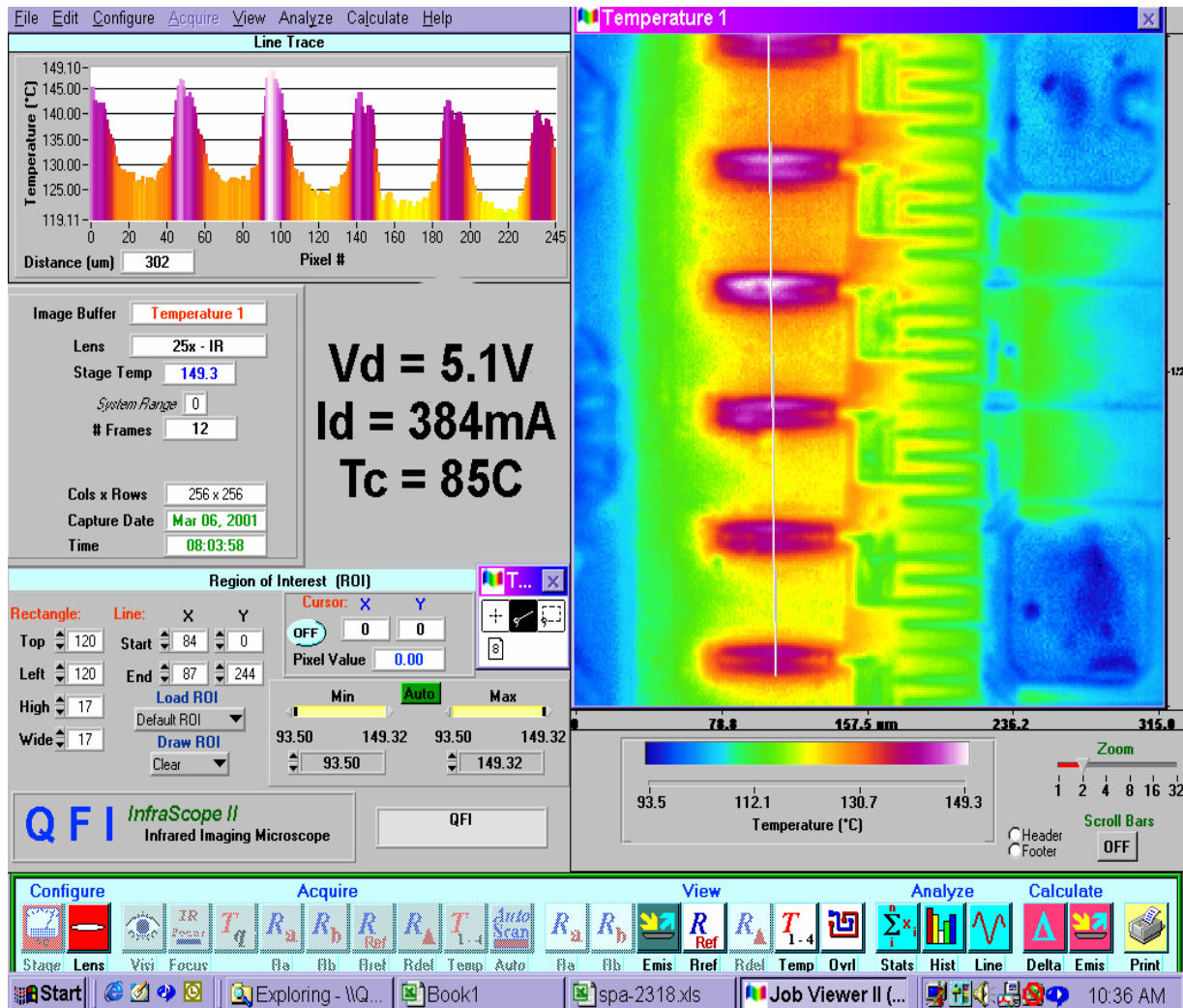


Figure 2: Infrared Thermal Image of SPA-2318, $V_d = 5.1\text{V}$, $I_d = 384\text{mA}$, $T_c = 85^\circ\text{C}$