



Reliability Qualification Report

SPF-5043Z - Matte Sn, RoHS Compliant

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SPF-5043Z

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I. Qualification Overview

The SPF-5043Z product has demonstrated reliable operation by passing all qualification testing in our product qualification test plan. The SPF-5043Z 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' SPF-5043Z is a fully matched ultra-low noise, high linearity MMIC LNA designed for 500-2500 MHz operation. It delivers 1.0dB noise figure and 34dBm OIP3 at 1900 MHz (5V, 45ma), and requires only 5-6 external components.

III. Fabrication Technology

The SPF-5043Z are manufactured using a 0.5 micron optical gate enhancement and depletion pHEMT process featuring three thick global interconnect layers that are encapsulated in a high performance interlayer dielectric. This process is used for low-noise amplifiers as well as power amplifiers and integrated transceivers.

IV. Package Type

The SPF-5043Z is packaged in a plastic encapsulated SOT-343 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-343 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 provided that no new potential failure modes/mechanisms are possible in the new design. No products are qualified by similarity at this time.

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 SPF-5043Z 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

SPF-5043Z has successfully completed 168 hours of moisture soak (85°C/85%RH), followed by three passes through a convection reflow oven at 270°C. 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 SPF-5043Z. 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
SPF-5043Z	Class 1A

X. Operational Life Test Results

The results for SPF-5043Z High Temperature Operating Life Test are as follows

Test Duration	Junction Temperature	Quantity	Device Hours
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
B	Preconditioning ⁽¹⁾	MSL1 Reflow @ 270°C Peak JESD22-A113C	160	Pass
B1a	Temperature Cycling	Air to Air, Soldered on PCB -65°C to 150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	27	Pass
B1b	High Temperature Operating Life	T _j = 150°C 1000 hours JESD22-A108B	80	Pass
B1c	HAST	T _{amb} =110°C, 85%RH Biased, 264 hours JESD22-A110B	15	Pass
B1d	Power Temperature Cycle	-40°C to +85°C Cycled bias (5' on/5'off) 1000 cycles JESD22-A109A	20	Pass
B2	Autoclave	T _{amb} =121°C, 100%RH Un-Biased, 96 hours JESD22-A102C	30	Pass
B3	Temperature Cycle	-65°C to +150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	30	Pass

(1) Preconditioning for Test Groups B1-B3.



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XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
C	Low Temperature Storage	Tamb=65°C 1000 hours	30	Pass
D	High Temperature Storage	Tamb=150°C 1000 hours JESD22-A103B	30	Pass
F	Tin Whisker	Temperature Cycle -55°C to +85°C 10 minute soak 1000 cycles	25	Pass
		Temp-Humidity 23°C, 55%RH 4000 hours	25	Pass
		Temp-Humidity 60°C, 87%RH 4000 hours	25	Pass
G	Solderability	Dip & Look Sn/Ag/Cu solder Steam Age Condition C Dip Condition B, 245°C JESD22-B102C	15	Pass

XII. Junction Temperature Determination

One key issue in performing qualification testing is to accurately determine the channel temperature of the device. Liquid crystal measurements indicate a thermal resistance of 125 °C/W, channel to lead.