

RELIABILITY REPORT  
FOR  
MAX7359ETG+  
PLASTIC ENCAPSULATED DEVICES

July 8, 2008

**MAXIM INTEGRATED PRODUCTS**

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Quality Assurance
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## Conclusion

The MAX7359ETG+ 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.

## Table of Contents

<b>I. ....Device Description</b>	<b>V. ....Quality Assurance Information</b>
<b>II. ....Manufacturing Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>III. ....Packaging Information</b>	<b>IV. ....Die Information</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX7359 I<sup>2</sup>C interfaced peripheral provides microprocessors with management of up to 64 key switches. Key codes are generated for each press and release of a key for easier implementation of multiple key entries. Key inputs are monitored statically, not dynamically, to ensure low-EMI operation. The switches can be metallic or resistive (carbon) with up to 5k $\Omega$  of resistance. The MAX7359 features autosleep and autowake to further minimize the power consumption of the device. The autosleep feature puts the device in a low-power state (1 $\mu$ A typ) after a sleep timeout period. The autowake feature configures the MAX7359 to return to normal operating mode from sleep upon a key press. The key controller debounces and maintains a FIFO of key-press and release events (including autorepeat, if enabled). An interrupt (active-low INT) output can be configured to alert key presses either as they occur, or at maximum rate. Any of the column drivers (COL2/PORT2-COL7/PORT7) or the active-low INT, if not used, can function as a general-purpose output (GPO). The MAX7359 is offered in a small 24-pin TQFN (3.5mm x 3.5mm) package for cell phones, pocket PCs, and other portable consumer electronic applications. The MAX7359 operates over the -40°C to +85°C temperature range.

**II. Manufacturing Information**

A. Description/Function:	2-Wire Interfaced Low-EMI Key Switch Controller/GPO
B. Process:	S4
C. Number of Device Transistors:	43668
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Thailand
F. Date of Initial Production:	2007

**III. Packaging Information**

A. Package Type:	24-pin TQFN 3.5x3.5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-2869
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:	65.1°C/W
K. Single Layer Theta Jc:	5.4°C/W

**IV. Die Information**

A. Dimensions:	70 X 80 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
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:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

**V. Quality Assurance Information**

- A. Quality Assurance Contacts: Ken Wendel (Director, Reliability Engineering)  
Bryan Preeshl (Managing Director 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 pending. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

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

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

$$\lambda = 24.43 \times 10^{-9}$$

$$\lambda = 24.43 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the S4 Process results in a FIT Rate of 0.28 @ 25C and 4.85 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The DX46 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114-D, +/-250V MM ESD per JEDEC JESD22-A115 and +/-750V CDM ESD per JEDEC JESD22-C101-A. Latch-Up testing has shown that this device withstands a current of 250mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX7359ETG+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2) 85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (Note 2) Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

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

Note 2: Generic Package/Process data