RELIABILITY REPORT

FOR

MAX16128UAACAC+T

PLASTIC ENCAPSULATED DEVICES

October 15, 2012

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX16128UAACAC+T 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 MAX16128/MAX16129 load-dump/reverse-voltage protection circuits protect power supplies from damaging input-voltage conditions, including overvoltage, reverse-voltage, and high-voltage transient pulses. Using a built-in charge pump, the devices control two external back-to-back n-channel MOSFETs that turn off and isolate downstream power supplies during damaging input conditions, such as an automotive load-dump pulse or a reverse-battery condition. Operation is guaranteed down to 3V that ensures proper operation during automotive cold-crank conditions. These devices feature a flag output (active-low FLAG) that asserts during fault conditions.

For reverse-voltage protection, external back-to-back MOSFETs outperform the traditional reverse-battery diode, minimizing the voltage drop and power dissipation during normal operation. The devices use fixed overvoltage and undervoltage thresholds, minimizing the external component count.

The MAX16129 provides limiter-mode fault management for overvoltage and thermal-shutdown conditions; whereas the MAX16128 provides switch-mode fault management for overvoltage and thermal shutdown conditions. In the limiter mode, the output voltage is limited and active-low FLAG is asserted low during a fault. In the switch mode, the external MOSFETs are switched off and active-low FLAG is asserted low after a fault. The switch mode is available in four options—Latch mode, 1 Autoretry mode, 3 Autoretry mode, and Always autoretry mode.

The MAX16128/MAX16129 are available in an 8-pin µMAX® package and operate over the automotive temperature range (-40°C to +125°C).

II. Manufacturing Information

A. Description/Function:	Load-Dump/Reverse-Voltage Protection Circuits
B. Process:	S45
C. Number of Device Transistors:	5980
D. Fabrication Location:	USA or Japan
E. Assembly Location:	Malaysia, Philippines and Thailand
F. Date of Initial Production:	December 16, 2011

III. Packaging Information

A. Package Type:	8-pin uMAX
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-4560
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	221°C/W
K. Single Layer Theta Jc:	42°C/W
L. Multi Layer Theta Ja:	206.3°C/W
M. Multi Layer Theta Jc:	42°C/W

IV. Die Information

A. Dimensions:	58X61 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Richard Aburano (Manager, Reliability Engineering) 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 80 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 13.7 \times 10^{-9}$

$\lambda = 13.7$ 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 S45 Process results in a FIT Rate of 0.06 @ 25C and 1.00 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The MT23 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM:	+/- 2500V per JEDEC JESD22-A114 (lot TAFD2Q003A, D/C 1211)
ESD-CDM:	+/- 750V per JEDEC JESD22-C101 (lot TAFD2Q003B, D/C 1222)
ESD-MM:	+/- 100V per JEDEC JESD22-A115 (lot TAFD2Q003B, D/C 1222)

Latch-Up testing has shown that this device withstands a current of +/- 250mA and overvoltage per JEDEC JESD78 (lot TAFD2Q003A, D/C 1211).

Table 1

Reliability Evaluation Test Results

MAX16128UAACAC+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	80	0	TAAP2Q001D, D/C 1139

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