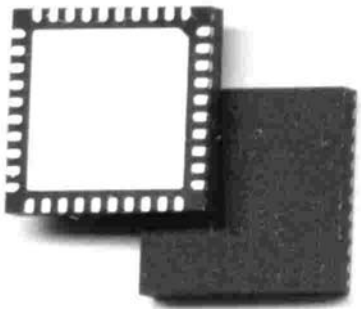
Reliability Qualification Report

SZM-3066Z - Matte Sn, RoHS Compliant

Products Qualified by Similarity

SZM-2066Z	**SWA-5002Z**
SZM-2166Z	**SWA-5004Z**
SZM-3166Z	



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SZM-3066Z Reliability Qualification Report

I. Qualification Overview

The SZM-3066Z product has demonstrated reliable operation by passing all qualification testing in our product qualification test plan. It 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 has demonstrated reliable performance.

II. Introduction

Sirenza Microdevices SZM-3066Z is a multi-stage high linearity class AB Heterojunction Bipolar Transistor (HBT) amplifier housed in a low-cost surface-mountable plastic multi-chip module package. This product is specifically designed as a final or driver stage for 802.16 equipment in the 3.3-3.8 GHz bands. It is a robust design with on chip active bias, power up down control, power detector, interstage matching networks and ESD protection.

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 SZM-3066Z is packaged in a plastic encapsulated 6mm X 6mm Quad Flat Pack No-Lead (QFN) 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: 6mm X 6mm QFN Encapsulated Plastic Package

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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. The following products are qualified by similarity to the SZM-3066Z:

SZM-2066Z SZM-2166 SZM-3166Z SWA-5002Z SWA-5004Z

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 SZM-3066Z the maximum operational junction temperature limit is 150ºC. 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

SZM-3066Z has successfully completed 168 hours of moisture soak (85ºC/85%RH), followed by three passes through a convection reflow oven at 270ºC. 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 SZM-3066Z. MSL-1 is highest level of moisture resistance that a device can be classified according to the above mentioned standard.

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VI. 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
SZM-3066Z	Class 1C
SZM-3166Z	Class 1C
SZM-2066Z	Class 1B
SZM-2166Z	Class 1B
SWA-5002Z	Class 1C
SWA-5004Z	Class 1B

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 QFN product family, the maximum operational temperature limit is 150ºC. 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.

Test Duration	Junction Temperature	Quantity	Device Hours
1000 hours	**150˚C**	**40**	**40,000**
1000 hours	**150˚C**	**78**	**78,000**

Summary of High Temperature Operational Life Test Cumulative Device Hours

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VIII. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
A0	Preconditioning	MSL1 Reflow @ 270ºC Peak JESD22-A113C	135	Pass
A1a	Temperature Cycling	Air to Air, Soldered on PCB -65ºC to 150ºC 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	10	Pass
A1	Temperature Cycle	-65°C to +150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	271	Pass
A2	High Temperature Operating Life	Tj = 150°C 1000 hours JESD22-A108B	118	Pass
B	HAST	Tamb=110°C, 85%RH Biased, 264 hours JESD22-A110B	9	Pass
C	Autoclave	Tamb=121°C, 100%RH Un-Biased, 96 hours JESD22-A102C	15	Pass

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VIII. 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	33	Pass
E	High Temperature Storage	Tamb=150°C 1000 hours JESD22-A103B	20	Pass
E2	Low Temperature Storage	Tamb=-65°C 1000 hours	20	Pass
F	Tin Whisker	Tamb=60°C, 90%RH 2000 hours NEMI	10	Pass
G	Solderability	Dip & Look Sn63/Pb37 solder Steam Age Condition C Dip Condition A, 215°C JESD22-B102C	15	Pass
		Dip & Look Sn/Ag/Cu solder Steam Age Condition C Dip Condition B, 245°C JESD22-B102C	45	Pass

IX. 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 temperature of the device at the maximum operational power dissipation. Typical result for the SZM-3166Z device running at operational current of Id=924mA, a device voltage of 5.2V, lead temperature of 85°C, and 27dBm applied are shown below.

Tj=142.9°C

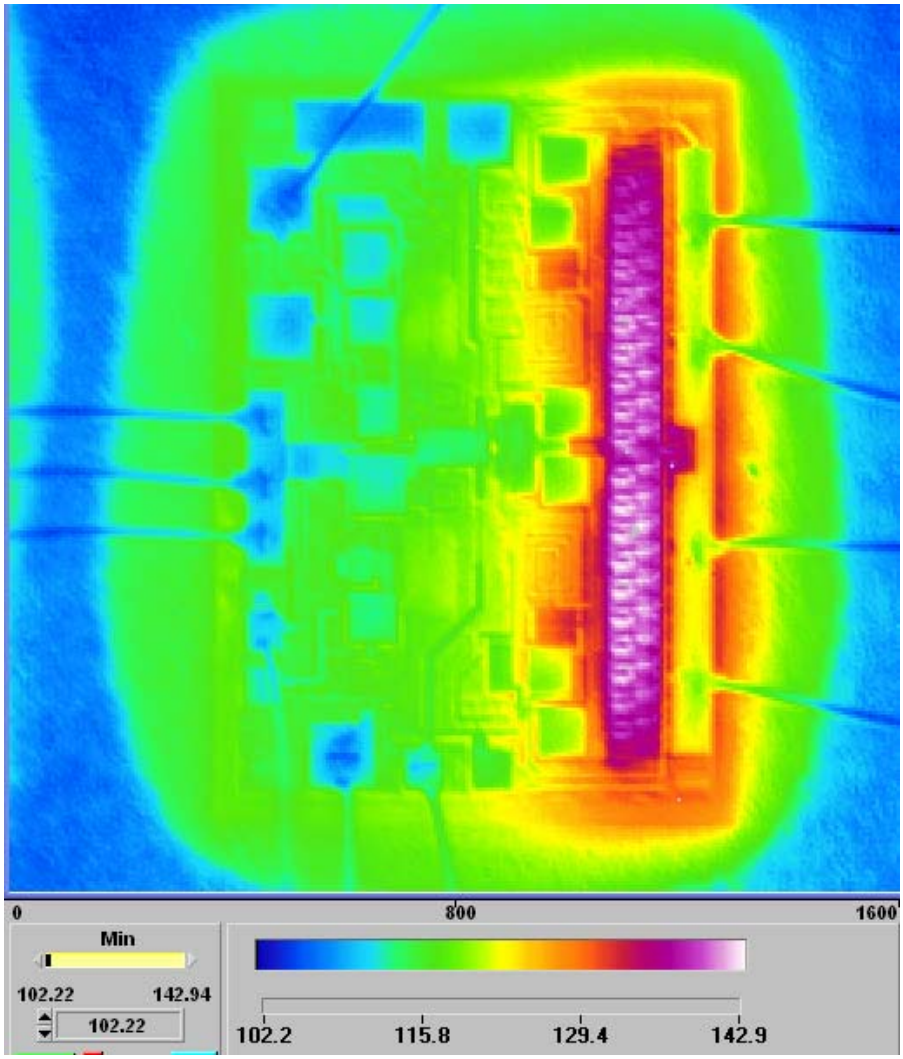

Figure 2: Infrared Thermal Image of SZM-3166Z, Vbias= 5.2V, Id = 924mA, 27 dBm RF output power, Tlead = 85°C

X. Thermal Resistance (junction to lead)

Junction temperature measurements determine the thermal resistance (Rth) of the product. Statistically calculated thermal resistances (°C/W) are given in the table below.

Part	Rth (C/W)
SZM-3066Z	12
SZM-3166Z	12
SZM-2066Z	12
SZM-2166Z	12
SWA-5002Z	12
SWA-5004Z	12