

RELIABILITY REPORT
FOR
MAX98371EWV+T
WAFER LEVEL DEVICES

December 1, 2016

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Conclusion

The MAX98371EWV+T 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.

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I. Device Description

A. General

The MAX98371 is a high-efficiency, mono Class D audio amplifier featuring dynamic headroom tracking (DHT). DHT automatically optimizes the headroom available to the Class D amplifier as the power supply voltage varies, due to sudden transients and declining battery life to maintain a consistent listening experience. A wide 5.5V to 18V supply range allows the device to reach 19W into an 8Ω load.

The MAX98371's flexible digital audio interface (DAI) supports I²S, left-justified, and TDM formats. The digital audio interface accepts 32kHz, 44.1kHz, 48kHz, 88.2kHz, and 96kHz sample rates with 16-/24-/32-bit data supported for all data formats. In TDM mode, the device can support up to 16 channels of audio data. A unique clocking structure eliminates the need for an external MCLK signal that is typically needed for PCM communication. This reduces pin count and simplifies board layout.

Active emissions limiting with edge rate control minimizes EMI, and eliminates the need for output filtering found in traditional Class D devices.

An 8-bit PVDD supply voltage ADC enables the Dynamic Headroom Tracking circuit. DHT optimizes audio program peak behavior as the supply voltage varies and provides flexible user-defined parameters.

Thermal foldback protection ensures robust behavior when the thermal limits of the device are exercised. The circuit can be enabled to automatically reduce the output power above a user specified temperature. This allows for uninterrupted music playback even at high ambient temperatures. Traditional thermal protection is also available in addition to robust overcurrent protection.

All MAX98371 control is performed using a standard 2-wire, I²C interface. One of sixteen slave addresses can be selected through two, four-level address pins. The IC is available in a 0.4mm pitch, 30-bump WLP package. It is specified over the extended, -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	Digital Input Class D Speaker Amplifier with Dynamic Headroom Tracking
B. Process:	S18
C. Number of Device Transistors:	432845
D. Fabrication Location:	USA
E. Assembly Location:	USA
F. Date of Initial Production:	December 19, 2014

III. Packaging Information

A. Package Type:	30-bump WLP
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	None
E. Bondwire:	N/A (N/A mil dia.)
F. Mold Material:	None
G. Assembly Diagram:	#05-9000-5807
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:	N/A°C/W
K. Single Layer Theta Jc:	N/A°C/W
L. Multi Layer Theta Ja:	49°C/W
M. Multi Layer Theta Jc:	N/A°C/W

IV. Die Information

A. Dimensions:	111.4173X81.8897 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 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: Eric Wright (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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.7 \times 10^{-9}$$

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S18 Process results in a FIT Rate of 0.40 @ 25C and 6.96 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The AX78-0 die type has been found to have all pins able to withstand an HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX98371EWV+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	80	0	

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