

RELIABILITY REPORT
FOR
MAX6399ATA+T
PLASTIC ENCAPSULATED DEVICES

April 7, 2015

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX6399ATA+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 MAX6399 is a small overvoltage and undervoltage protection circuit. The device can monitor a DC-DC output voltage and quickly disconnect the power source from the DC-DC input load when an overvoltage condition occurs. A power-OK output signals when the DC-DC input voltage falls below an adjustable threshold. This controller architecture provides the ability to size the external n-channel MOSFET to meet specific load current requirements. When the DC-DC monitored output voltage is below the user-adjustable overvoltage threshold, the GATE output of the MAX6399 goes high to enhance the n-channel MOSFET. The MAX6399 offers internal charge-pump circuitry that allows the GATE voltage to be 10V above the input voltage ($V_{GS} = 10V$) to fully enhance the external n-channel MOSFET, thus minimizing the drain-to-source resistance. When the monitored output voltage rises above the user-adjusted overvoltage threshold, the GATE output rapidly pulls low to shut off the MOSFET. The MOSFET remains latched off until either the MAX6399 input power or SHDN-bar input is cycled. The MAX6399 includes a logic-low shutdown input that disables the GATE. An internal overtemperature detector also disables the gate when the MAX6399 temperature reaches the thermal-shutdown threshold. The device operates over a wide supply voltage range (5.75V to 72V) and is offered in a small TDFN package, fully specified from -40°C to +125°C.

II. Manufacturing Information

A. Description/Function:	High-Voltage, Overvoltage/Undervoltage, Protection Switch Controller
B. Process:	BCD8
C. Number of Device Transistors:	579
D. Fabrication Location:	Oregon
E. Assembly Location:	Philippines, China, Thailand, Malaysia
F. Date of Initial Production:	April 21, 2005

III. Packaging Information

A. Package Type:	8-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:	#05-9000-1483
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:	54°C/W
K. Single Layer Theta Jc:	8.3°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	8.3°C/W

IV. Die Information

A. Dimensions:	70X94 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:	3.0 microns (as drawn)
F. Minimum Metal Spacing:	3.0 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: 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:

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

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

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

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

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 0.06 @ 25C and 0.98 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (ESD lot JWI2FQ001B D/C 0825, Latch-Up lot NWI2BQ001B D/C 0453)

The MS89-2 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX6399ATA+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.