

RELIABILITY REPORT
FOR
MAX6398ATT+T
PLASTIC ENCAPSULATED DEVICES

May 14, 2013

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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Conclusion

The MAX6398ATT+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 MAX6397/MAX6398 are small, high-voltage overvoltage protection circuits. These devices disconnect the output load or limit the output voltage during an input overvoltage condition. These devices are ideal for applications that must survive high-voltage transients such as those found in automotive and industrial applications. The MAX6397/MAX6398 monitor the input or output voltages and control an external n-channel MOSFET to isolate or limit the load from overvoltage transient energy. When the monitored input voltage is below the user-adjustable overvoltage threshold, the external n-channel MOSFET is turned on by the GATE output. In this mode, the internal charge pump fully enhances the n-channel MOSFET with a 10V gate-to-source voltage. When the input voltage exceeds the overvoltage threshold, the protection can disconnect the load from the input by quickly forcing the GATE output low. In some applications, disconnecting the output from the load is not desirable. In these cases, the protection circuit can be configured to act as a voltage limiter where the GATE output sawtooths to limit the voltage to the load. The MAX6397 also offers an always-on linear regulator that is capable of delivering up to 100mA of output current. This high-voltage linear regulator consumes only 37 μ A of quiescent current. The regulator is offered with output options of 5V, 3.3V, 2.5V, or 1.8V. An open-drain, power-good output (POK) asserts when the regulator output falls below 92.5% or 87.5% of its nominal voltage. The MAX6397/MAX6398 include internal thermal-shutdown protection, disabling the external MOSFET and linear regulator if the chip reaches overtemperature conditions. The devices operate over a wide 5.5V to 72V supply voltage range, are available in small TDFN packages, and are fully specified from -40°C to +125°C.

II. Manufacturing Information

A. Description/Function:	Overvoltage Protection Switch/Limiter Controllers Operate Up to 72V
B. Process:	BCD8
C. Number of Device Transistors:	579
D. Fabrication Location:	USA
E. Assembly Location:	China, Taiwan and Thailand
F. Date of Initial Production:	April 23, 2005

III. Packaging Information

A. Package Type:	6-pin TDFN 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:	#05-9000-1482
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:	55°C/W
K. Single Layer Theta Jc:	9°C/W
L. Multi Layer Theta Ja:	42°C/W
M. Multi Layer Theta Jc:	9°C/W

IV. Die Information

A. Dimensions:	70 X 94 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:	1 micron (as drawn)
F. Minimum Metal Spacing:	2 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 BCD8 Process results in a FIT Rate of 0.04 @ 25C and 0.7 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot NW11CA004B, D/C 0521)

The MS89-1 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.

Table 1
Reliability Evaluation Test Results

MAX6398ATT+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	48	0	NWI0CA004B, D/C 0517

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