

RELIABILITY REPORT  
FOR  
MAX7347AEE+  
PLASTIC ENCAPSULATED DEVICES

December 15, 2015

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

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## Conclusion

The MAX7347AEE+ 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 MAX7347/MAX7348/MAX7349 I<sup>2</sup>C interfaced peripherals provide microprocessors with management of up to 64 key switches. Key inputs are monitored statically, not dynamically scanned, to ensure low-EMI operation. The MAX7347 can monitor up to 24 switches, the MAX7348 can monitor up to 40 switches, and the MAX7349 can monitor up to 64 switches. The switches can be metallic or resistive (carbon) up to 1k $\Omega$ . The key controller debounces and maintains a FIFO of key-press 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. The MAX7348/MAX7349 feature a tone generator to generate automatic key-click sounds or alarm tones under processor control. The sounder frequencies cover the 5th musical octave (523.25Hz to 987.77Hz), plus seven other musical notes up to 2637Hz. The output can also be programmed to be high or low for the sound duration to operate an electronic sounder, relay, or lamp. The MAX7347 is offered in 16-pin QSOP and TQFN packages. The MAX7348 is offered in a 20-pin QSOP package. The MAX7349 is available in 24-pin QSOP and TQFN packages. The MAX7347/MAX7348/MAX7349 operate over the -40°C to +125°C temperature range.

## II. Manufacturing Information

A. Description/Function:	2-Wire Interfaced Low-EMI Key Switch and Sounder Controllers
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Philippines, Thailand
F. Date of Initial Production:	January 22, 2005

## III. Packaging Information

A. Package Type:	16-pin QSOP
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:	#05-9000-0931
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:	120°C/W
K. Single Layer Theta Jc:	37°C/W
L. Multi Layer Theta Ja:	103.7°C/W
M. Multi Layer Theta Jc:	37°C/W

## IV. Die Information

A. Dimensions:	70X80 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
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 ( $\lambda$ ) 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 S4 Process results in a FIT Rate of 0.13 @ 25C and 2.31 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot SOJ0CZ002B, D/C 0448)

The DW62 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX7347AEE+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	SOJ0CZ002C, D/C 0448

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