RELIABILITY REPORT

FOR

MAX9770ETI+

PLASTIC ENCAPSULATED DEVICES

January 17, 2014

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX9770ETI+ 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.

Table of Contents

I. Device Description

A. General

The MAX9770 combines a mono, filterless, Class D speaker amplifier and stereo DirectDrive® headphone amplifier in a single device. The MAX9770 operates from a single 2.5V to 5.5V supply and includes features that reduce external component count, system cost, board space, and offer improved audio reproduction. The speaker amplifier makes use of Maxim's Class D architecture, providing Class AB performance with Class D efficiency, conserving board space, and extending battery life. The speaker amplifier delivers 1.2W into an 8 load while offering efficiencies above 85%. A spread-spectrum modulation scheme reduces radiated emissions caused by the modulation frequency. Furthermore, the MAX9770 oscillator can be synchronized to an external clock through the SYNC input, avoiding possible problem frequencies inside a system. The speaker amplifier features THD+N as low as 0.025%, high 70dB PSRR, and SNR in excess of 90dB. The headphone amplifiers feature Maxim's DirectDrive architecture that produces a ground-referenced output from a single supply, eliminating the need for large DC-blocking capacitors. The headphone amplifiers deliver up to 80mW into a 16 load, feature low 0.015% THD+N, high 85dB PSRR, and Â±8kV ESD-protected outputs. A headphone sense input detects the presence of a headphone, and automatically configures the amplifiers for either speaker or headphone mode. The MAX9770 includes internally set, logic-selectable gain, and a comprehensive input multiplexer/mixer, allowing multiple audio sources to be selected and for true mono reproduction of a stereo source in speaker mode. Industry-leading click-and-pop suppression eliminates audible transients during power and shutdown cycles. A low-power shutdown mode decreases supply current consumption to 0.1µA, further extending battery life. The MAX9770 is offered in space-saving, thermally efficient 28-pin TQFN (5mm x 5mm x 0.8mm) and 28-pin TSSOP packages. The MAX9770 features thermal-overload and output short-circuit protection, and is specified over the extended -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	1.2W, Low-EMI, Filterless, Mono Class D Amplifier with Stereo DirectDrive Headphone Amplifiers
B. Process:	B6
C. Number of Device Transistors:	
D. Fabrication Location:	California
E. Assembly Location:	Thailand
F. Date of Initial Production:	January 23, 2004

III. Packaging Information

A. Package Type:	28-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Non-conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-0663
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:	56.9°C/W
K. Single Layer Theta Jc:	24°C/W
L. Multi Layer Theta Ja:	42.1°C/W
M. Multi Layer Theta Jc:	24°C/W

IV. Die Information

A. Dimensions:	93X86 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	0.6 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:	Richard Aburano (Manager, Reliability Engineering) 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:

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

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

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

$\lambda = 22.9$ 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 B6 Process results in a FIT Rate of 0.06 @ 25C and 0.97 @ 55C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (lot SHZ0DQ001B, D/C 0520)

The AU09 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX9770ETI+

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	IHZ0BQ001B, D/C 0520

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