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Reliability and Qualification Report

Silan BP3 Process Reliability Qualification using the SPX2945

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Device Description:

The SPX2945 is a low power voltage regulator. This device is an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. The SPX2945 features very low quiescent current (100µA Typ.) and very low dropout voltage. This includes a tight initial tolerance of 1% max and very low output temperature coefficient, making the SPX2945 useful as a low power voltage reference. The error flag output feature is used as power-on reset for warning of a low output voltage, due to a falling voltage input of batteries. Another feature is the logic-compatible shutdown input which enables the regulator to be switched on and off. The SPX2945 is offered in 3-pin TO-220 package, SO-8 (same pin out as SPX2951), SOT-223, surface mount 3-Pin TO-252, 3-Pin TO-263 packages and 5-Pin TO-263.
The regulator output voltage (of the 8-pin SO-8) may be pin-strapped for a 3.3V and 5.0V or programmed from 1.24V to 20V with an external pair of resistors. Look for SPX2951 for 150mA and SPX2954 for 250mA applications.

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Manufacturing Information:

Product: SPX2945

Description: 400mA NPN LDO

Mask Set(s): MS1595AW

Lot Number(s): CF10032.1, CF10033.1, CF10036.1

Process: sil-bp3
Wafer Fab: Silan

Package Information:

Package Type: TO-263-5L
Package Code: JEDEC

PIN OUT SPX2945

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Reliability Qualification Test Summary:

Stress Level	Device	Lot Number	Burn-In Temp	Sample Size	No. Fail
168Hrs	SPX2945	CF10032.1	125 °C	77	0
168Hrs	SPX2945	CF10033.1	125 °C	77	0
168Hrs	SPX2945	CF10036.1	125 °C	77	0
1000Hrs	SPX2945	CF10032.1	125 °C	77	0
1000Hrs	SPX2945	CF10033.1	125 °C	77	0
1000Hrs	SPX2945	CF10036.1	125 °C	77	0

Life Test

Life testing is conducted to determine if there are any fundamental reliability related failure mechanism(s) present in the device.

These failure mechanisms can be divided roughly into four groups:

1. Process or die related failures such as oxide defects, metallization defects, and diffusion defects.
2. Assembly related failures such as chip mount defects, wire bond defects, molding defects, and trim/form/singulation defects.
3. Design related defects.
4. Miscellaneous, undetermined, or application induced failures.

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125C Operating Life Test Results

As part of the Sipex design qualification program, the Product/Reliability Engineering group subjected 77 parts to 168 hours of 125° C life stress testing and then to 1000 hours of 125° C life stress testing.

168 Hour Timepoint

The 77 parts were subjected to the life test profile and completed the first phase with no failures.

1000 Hour Timepoint

77 parts were reintroduced to life stress testing, completing the 1000 hour HTOL time point without any failures or significant shifts in process parameters.

FIT Rate Calculations

FIT rate (failures in time) is the predicted number of failures per billion device hours.

This predicted value is based upon,

- The Life Test conditions summarized in the HTOL table (time/temperature, device quantity, failure quantity).
- The Activation Energy (E_a) for potential failure modes. The weighted Activation Energy(E_a) of observed failure mechanisms for Sipex products has been determined to be 0.8eV.

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Based on the above criteria SPX2945 product FIT rates for 25°, 55°, and 70°C of operation at 60% and 90% confidence levels have been calculated and listed below.

FIT Failure Rates: SPX2945 BP3 Silan Process

Confidence Level	+25°C	+55°C	+70°C
60%	1.8	29.5	99.1
90%	4.6	75.5	254.2

1 FIT = 1 Failure per Billion Device-Hours

MTBF Calculation: SPX2945 BP3 Silan Process

Confidence Level	+25°C	+55°C	+70°C
60%	5.52E+08	3.39E+07	1.01E+07
90%	2.15E+08	1.32E+07	3.93E+06

ESD Testing

Human Body Model ESD – 60 units were subjected to Human Body Model ESD testing at +/- 2KV. All units passed.

Additional Reliability Tests

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77 of the units were placed on -65C/+150C Temperature Cycle testing, 77 of the units were placed on Highly-Accelerated Temp. and Humidity Stress testing (130C, 85% RH), 200 of the units were placed on ELFR testing and 77 on -65C/+150C Thermal Shock testing. All units passed testing as summarized in the following table.

Test	Condition	Time	Sample Size	# of rejects
TEMP. Cycles	-65C/+150C	1000 Cycles	77	0
HAST Unbiased	130C/85%RH	96hrs	77	0
ELFR	125C	48hrs	200	0
Thermal Shock	-65C/+150C	500 Cycles	77	0

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