RELIABILITY REPORT

FOR

MAX4194ESA

PLASTIC ENCAPSULATED DEVICES

September 2, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by  Reviewed by
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Quality Assurance  Quality Assurance
Reliability Lab Manager  Executive Director
Conclusion

The MAX4194 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 MAX4194 is a variable-gain precision instrumentation amplifier that combines Rail-to-Rail® single-supply operation, outstanding precision specifications, and a high gain bandwidth.

The MAX4194 has rail-to-rail outputs and inputs that can swing to within 200mV of the negative rail and to within 1.1V of the positive rail. The part draws only 93µA and operates from a single +2.7V to +7.5V supply or from dual ±1.35V to ±3.75V supplies. This amplifiers is offered in 8-pin SO packages and is specified for the extended temperature range (-40°C to +85°C).

B. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (VCC to VEE)</td>
<td>+8V</td>
</tr>
<tr>
<td>All Other Pins</td>
<td>(VCC + 0.3V) to (VEE - 0.3V)</td>
</tr>
<tr>
<td>Current into Any Pin</td>
<td>±30mA</td>
</tr>
<tr>
<td>Output Short-Circuit Duration (to VCC or VEE)</td>
<td>Continuous</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+150°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Lead Temperature (soldering, 10sec)</td>
<td>+300°C</td>
</tr>
<tr>
<td>Continuous Power Dissipation (TA = +70°C)</td>
<td>471mW</td>
</tr>
<tr>
<td>8-Pin SO</td>
<td>5.9mW/°C</td>
</tr>
<tr>
<td>Derates above +70°C</td>
<td></td>
</tr>
<tr>
<td>8-Pin SO</td>
<td></td>
</tr>
</tbody>
</table>

.....Attachments
II. Manufacturing Information

A. Description/Function: Micropower, Single-Supply, Rail-to-Rail, Precision Instrumentation Amplifiers

B. Process: S12 (Standard 1.2 micron silicon gate CMOS)

C. Number of Device Transistors: 432

D. Fabrication Location: Oregon, USA

E. Assembly Location: Philippines, Thailand or Malaysia

F. Date of Initial Production: April, 1999

III. Packaging Information

A. Package Type: 8-Pin NSO

B. Lead Frame: Copper

C. Lead Finish: Solder Plate

D. Die Attach: Silver-filled Epoxy

E. Bondwire: Gold (1.3 mil dia.)

F. Mold Material: Epoxy with silica filler

G. Assembly Diagram: # 05-3001-0103

H. Flammability Rating: Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112: Level 1

IV. Die Information

A. Dimensions: 76 x 125 mils

B. Passivation: Si3N4/SiO2 (Silicon nitride/ Silicon dioxide)

C. Interconnect: Aluminum/Si (Si = 1%)

D. Backside Metallization: None

E. Minimum Metal Width: 1.2 microns (as drawn)

F. Minimum Metal Spacing: 1.2 microns (as drawn)

G. Bondpad Dimensions: 5 mil. Sq.

H. Isolation Dielectric: SiO2

I. Die Separation Method: Wafer Saw
V. Quality Assurance Information

A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)
   Bryan Preeshl (Executive Director)
   Kenneth Huening (Vice President)

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:

   $\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 80 \times 2}$

   (Chi square value for MTTF upper limit)

   Temperature Acceleration factor assuming an activation energy of 0.8eV

   $\lambda = 13.57 \times 10^{-9}$

   $\lambda = 13.57$ F.I.T. (60% confidence level @ 25°C)

   This low failure rate represents data collected from Maxim’s reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-5323) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (RR-1M).

B. Moisture Resistance Tests

   Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

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

   The OP57 die type has been found to have all pins able to withstand a transient pulse of ±2000V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.
<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>PACKAGE</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Life Test (Note 1)</td>
<td>Ta = 135°C Biased Time = 192 hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td></td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Moisture Testing (Note 2)</td>
<td>Pressure Pot Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>SO</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>85/85</td>
<td>Ta = 85°C RH = 85% Biased Time = 1000hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mechanical Stress (Note 2)</td>
<td>Temperature Cycle -65°C/150°C 1000 Cycles Method 1010</td>
<td>DC Parameters</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data
3.4 Pin combinations to be tested.

a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{PS1}, V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.

c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.
NOTES:
1. TEMPERATURE: 125°C OR EQUIVALENT
2. TIME: 160 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 125°C CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL
   (X) MIL/DEF

SPEC. NO. 06-5323 REV: A
DATE: 11/14/97
DRAWN BY:

MAXIM BURN-IN SCHEMATIC
DEVICE TYPE (S):
MAX4195/6/7/8/9