

RELIABILITY REPORT
FOR
MAX16126TC+T
PLASTIC ENCAPSULATED DEVICES

June 8, 2012

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX16126TC+T successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

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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:	S4
C. Number of Device Transistors:	5980
D. Fabrication Location:	USA
E. Assembly Location:	China, Taiwan and 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:	11°C/W

IV. Die Information

A. Dimensions:	58X61 mils
B. Passivation:	Si ₃ N 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

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

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

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

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the S4 Process results in a FIT Rate of 0.06 @ 25C and 1.0 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot TAFD2Q003A, D/C 1211)

The MT23 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/- 250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX16126TC+T

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

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