RELIABILITY REPORT

FOR

MAX16993ATJA+

PLASTIC ENCAPSULATED DEVICES

August 3, 2015

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX16993ATJA+ successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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I. Device Description

A. General

The MAX16993 power-management integrated circuit (PMIC) is a 2.1MHz, multichannel, DC-DC converter designed for automotive applications. The device integrates three supplies in a small footprint. The device includes one high-voltage step-down controller (OUT1) designed to run directly from a car battery and two low-voltage step-down converters (OUT2/OUT3) cascaded from OUT1. Under no-load conditions, the MAX16993 consumes only 30µA of quiescent current, making it ideal for automotive applications. The high-voltage synchronous step-down DC-DC controller (OUT1) operates from a voltage up to 36V continuous and is protected from load-dump transients up to 42V. There is a pin-selectable frequency option of either 2.1MHz or a factory-set frequency for 1.05MHz, 525kHz, 420kHz, or 350kHz. The low-voltage, synchronous step-down DC-DC converters run directly from OUT1 and can supply output currents up to 3A. The device provides a spread-spectrum enable input (SSEN) to provide quick improvement in electromagnetic interference when needed. There is also a SYNC input for providing an input to synchronize to an external clock source (see the *Selector Guide* in the full data sheet). The device includes overtemperature shutdown and overcurrent limiting. The device also includes individual active-low RESET_ outputs and individual enable inputs. The active-low RESET_ outputs provide voltage monitoring for all output channels. The MAX16993 is available in a 32-pin TQFN/side-wettable QFND-EP package and is specified for operation over the -40°C to +125°C automotive temperature range.

II. Manufacturing Information

A. Description/Function:	Step-Down Controller with Dual 2.1MHz Step-Down DC-DC Converters
B. Process:	S18
C. Number of Device Transistors:	27989
D. Fabrication Location:	California
E. Assembly Location:	Taiwan
F. Date of Initial Production:	June 26, 2013

III. Packaging Information

A. Package Type:	32L TQFN-CU
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Cu (2 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-5665
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	47°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	1.7°C/W

IV. Die Information

A. Dimensions:	104.7244X112.20472 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.18um
F. Minimum Metal Spacing:	0.18um
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Don Lipps (Manager, Reliability Engineering) Bryan Preeshl (Vice President of QA)
B. Outgoing Inspection Level:	0.1% for all electrical parameters guaranteed by the Datasheet. 0.1% for all Visual Defects.
C. Observed Outgoing Defect Rate:	< 50 ppm
D. Sampling Plan:	Mil-Std-105D

VI. Reliability Evaluation

A. Accelerated Life Test

The results of the 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{1000 \times 4340 \times 235 \times 2}$$ (Chi square value for MTTF upper limit)

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$\lambda = 0.9 \times 10^{-9}$

$\lambda = 0.9$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at http://www.maximintegrated.com/qa/reliability/monitor. Cumulative monitor data for the S18 Process results in a FIT Rate of 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot TBAA5U002B, D/C 1509)

The AP38-0 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM:	+/- 2500V per JEDEC JESD22-A114
ESD-CDM:	+/- 750V per JEDEC JESD22-C101

Latch-Up testing has shown that this device withstands a current of+/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX16993ATJA+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135°C	DC Parameters	77	0	SAKP6Q001E, D/C 1305
	Biased	& functionality	79	0	SAKP6Q003A, D/C 1321
	Time = 1000 hrs.		79	0	SAKP6Q002B, D/C 1320

Note 1: Life Test Data may represent plastic DIP qualification lots.