

RELIABILITY REPORT  
FOR  
MAX4294EUD  
PLASTIC ENCAPSULATED DEVICES

October 15, 2008

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

<b>Approved by</b>
Ken Wendel
Quality Assurance
Director, Reliability Engineering

## Conclusion

The MAX4294EUD 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.

## Table of Contents

<b>I. ....Device Description</b>	<b>V. ....Quality Assurance Information</b>
<b>II. ....Manufacturing Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>III. ....Packaging Information</b>	<b>IV. ....Die Information</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX4291/MAX4292/MAX4294 family of micropower operational amplifiers operates from a 1.8V to 5.5V single supply or  $\pm 0.9V$  to  $\pm 2.75V$  dual supplies and has Rail-to-Rail input/output capabilities. These amplifiers provide a 500kHz gain-bandwidth product and 120dB open-loop voltage gain while using only 100 $\mu$ A of supply current per amplifier. The combination of low input offset voltage ( $\pm 200\mu$ V) and high open-loop gain makes them ideal for low-power/low-voltage, high-precision portable applications. The MAX4291/MAX4292/MAX4294 have an input common-mode range that extends to each supply rail, and their outputs swing to within 46mV of the rails with a 2k load. Although the minimum operating voltage is specified at 1.8V, these devices typically operate down to 1.5V. The combination of ultra-low-voltage operation, rail-to-rail inputs/output, and low-power consumption makes these devices ideal for any portable/two-cell battery-powered system. The single MAX4291 is offered in an ultra-small 5-pin SC70 package. The dual MAX4292 is offered in a space-saving 8-bump, 1.5mm x 1.5mm footprint, ultra chip-scale package (UCSP(tm)).

**II. Manufacturing Information**

A. Description/Function:	Ultra-Small, +1.8V, $\mu$ Power, Rail-to-Rail I/O Op Amps
B. Process:	B8
C. Fabrication Location:	California or Texas
D. Assembly Location:	Carsem, ATP
E. Date of Initial Production:	April 22, 2000

**III. Packaging Information**

A. Package Type:	14-pin TSSOP
B. Lead Frame:	Copper
C. Lead Finish:	85Sn/15Pb
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-3001-0171
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:	61 X 86 mils
B. Passivation:	$\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	0.8 microns (as drawn)
F. Minimum Metal Spacing:	0.8 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	$\text{SiO}_2$
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 pending. Using these results, the Failure Rate ( $\lambda$ ) 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)

$$\lambda = 13.4 \times 10^{-9}$$

$$\lambda = 13.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 B8 Process results in a FIT Rate of 1.53 @ 25C and 26.4 @ 55C, data limited (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 OP84 die type has been found to have all pins able to withstand a HBM transient pulse of 2000 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

**MAX4294EUD**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	80	0
<b>Moisture Testing</b> (Note 2) 85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (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