

RELIABILITY REPORT  
FOR  
MAX9728AETC+  
(MAX9728A/MAX9728B)  
PLASTIC ENCAPSULATED DEVICES

December 19, 2008

**MAXIM INTEGRATED PRODUCTS**

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<b>Approved by</b>
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## Conclusion

The MAX9728AETC+ 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 MAX9728A/MAX9728B stereo headphone amplifiers are designed for display and notebook applications or portable equipment where board space is at a premium. These devices use a unique, patented DirectDrive architecture to produce a ground-referenced output from a single supply, eliminating the need for large DC-blocking capacitors, saving cost, board space, and component height. The MAX9728A offers an externally adjustable gain, while the MAX9728B has an internally preset gain of -1.5V/V. The MAX9728A/MAX9728B deliver up to 60mW per channel into a 32 load and have low 0.02% THD+N. An 80dB at 1kHz power-supply rejection ratio (PSRR) allows these devices to operate from noisy digital supplies without an additional linear regulator. Comprehensive click-and-pop circuitry suppresses audible clicks and pops on startup and shutdown. The MAX9728A/MAX9728B operate from a single 4.5V to 5.5V supply, consume only 3.5mA of supply current, feature short-circuit and thermal-overload protection, and are specified over the extended -40°C to +85°C temperature range. The devices are available in tiny 12-pin Thin QFN (3mm x 3mm x 0.8mm) and 14-pin TSSOP packages (5mm x 4.4mm x 1.1mm).

## II. Manufacturing Information

A. Description/Function:	60mW, DirectDrive®, Stereo Headphone Amplifier with Shutdown
B. Process:	0.6um Silicon Gate CMOS (C6)
C. Number of Device Transistors:	993
D. Fabrication Location:	California USA
E. Assembly Location:	ISPL Philippines, UTL Thailand
F. Date of Initial Production:	January 21, 2006

## III. Packaging Information

A. Package Type:	12-pin TQFN 3x3
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:	#05-9000-1486
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:	68°C/W
K. Single Layer Theta Jc:	10.8°C/W
L. Multi Layer Theta Ja:	60°C/W
M. Multi Layer Theta Jc:	10.8°C/W

## IV. Die Information

A. Dimensions:	45 X 45 mils
B. Passivation:	SiO <sub>2</sub> /SiN <sub>3</sub>
C. Interconnect:	Al/Cu
D. Backside Metallization:	None
E. Minimum Metal Width:	0.6um
F. Minimum Metal Spacing:	0.6um
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	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 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)

$$\lambda = 22.4 \times 10^{-9}$$

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 C6 Process results in a FIT Rate of 0.82 @ 25C and 14.21 @ 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 AU49 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX9728AETC+**

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