RELIABILITY REPORT

FOR

MAX16127TC+T

PLASTIC ENCAPSULATED DEVICES

May 12, 2016

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
Eric Wright
Quality Assurance
Reliability Engineer

Conclusion

The MAX16127TC+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.

Table of Contents

I. Device Description

A. General

The MAX16126/MAX16127 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 to ensure 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 MAX16126/MAX16127 use external resistors to adjust the overvoltage and undervoltage comparator thresholds for maximum flexibility. The MAX16127 provides limiter-mode fault management for overvoltage and thermal shutdown conditions; whereas the MAX16126 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 MAX16126/MAX16127 are available in 12-pin TQFN packages. These devices 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
E. Assembly Location:	Taiwan, Thailand
F. Date of Initial Production:	September 23, 2011

III. Packaging Information

A. Package Type:	12-pin TQFN 3x3
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:	#05-9000-4561
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:	76°C/W
K. Single Layer Theta Jc:	10.8°C/W
L. Multi Layer Theta Ja:	68°C/W
M. Multi Layer Theta Jc:	10.8°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:	Eric Wright (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 0.49 @ 25°C and 8.49 @ 55°C (0.8 eV, 60% UCL)

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

The MT23-1 die type has been found to have all pins able to withstand an HBM transient pulse of +/-1000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1

Reliability Evaluation Test Results

MAX16127TC+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	

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