

RELIABILITY REPORT
FOR
MAX9725xETC
PLASTIC ENCAPSULATED DEVICES

May 28, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
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Quality Assurance
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Conclusion

The MAX9725xETC 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 MAX9725A–MAX9725D fixed-gain, stereo headphone amplifiers are ideal for portable equipment where board space is at a premium. The MAX9725E offers the flexibility to adjust the gain with external input and feedback resistors. The MAX9725A–MAX9725E 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. Fixed gains of -2V/V (MAX9725A), -1.5V/V (MAX9725B), -1V/V (MAX9725C), and -4V/V (MAX9725D) further reduce external component count. The adjustable gain of the MAX9725E DirectDrive headphone amplifier allows for any gain down to -1V/V using external resistors.

The MAX9725 delivers up to 20mW per channel into a 32 Ω load and achieves 0.006% THD+N. An 80dB at 1kHz power-supply rejection ratio (PSRR) allows the MAX9725 to operate from noisy digital supplies without an additional linear regulator. The MAX9725 includes ± 8 kV ESD protection on the headphone output. Comprehensive click-and-pop circuitry suppresses audible clicks and pops at startup and shutdown. A low-power shutdown mode reduces supply current to 0.6 μ A (typ).

The MAX9725 operates from a single 0.9V to 1.8V supply, allowing the device to be powered directly from a single AA or AAA battery. The MAX9725 consumes only 2.1mA of supply current, provides short-circuit protection, and is specified over the extended -40°C to +85°C temperature range. The MAX9725 is available in a tiny (1.54mm x 2.02mm x 0.6mm) 12-bump chip-scale package (UCSP™) and a 12-pin thin QFN package (4mm x 4mm x 0.8mm).

II. Manufacturing Information

A. Description/Function:	1V, Low-Power, DirectDrive, Stereo Headphone Amplifier with Shutdown
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	ASAT China, UTL Philippines
F. Date of Initial Production:	April 11, 2008

III. Packaging Information

A. Package Type:	12-pin TQFN 4x4
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
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:	59.3°C/W
K. Single Layer Theta Jc:	5.7°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	5.7°C/W

IV. Die Information

A. Dimensions:	80 X 61 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/0.5% Cu
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 ₂
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 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)

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

$\lambda = 22.4$ 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 4.6 @ 25C and 79.2 @ 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 AU92 die types have been found to have all pins able to withstand a HBM transient pulse of +/-1000 V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX9725xETC

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