

RELIABILITY REPORT
FOR
MAX9856ETL+
PLASTIC ENCAPSULATED DEVICES

February 27, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
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Quality Assurance
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Conclusion

The MAX9856ETL+ 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 MAX9856 is a high-performance, low-power stereo audio CODEC designed for MP3, personal media players (PMPs), or other portable multimedia devices. Using on-board stereo DirectDrive® headphone amplifiers, the CODEC can output 30mW into stereo 32 headphones while operating from a single 1.8V power supply. Very low 9mW playback power consumption makes it an ideal choice for battery-powered applications. The MAX9856 provides microphone input amplifiers, plus flexible input selection, signal mixing, and automatic gain control (AGC). Comprehensive load-impedance sensing allows the MAX9856 to autodetect most common audio and audio/video headset and jack plug types. Outputs include stereo DirectDrive line outputs and DirectDrive headphone amplifiers. The stereo ADC can convert audio signals from either internal or external microphones that can be configured for single-ended or differential signal inputs. Line inputs can be configured as stereo, differential, or mono and fed through one channel of the microphone path. The analog inputs selected can be gain ranged or mixed with other input sources prior to conversion to digital. The ADC path also features programmable digital highpass filters to remove DC offset voltages and wind noise. The MAX9856 supports all common sample rates from 8kHz to 48kHz in both master and slave mode. The serial digital audio interfaces support a variety of formats including I²S, left justified, and PCM modes. The MAX9856 uses a thermally efficient, space-saving 40-pin, 6mm x 6mm x 0.8mm TQFN package.

II. Manufacturing Information

A. Description/Function:	Low-Power Audio CODEC with DirectDrive Headphone Amplifiers
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	California
E. Assembly Location:	ASAT China, UTL Thailand
F. Date of Initial Production:	April 21, 2007

III. Packaging Information

A. Package Type:	40-pin TQFN 6x6
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:	#05-9000-2351
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:	38°C/W
K. Single Layer Theta Jc:	1.4°C/W
L. Multi Layer Theta Ja:	27°C/W
M. Multi Layer Theta Jc:	1.4°C/W

IV. Die Information

A. Dimensions:	174 X 155 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (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 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)

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

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

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 AU65 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500 V 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

MAX9856ETL+

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