

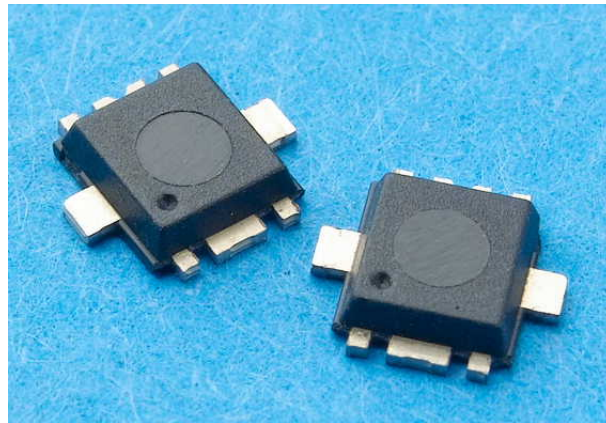


# Reliability Qualification Report

**SZP-3026Z**

**Products Qualified by Similarity**

**SZP-2026Z  
SPB-2026Z  
SPA-1426Z  
SPA-1526Z**



**Initial Qualification      June 2005**

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# SZP-3026Z Reliability Qualification Report

## I. Qualification Overview

The SZP-3026Z has demonstrated reliable operation by passing all qualification testing in our product qualification test plan. The SZP-3026Z has been subjected to stress testing such as humidity (HAST and autoclave), extreme hot and cold environments (temperature cycling), moisture sensitivity (MSL-1 and solder reflow testing), and operational life testing.

## II. Introduction

Sirenza Microdevice's SZP-3026Z is a high linearity single stage class AB Heterojunction Bipolar Transistor (HBT). It is designed as a flexible final or driver stage for 802.16 equipment in the 2.7-3.8GHz bands and can run from a 3V to 6V supply.

## III. Fabrication Technology

The SZP-3026Z amplifier is manufactured using a InGaP Heterojunction Bipolar Transistor (HBT) technology. The devices are fabricated using MOCVD epitaxy technology which produces consistent and reproducible performance from lot to lot. Through the use of InGaP emitters, a mature MMIC fabrication process and rigorous in-process monitoring, excellent reliability with MTTF of greater than  $1 \times 10^6$  hrs at 150°C junction temperature has been achieved.

## IV. Package Type

The SZP-3026Z power amplifier is packaged in a plastic encapsulated SOF-26 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. This product is RoHS compliant and Green package with matte tin finish.

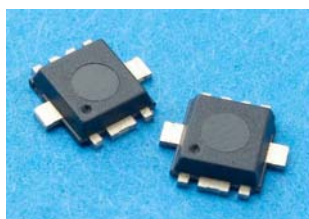


Figure 1 : Photograph of SOF-26 Encapsulated Plastic Package





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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. 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 have been qualified by similarity to SZP-3026Z:

SZP-2026Z SPB-2026Z SPA-1426Z SPA-1526Z

## 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 SZP-3026Z 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.

## VIII. Moisture Sensitivity Level - MSL Level 1 Device

Sirenza Microdevices classifies moisture sensitivity levels (MSL) according to the JEDEC 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. 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 SZP-3026Z as MSL-1, the most resistant to humidity, indicating that no special anti-moisture packaging or handling is required.





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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.

HBM 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
SZP-3026Z	Class 1C
SZP-2026Z	Class 1C
SPB-2026Z	Class 1C
SPA-1526Z	Class 1C

## X. Operational Life Test Results

The results for SZP-3026Z High Temperature Operating Life Test are as follows

Test Duration	Junction Temperature	Quantity	Device Hours
1000 hours	150°C	40	40,000





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## XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
B	Preconditioning	MSL1 Reflow @ 270°C Peak JESD22-A113C	193	Pass
B1a	Temperature Cycling	Air to Air, Soldered on PCB -65°C to 165°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	5	Pass
B1b	High Temperature Operating Life	T <sub>j</sub> = 150°C 1000 hours JESD22-A108B	40	Pass
B1c	HAST	T <sub>amb</sub> =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
B3	Temperature Cycle	-65°C to +150°C 10 min dwell, 1 min transition 1000 cycles JESD22-A104B	158	Pass
C	Autoclave	T <sub>amb</sub> =121°C, 100%RH Un-Biased, 96 hours JESD22-A102C	11	Pass





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## XI. Qualification Test Results

Group	Test Name	Test Condition/ Standard	Sample Size	Results
G	Solderability	Dip & Look Sn/Pb solder Steam Age Condition C Dip Condition A, 215°C JESD22-B102C	45	Pass
		Dip & Look Sn/Ag/Cu solder Steam Age Condition C Dip Condition B, 245°C JESD22-B102C	45	Pass
F	Tin Whiskering	Tamb=60°C, 90%RH 1500 hours	5	Pass
		Tamb=60°C, 87%RH 3000 hours	6	Pass
		Temp Cycle -55°C to 85°C 1500 cycles	6	Pass
		150°C storage 3000 hours	6	Pass
		Tamb=30°C, 60%RH 3000 hours	6	Pass

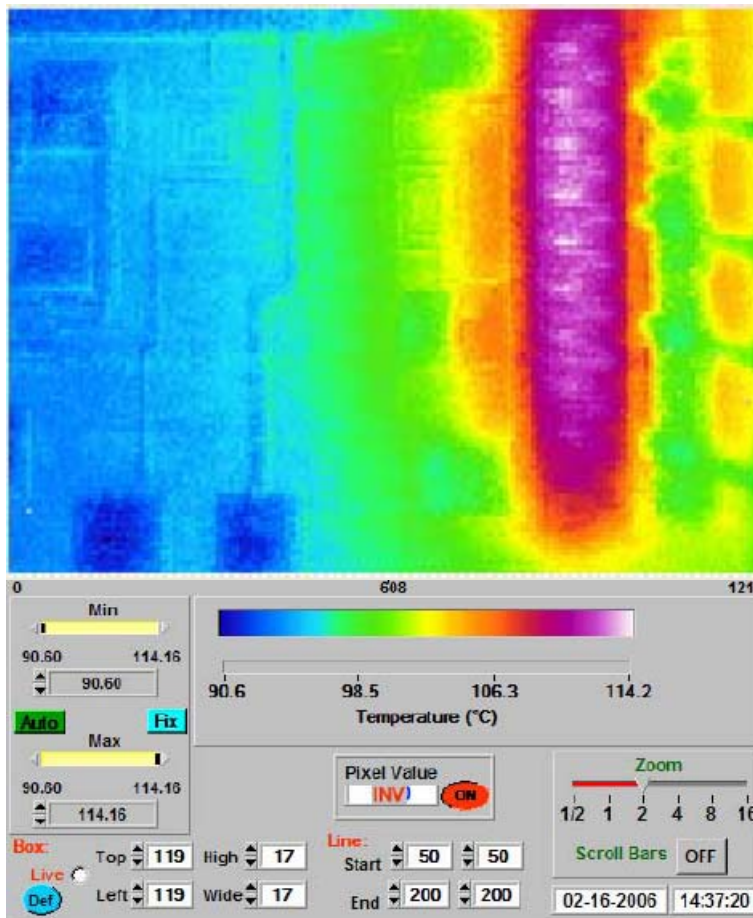




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## XII. Junction Temperature

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 SZP-3026Z device running at operational current of 501 mA, a device voltage of 5V, lead temperature of 85.0°C, and RF drive with Pout=26 dBm.



T<sub>j</sub> = 114 °C

Figure 2: Infrared Thermal Image of SZP-3026Z, V<sub>d</sub> =5V, I<sub>d</sub> = 501 mA, P<sub>out</sub>=26dBm, Lead Temp = 85.0°C





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### XII. Thermal Resistance

Junction temperature measurements determine the thermal resistance ( $R_{th}$ ) of the product. Statistically calculated thermal resistances ( $^{\circ}C/W$ ) are given in the table below.

Part	$R_{th}$ (C/W)
SZP-2026Z	12
SZP-3026Z	12
SPB-2026Z	12
SPA-1426Z	21
SPA-1526Z	12

