RELIABILITY REPORT

FOR

MAX9003ExA

PLASTIC ENCAPSULATED DEVICES

April 4, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX9003 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

I. Device Description

A. General

The MAX9003 features the combination of a high-speed operational amplifier, a 185ns comparator, and a precision 1.230V reference. This device operates from a single +2.5V to +5.5V supply and draws less than 500µA of quiescent current.

The amplifiers in the MAX9003 are stable for closed-loop gains of +10V/V or greater with an 8MHz gain-bandwidth product. The input common-mode voltage extends from 150mV below the negative supply to within 1.2V of the positive supply for the amplifier, and to within 1.1V for the comparator. The amplifier and comparator outputs can swing Rail-to-Rail® and deliver up to ±2.5mA and ±4.0mA, respectively, to an external load while maintaining excellent DC accuracy. The unique design of the comparator output stage substantially reduces switching current during output transitions, virtually eliminating power-supply glitches.

The comparator's ±2mV of built-in hysteresis provides noise immunity and prevents oscillations even with a slow-moving input signal. The MAX9003 has an internal 1.230V ±1% precision reference with a low 8ppm/°C temperature coefficient that can sink or source up to 1mA. The amplifier and reference are stable with capacitive loads up to 250pF and 100nF, respectively. The comparator's inverting input is internally connected to the reference output in the MAX9003

B. Absolute Maximum Ratings

Item	Rating
Supply Voltage (VDD o VSS)	-0.3V to +6V
Voltage Inputs (AIN_, CIN_)	(VSS – 0.3V) to (VDD + 0.3V)
Output Short-Circuit Duration (AOUT, COUT, REF)	Continuous to either VSS or VDD
Storage Temperature	-65°C to +160°C
Operating Temperature Range	-40°C to +85°C
Lead Temperature	+300°C
Power Dissipation (TA = +70°C)	
8-pin uMAX	330mW
8-pin SO	471mW
Derates above +70°C	
8-pin uMAX	4.1mW/°C
8-pin SO	5.88 mW/°C

II. Manufacturing Information

A. Description/Function:	Low-Power, High-Speed, Single-Supply Op Amp + Comparator +Reference
B. Process:	S12 – Silicon Gate 1.2 micron CMOS
C. Number of Device Transistors:	283
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Malaysia, Philippines or Thailand
F. Date of Initial Production:	January, 1998

III. Packaging Information

A. Package Type:	**8-Lead NSO**	**8-Lead uMAX**
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.3 mil dia.)	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica fill
G. Bonding Diagram	05-3001-0088	05-3001-0120
H. Flammability Rating:	Class UL94-V0	Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1

IV. Die Information

A. Dimensions:	60 x 50 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum
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:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager
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 (λ) is calculated as follows:

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

(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 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. # 06-5307) 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 OP69-1Z die type has been found to have all pins able to withstand a transient pulse of ±1500V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA and/or ±20V.

Table 1
Reliability Evaluation Test Results

MAX9003ExA

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		80	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	NSO SOT	1480 740	2 0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
Mechanical Stress (Note 2)					
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters		77	0

Note 1: Life Test Data may represent plastic D.I.P. 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

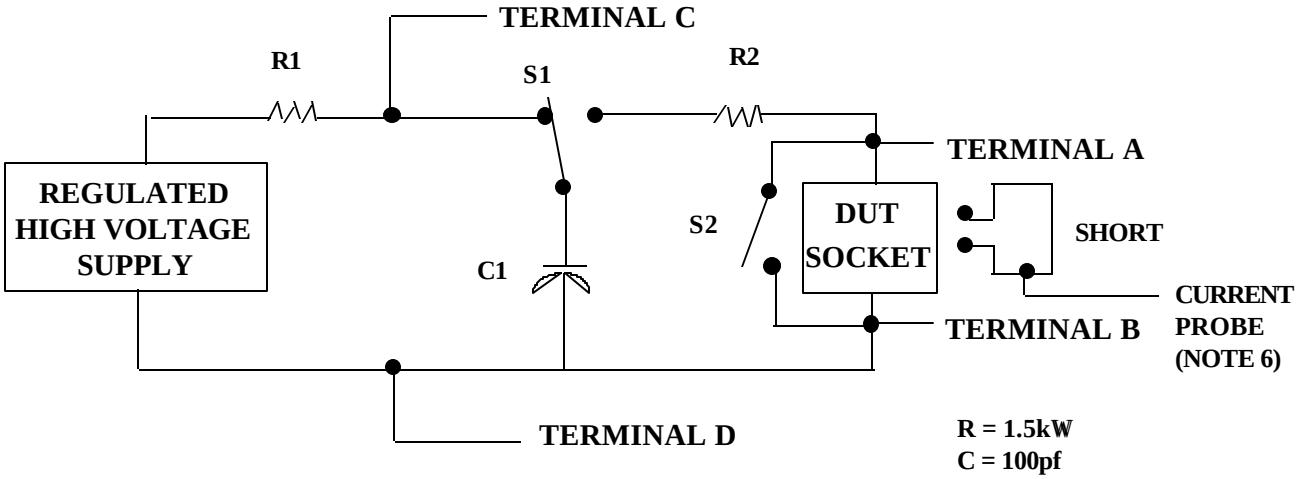
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

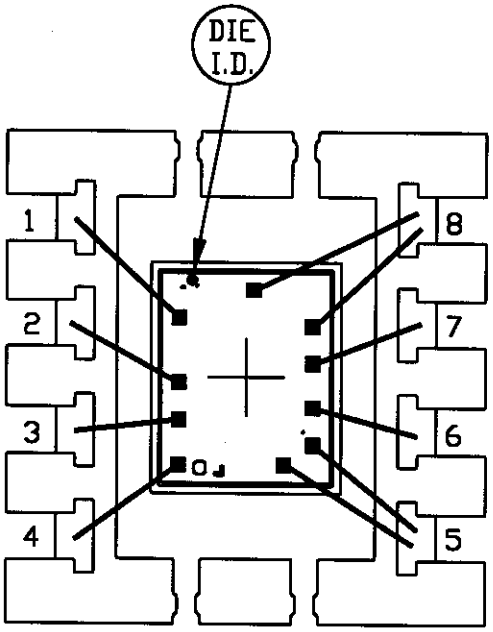
3.4 Pin combinations to be tested.

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.

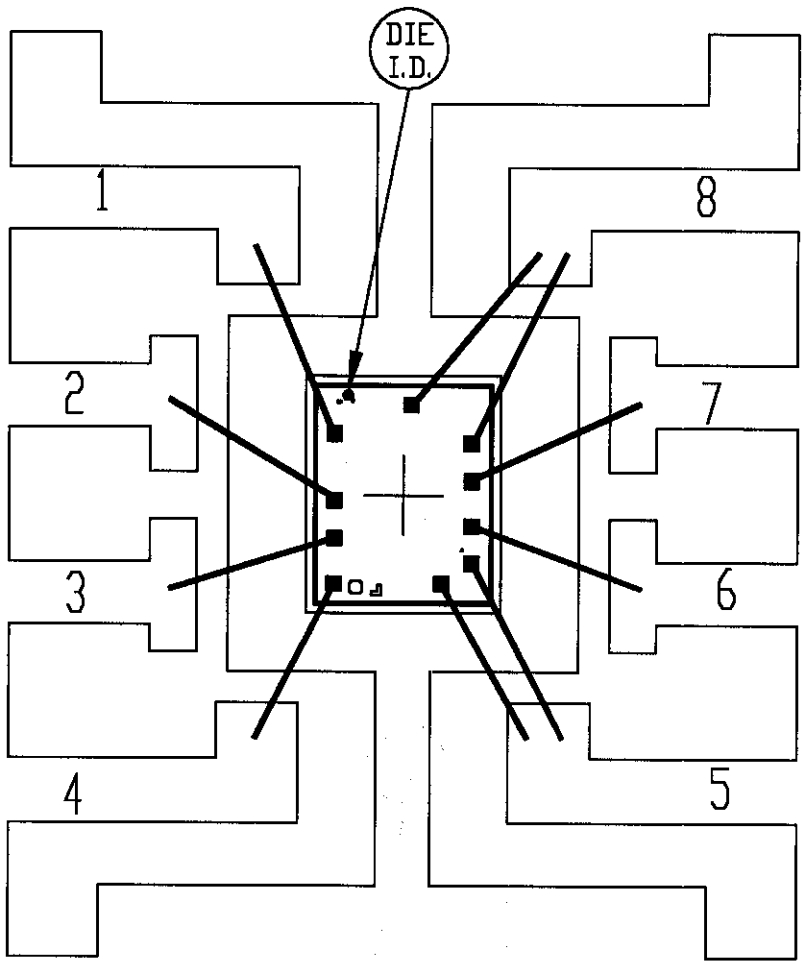
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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





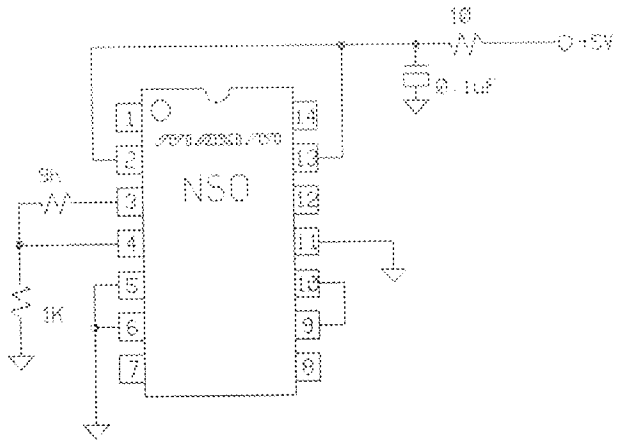
PKG.CODE: U8-1		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 68X94	PKG. DESIGN			BUILDSHEET NUMBER: 05-3001-0120 / REV.: A



PKG.CODE: S8-2		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 90 X 90	PKG. DESIGN			BUILDSHEET NUMBER: 05-3001-0088 / REV.: A

ONCE PER BOARD

ONCE PER DEVICE



+5V I < 1mA
100uF
PS2 I=
PS3 I=
PS4 I=
PS5 I=
PS6 I=

CLK0 FREQ= AMP=
CLK1 FREQ= AMP=
CLK2 FREQ= AMP=
CLK3 FREQ= AMP=
CLK4 FREQ= AMP=

GND

--STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1005.
--BURN-IN IS PER MIL-STD-883 METHOD 1015. COND. D

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 160 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR [X] COMMERCIAL
   [X] MR/883

SPEC. NO. 06-5307 REV: A

DATE: 7/24/97

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S): ALSO REFERENCE 06-5899

MAX9001