

RELIABILITY REPORT
FOR
LMX324AUD+
PLASTIC ENCAPSULATED DEVICES

December 17, 2014

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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| Approved by |
| Sokhom Chum |
| Quality Assurance |
| Reliability Engineer |

Conclusion

The LMX324AUD+ 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 LMX321/LMX358/LMX324 are single/dual/quad, low-cost, low-voltage, pin-to-pin compatible upgrades to the LMV321/LMV358/LMV324 family of general purpose op amps. These devices offer rail-to-rail outputs and an input common-mode range that extends below ground. These op amps draw only 105 μ A of quiescent current per amplifier, operate from a single +2.3V to +7V supply, and drive 2k Ω resistive loads to within 40mV of either rail. The LMX321/LMX358/LMX324 are unity-gain stable with a 1.3MHz gain-bandwidth product capable of driving capacitive loads up to 400pF. The combination of low voltage, low cost, and small package size makes these amplifiers ideal for portable/battery-powered equipment. The LMX321 single op amp is available in ultra-small 5-pin SC70 and space-saving 5-pin SOT23 packages. The LMX358 dual op amp is available in the tiny 8-pin SOT23 or the 8-pin μ MAX® package. The LMX324 quad op amp is available in 14-pin TSSOP and SO packages.

II. Manufacturing Information

| | |
|----------------------------------|---|
| A. Description/Function: | Single/Dual/Quad, General-Purpose, Low-Voltage, Rail-to-Rail Output Op Amps |
| B. Process: | CB2 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | Oregon |
| E. Assembly Location: | Thailand |
| F. Date of Initial Production: | July 28, 2001 |

III. Packaging Information

| | |
|--|--------------------------|
| A. Package Type: | 14-pin TSSOP |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive |
| E. Bondwire: | Au (1 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-2501-0180 |
| 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: | 110°C/W |
| K. Single Layer Theta Jc: | 30°C/W |
| L. Multi Layer Theta Ja: | 100.4°C/W |
| M. Multi Layer Theta Jc: | 30°C/W |

IV. Die Information

| | |
|----------------------------|--|
| A. Dimensions: | 56X56 mils |
| B. Passivation: | Si ₃ N ₄ (Silicon nitride) |
| C. Interconnect: | Au |
| D. Backside Metallization: | None |
| E. Minimum Metal Width: | 2 microns (as drawn) |
| F. Minimum Metal Spacing: | 2 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: 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 150C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 9706 \times 157 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 9706 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 0.6 \times 10^{-9}$$

$$\lambda = 0.6 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 CB2 Process results in a FIT Rate of 0.06 @ 25C and 0.95 @ 55C (0.8 eV, 60% UCL).

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

The OX65 die type has been found to have all pins able to withstand a transient pulse of:

| | |
|----------|---------------------------------|
| ESD-HBM: | +/- 2500V per JEDEC JESD22-A114 |
| ESD-CDM: | +/- 750V per JEDEC JESD22-C101 |

Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

LMX324AUD+

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|----------------------------------|------------------|------------------------|-------------|--------------------|----------------------|
| Static Life Test (Note 1) | Ta = 150°C | DC Parameters | 80 | 0 | N480AA304A, D/C 1426 |
| | Biased | & functionality | 77 | 0 | N48AA007F, D/C 0628 |
| | Time = 1000 hrs. | | | | |

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