

RELIABILITY REPORT  
FOR  
**MAX965ExA**  
PLASTIC ENCAPSULATED DEVICES

September 29, 2003

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



Jim Pedicord  
Quality Assurance  
Reliability Lab Manager

Reviewed by



Bryan J. Preeshl  
Quality Assurance  
Executive Director

## Conclusion

The MAX965 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	V. ....Quality Assurance Information
II. ....Manufacturing Information	VI. ....Reliability Evaluation
III. ....Packaging Information	
IV. ....Die Information	.....Attachments

### I. Device Description

#### A. General

The MAX965 single micropower comparator features Rail-to-Rail® inputs and outputs, and fully specified single-supply operation down to +1.6V. This device draws less than 5 $\mu$ A per comparator and has an open-drain output that can be pulled beyond  $V_{CC}$  to 6V (max) above ground. In addition, its rail-to-rail input common-mode voltage range makes this comparator suitable for ultra-low-voltage operation.

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage (VCC)	+6V
Voltages	
IN <sub>-</sub> , IN <sub>+</sub> , REF, HYST	-0.3V to (VCC + 0.3V)
OUT <sub>-</sub>	-0.3V to +6.0V
Duration of OUT <sub>-</sub> Short Circuit to GND or VCC	Continuous
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10sec)	+300°C
Continuous Power Dissipation (TA = +70°C)	
8-Pin SO	471mW
8-Pin $\mu$ MAX	330mW
Derates above +70°C	
8-Pin SO	5.88mW/°C
8-Pin $\mu$ MAX	4.10mW/°C

## II. Manufacturing Information

A. Description/Function:	Dual, Micropower, Ultra-Low-Voltage, Rail-to-Rail I/O Comparator
B. Process:	S12 (SG1.2) - Standard 1.2 micron silicon gate CMOS
C. Number of Device Transistors:	216
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Philippines, Malaysia, or Thailand
F. Date of Initial Production:	April, 1997

## III. Packaging Information

A. Package Type:	<b>8-Lead Small Outline</b>	<b>8-Lead uMAX</b>
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 mil dia.)	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-1501-0113	# 05-1501-0114
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:	50 x 62 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	TiW/ AlCu/ TiWN
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 <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Jim Pedicord (Manager, Reliability Operations)  
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 240 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 4.52 \times 10^{-9}$$

$$\lambda = 4.52 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5241) 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 CM32 die type has been found to have all pins able to withstand a transient pulse of  $\pm 1000\text{V}$ , 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

**MAX965ExA**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>PACKAGE</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		240	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 & functionality		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.

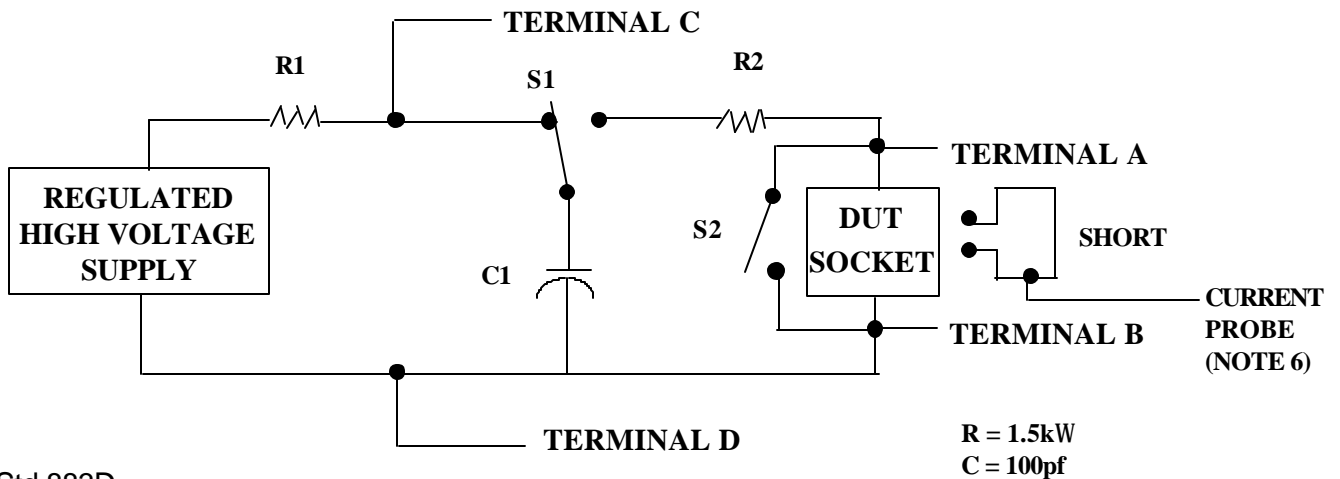
2/ No connects are not to be tested.

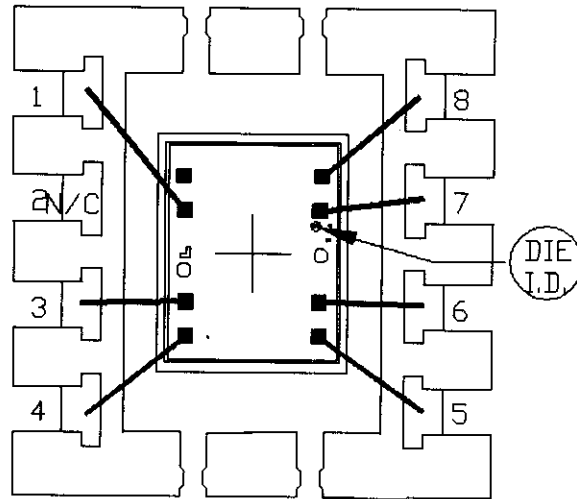
3/ Repeat pin combination I for each named Power supply and for ground

(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

APPROVALS

DATE

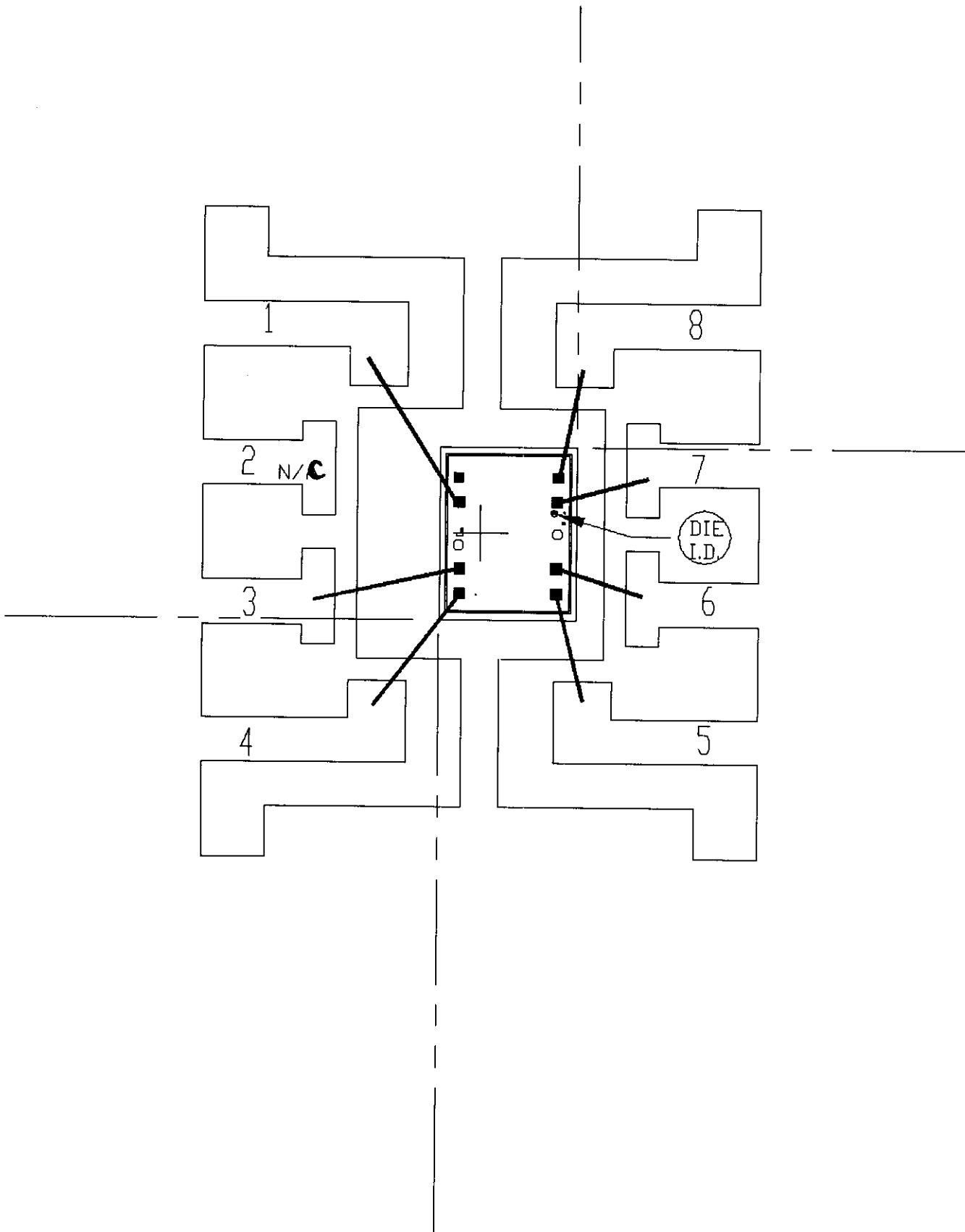


CAV./PAD SIZE:  
68X94

PKG.  
DESIGN

BUILDSHEET NUMBER:  
05-1501-0114

REV.:  
A



PKG.CODE: S8-2

CAV./PAD SIZE: 90 X 90

PKG.  
DESIGN

APPROVALS

DATE



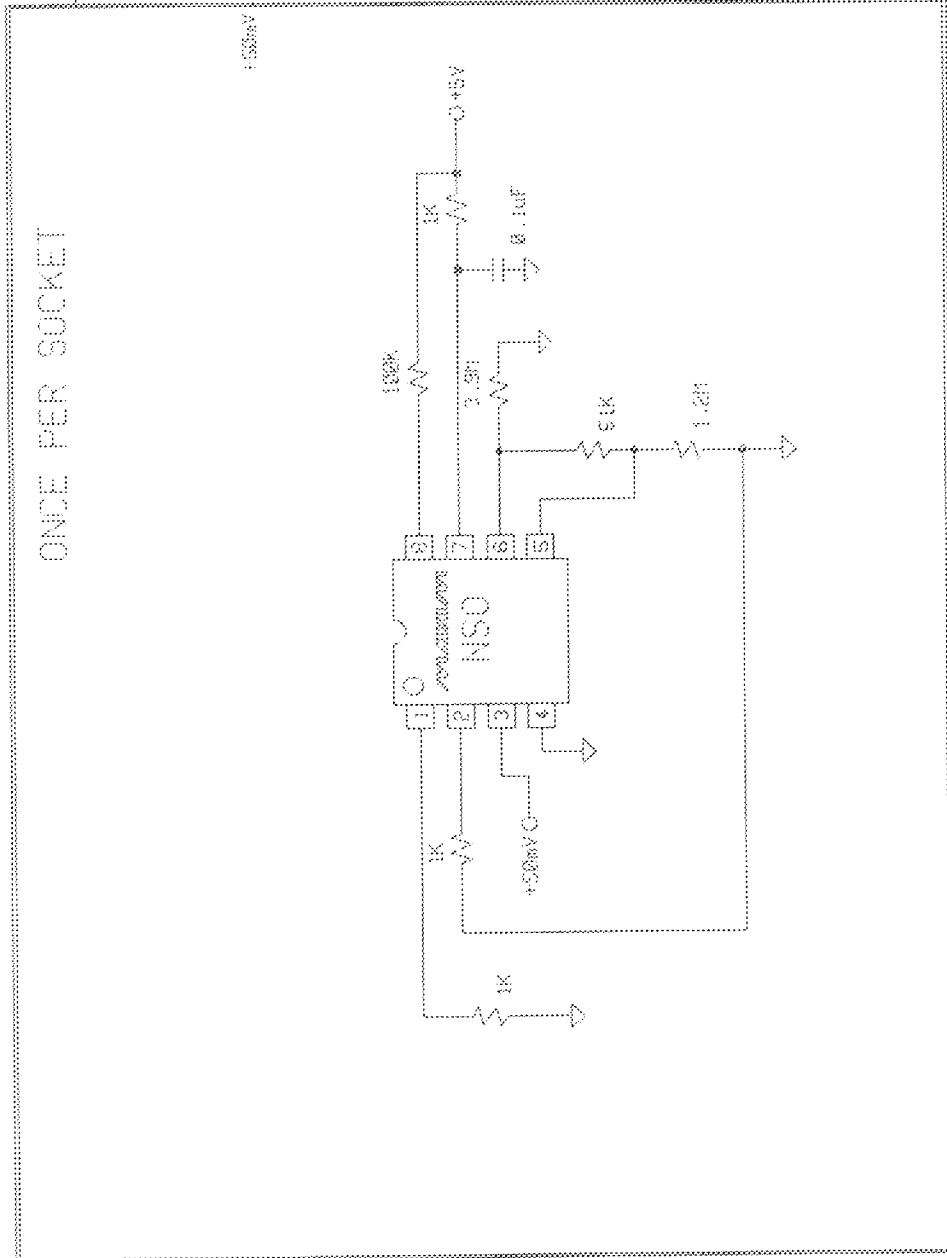
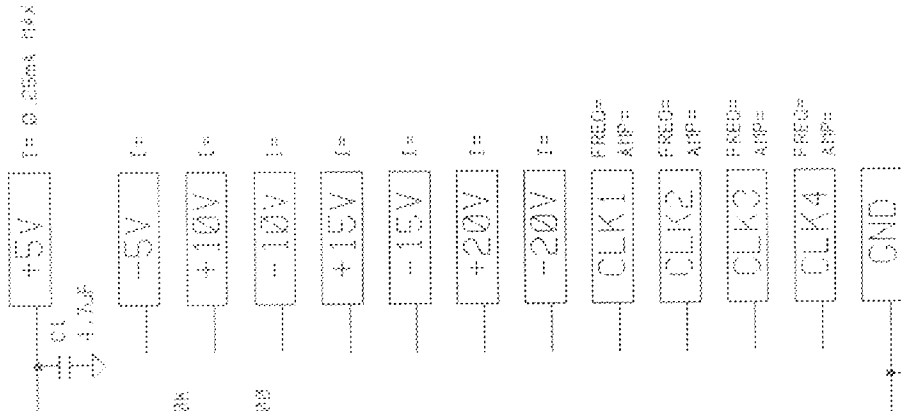
BUILDSHEET NUMBER:  
05-1501-0113

REV.:  
A



ONCE PER BOARD

ONCE PER SOCKET



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

NOTES:

1. TEMPERATURE : 125C OR EQUIVALENT
2. TIME : 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 15SEC CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL (X) HR/983

SPEC. NO. 06-5241 REV. A

DATE: 12/23/95

DRAWN BY:

MINIMUM BURN-IN SCHEMATIC

DEVICE TYPE:

MAX65/965/657/968