

RELIABILITY REPORT  
FOR  
**MAX4092AxA**  
PLASTIC ENCAPSULATED DEVICES

April 15, 2003

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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## Conclusion

The MAX4092 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 dual MAX4092 operational amplifier combines excellent DC accuracy with Rail-to-Rail® operation at the input and output. Since the common-mode voltage extends from  $V_{CC}$  to  $V_{EE}$ , the device can operate from either a single supply (2.7V to 6V) or split supplies ( $\pm 1.35V$  to  $\pm 3V$ ). Each op amp requires less than 130 $\mu A$  of supply current. Even with this low current, the op amps are capable of driving a 1k $\Omega$  load, and the input-referred voltage noise is only 12nV/ $\sqrt{Hz}$ . In addition, these op amps can drive loads in excess of 2000pF.

The precision performance of the MAX4092 combined with its wide input and output dynamic range, low-voltage, single-supply operation, and very low supply current, make it an ideal choice for battery-operated equipment, industrial, and data acquisition and control applications. The MAX4092 is available in 8-pin  $\mu MAX$  and SO packages.

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage ( $V_{CC}$ to $V_{EE}$ )	7V
Common-Mode Input Voltage	( $V_{CC} + 0.3V$ ) to ( $V_{EE} - 0.3V$ )
Differential Input Voltage	$\pm(V_{CC} - V_{EE})$
Input Current ( $I_{N+}$ , $I_{N-}$ )	$\pm 10mA$
Output Short-Circuit Duration OUT shorted to GND or $V_{CC}$	Continuous
Operating Temperature Range	-40°C to +125°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation ( $T_A = +70^\circ C$ )	
8-Pin SO	471mW
8-Pin $\mu MAX$	330mW
Derates above +70°C	
8-Pin SO	5.88mW/°C
8-Pin $\mu MAX$	4.1mW/°C

## II. Manufacturing Information

A. Description/Function:	Dual Micropower, Single-Supply, Rail-to-Rail Op Amps
B. Process:	CB2 - Complementary Bipolar Process
C. Number of Device Transistors:	336
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Philippines, Malaysia or Thailand
F. Date of Initial Production:	January, 2002

## III. Packaging Information

A. Package Type:	<b>8-Lead SO</b>	<b>8-Lead uMAX</b>
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.0 mil dia.)	Gold (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-2501-0140	# 05-2501-0139
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	Level 1

## IV. Die Information

A. Dimensions:	46 x 87 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Gold
D. Backside Metallization:	None
E. Minimum Metal Width:	2 microns (as drawn)
F. Minimum Metal Spacing:	2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	iO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Jim Pedicord (Manager, Rel Operations)  
Bryan Preeshl (Executive Director of QA)  
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 13.57 \times 10^{-9} \quad \lambda = 13.57 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure reliability of its processes. The reliability required for lots which receive a burn-in qualification 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 rejects from lots exceeding this level. The attached Burn-In Schematic (Spec. # 06-5216) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1M**).

### B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

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

The OX55 die type has been found to have all pins able to withstand a transient pulse of  $\pm 2500\text{V}$ , per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of  $\pm 250\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX4092AxA**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		200	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SO uMAX	77 77	0 0
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		77	0

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

Note 2: Generic Package/Process data

## Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except $V_{PS1}$ 3/	All $V_{PS1}$ pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.

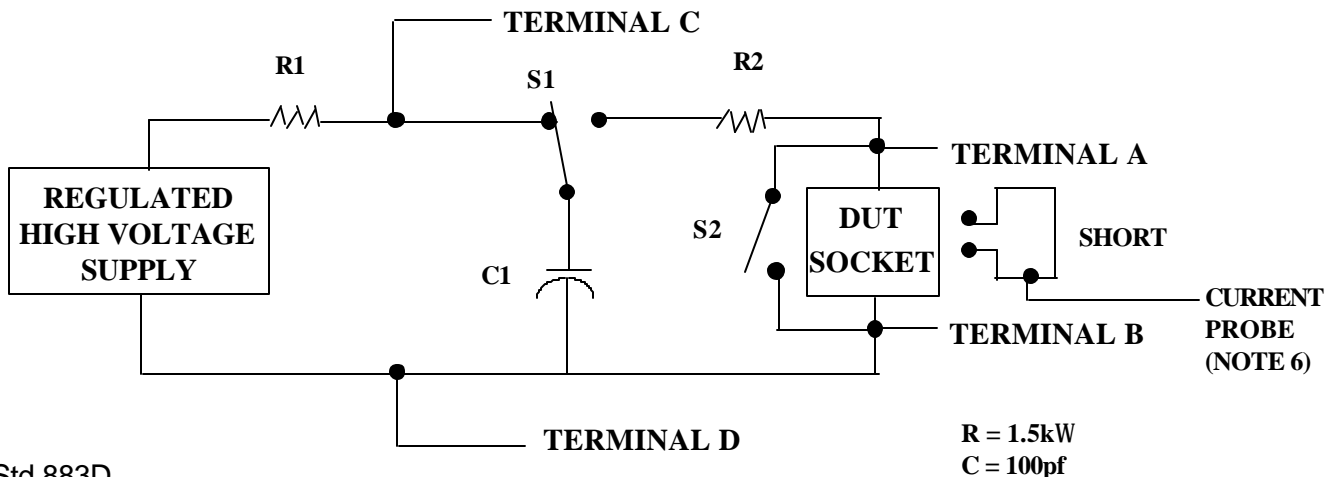
2/ No connects are not to be tested.

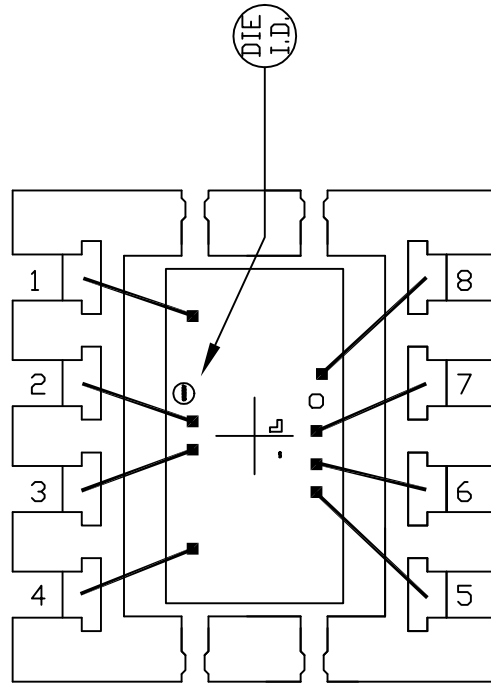
3/ Repeat pin combination I for each named Power supply and for ground

(e.g., where  $V_{PS1}$  is  $V_{DD}$ ,  $V_{CC}$ ,  $V_{SS}$ ,  $V_{BB}$ , GND,  $+V_S$ ,  $-V_S$ ,  $V_{REF}$ , etc).

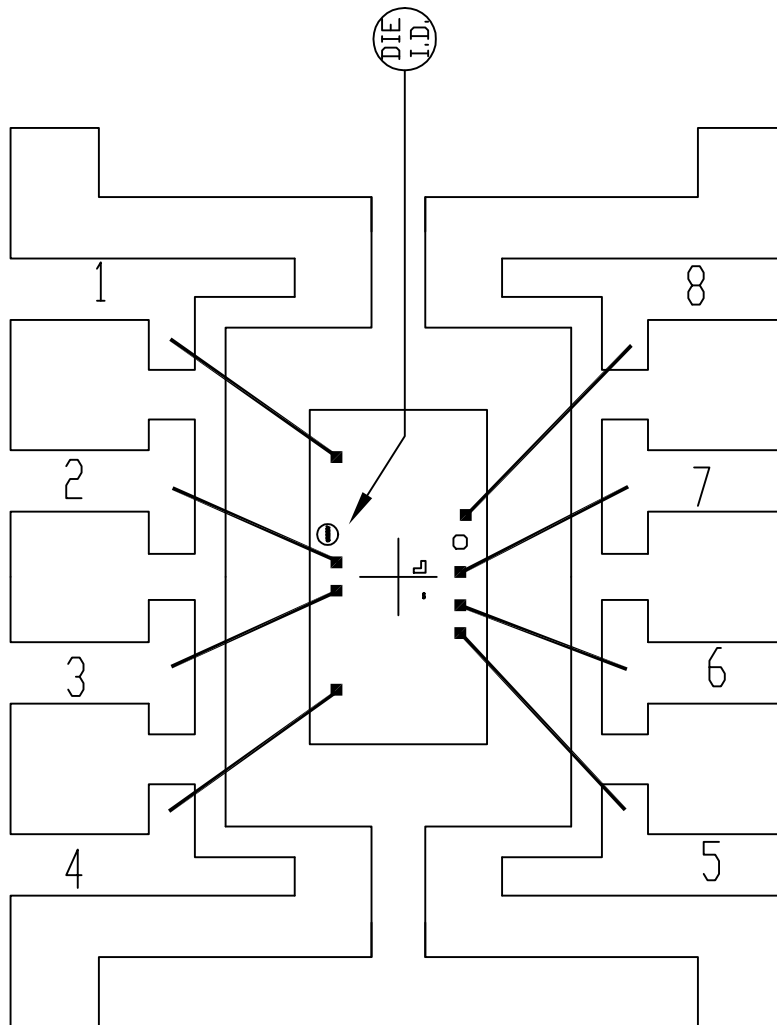
### 3.4 Pin combinations to be tested.

- 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.,  $V_{SS1}$ , 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.





PKG. CODE: U8-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 68x94	PKG. DESIGN			BOND DIAGRAM #: 05-2501-0139	REV: B

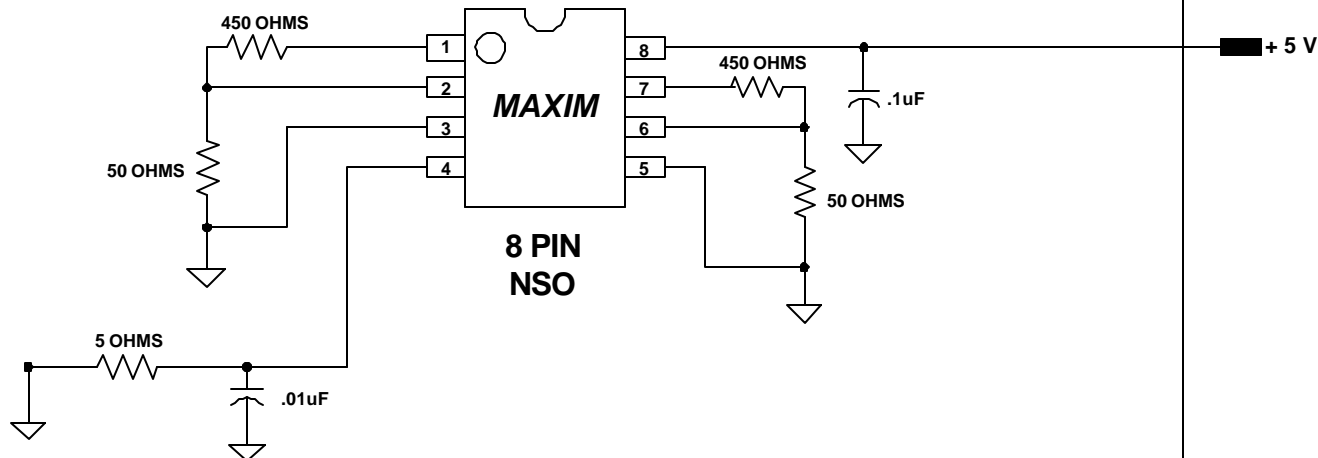


PKG. CODE: S8-4		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 90 X 130	PKG. DESIGN			BOND DIAGRAM #: 05-2501-0140	REV: B



ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 4016; MAX 4126 / 4128 / 4133 / 4167;  
MAX 4432/4433/4413/4416/4417/4450/4491;  
MAX 4353/4453/4436/4437/4092/4252/4163/4321/4232  
MAX. EXPECTED CURRENT = 15mA

DRAWN BY: HAK TAN. Max current for MAX  
4092=.5mA, MAX4252= 2mA, MAX4163= 1mA,  
MAX4321= 1.4mA, MAX4232= 20mA.