RELIABILITY REPORT
FOR
MAX98091EWN+T
WAFER LEVEL PRODUCTS

January 30, 2014

MAXIM INTEGRATED
160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
Sokhom Chum
Quality Assurance
Reliability Engineer
Conclusion

The MAX98091EWN+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 MAX98091 is a fully integrated audio codec whose high-performance, ultra-low power consumption and small footprint make it ideal for portable applications. The device features a highly flexible input scheme with six input pins that can be configured as analog or digital microphone inputs, differential or single-ended line inputs, or as full-scale direct differential inputs. Analog inputs can be routed to the record path ADC or directly to any analog output mixer. The device accepts master clock frequencies of either 256 x fS or from 10MHz to 60MHz. The digital audio interface supports master or slave mode operation, sample rates from 8kHz to 96kHz, and standard PCM formats such as I²S, left/right-justified, and TDM. The record/playback paths feature FlexSound® technology DSP. This includes digital gain and filtering, a biquad filter (record), dynamic range control (playback), and a seven band parametric equalizer (playback) that can improve loudspeaker performance by optimizing the frequency response. The stereo Class D speaker amplifier provides efficient amplification, features low radiated emissions, supports filterless operation, and can drive both 4 and 8 loads. The DirectDrive® stereo Class H headphone amplifier provides a ground-referenced output eliminating the need for large DC-blocking capacitors. The device also includes a differential receiver (earpiece) amplifier that can be reconfigured as a stereo single-ended line output.
II. Manufacturing Information

A. Description/Function: Ultra-Low Power Stereo Audio Codec
B. Process: S18
C. Number of Device Transistors: 1144366
D. Fabrication Location: Japan
E. Assembly Location: Texas
F. Date of Initial Production: June 14, 2013

III. Packaging Information

A. Package Type: 56 bmp WLP
B. Lead Frame: N/A
C. Lead Finish: N/A
D. Die Attach: N/A
E. Bondwire: N/A
F. Mold Material: N/A
G. Assembly Diagram: #05-9000-5170
H. Flammability Rating: Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C: 1
J. Single Layer Theta Ja: N/A
K. Single Layer Theta Jc: N/A
L. Multi Layer Theta Ja: 40°C/W
M. Multi Layer Theta Jc: N/A

IV. Die Information

A. Dimensions: 145.6693X127.559 mils
B. Passivation: Si$_3$N$_4$/SiO$_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect: Al with Ti/TiN Barrier
D. Backside Metallization: None
E. Minimum Metal Width: 0.18um
F. Minimum Metal Spacing: 0.18um
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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ($\lambda$) is calculated as follows:

$$\chi = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2}$$

(Chi square value for MTTF upper limit)

(Chisquare value for Temperatur Acceleration factor assuming an activation energy of 0.8eV)

$$\chi = 13.7 \times 10^9$$

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

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 0.05 @ 25°C and 0.93 @ 55°C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (lot EALZ7Q002B, D/C 1317)

The AX69-0 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.
<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Life Test</td>
<td>Ta = 135°C</td>
<td>DC Parameters</td>
<td>48</td>
<td>0</td>
<td>EALZ7Q002D, D/C 1317</td>
</tr>
<tr>
<td></td>
<td>Biased Time</td>
<td>&amp; functionality</td>
<td>32</td>
<td>0</td>
<td>EALZ7Q002C, D/C 1317</td>
</tr>
</tbody>
</table>

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