

RELIABILITY REPORT
FOR
MAX9759ETE+
PLASTIC ENCAPSULATED DEVICES

December 19, 2008

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX9759ETE+ 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 MAX9759 mono Class D, audio power amplifier provides Class AB amplifier audio performance with the benefits of Class D efficiency, eliminating the need for a heatsink and extending battery life. The MAX9759 delivers up to 3.2W of continuous power into a 4 Ω load while offering greater than 90% efficiency. Maxim's next-generation, low-EMI modulation scheme allows the amplifier to operate without an external LC filter while still meeting FCC EMI-radiated emission levels. The MAX9759 offers two modulation schemes: a fixed-frequency modulation (FFM) mode and a spread-spectrum modulation (SSM) mode. The SSM mode flattens the wideband spectral components, reducing EMI-radiated emissions due to the modulation frequency. Furthermore, the MAX9759 oscillator can be synchronized to an external clock through the SYNC input, allowing the switching frequency to range from 1000kHz to 1600kHz. The SYNC input and SYNC_OUT output of the MAX9759 allow multiple Maxim Class D amplifiers to be cascaded and frequency locked, minimizing interference due to clock intermodulation. The MAX9759 utilizes fully differential input amplifiers, a full-bridged output, comprehensive click-and-pop suppression, and features four selectable gain settings (6dB, 12dB, 18dB, 24dB). The MAX9759 features high 81dB PSRR, low 0.02% THD+N, and SNR in excess of 90dB. Short-circuit and thermal-overload protection prevents damage to the device during a fault condition. The MAX9759 operates from a single 5V supply, consumes 8.4mA of supply current, and is available in a 16-pin thin QFN package (4mm x 4mm x 0.8mm). The MAX9759 is fully specified over the extended -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	3.2W, High-Efficiency, Low-EMI, Filterless, Class D Audio Amplifier
B. Process:	B6
C. Number of Device Transistors:	
D. Fabrication Location:	California
E. Assembly Location:	ASAT China, UTL Thailand
F. Date of Initial Production:	April 23, 2005

III. Packaging Information

A. Package Type:	16-pin TQFN 4x4
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-1281
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:	40°C/W
M. Multi Layer Theta Jc:	5.7°C/W

IV. Die Information

A. Dimensions:	84 X 78 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:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	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 listed in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

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

(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 B6 Process results in a FIT Rate of 0.8 @ 25C and 14.2 @ 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 AU46 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

MAX9759ETE+

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