

RELIABILITY REPORT
FOR
MAX986Exx
PLASTIC ENCAPSULATED DEVICES

November 26, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

A handwritten signature in black ink, appearing to read "J Pedicord".

Jim Pedicord
Quality Assurance
Reliability Lab Manager

Reviewed by

A handwritten signature in black ink, appearing to read "Bryan J. Preeshl".

Bryan J. Preeshl
Quality Assurance
Executive Director

Conclusion

The MAX986 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 MAX986 single micropower comparator features low-voltage operation and Rail-to-Rail® inputs and outputs. Its operating voltage ranges from +2.5V to +5.5V, making it ideal for both 3V and 5V systems. This comparator also operates with $\pm 1.25\text{V}$ to $\pm 2.75\text{V}$ dual supplies. It consumes only $11\mu\text{A}$ of supply current while achieving a 300ns propagation delay.

The common-mode input voltage range extends 250mV beyond the supply rails. Input bias current is typically 1.0pA, and input offset voltage is typically 0.5mV. Internal hysteresis ensures clean output switching, even with slow-moving input signals.

The output stage's unique design limits supply-current surges while switching, virtually eliminating the supply glitches typical of many other comparators. This design also minimizes overall power consumption under dynamic conditions. The MAX986 has an open-drain output stage that can be pulled beyond V_{CC} to 6V (max) above V_{EE} . This open-drain version is ideal for level translators and bipolar to single-ended converters.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage (V_{CC} to V_{EE})	6V
IN_- , IN_+ to V_{EE}	-0.3V to ($V_{\text{CC}} + 0.3\text{V}$)
OUT_- to V_{EE}	-0.3V to 6V
OUT_- Short-Circuit Duration to V_{EE} or V_{CC}	10sec
Storage Temp.	-65°C to +150°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	571mW
Derates above +70°C	7.10mW/°C
Continuous Power Dissipation ($T_A = 70^\circ\text{C}$)	
5-Pin SOT23	571mW
5-Pin SC70	247mW
8-Pin SO	471mW
Derates above +70°C	
5-Pin SOT23	7.10mW/°C
5-Pin SC70	3.10mW/°C
8-Pin SO	5.88mW/°C

II. Manufacturing Information

A. Description/Function:	Micropower, Low-Voltage, SOT23, Rail-to-Rail I/O Comparator
B. Process:	S12 (SG1.2) - Standard 1.2 micron silicon gate CMOS
C. Number of Device Transistors:	105
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Malaysia, Philippines, Thailand or Korea
F. Date of Initial Production:	April, 1997

III. Packaging Information

A. Package Type:	5-Lead SOT23	5-Lead SC70	8-Lead SO
B. Lead Frame:	Copper	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate	Solder Plate
D. Die Attach:	Non-Conductive Epoxy	Non-Conductive Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1 mil dia.)	Gold (1 mil dia.)	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-1501-0201	# 05-1501-0200	# 05-1501-0202
H. Flammability Rating:	Class UL94-V0	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	Level 1	Level 1

IV. Die Information

A. Dimensions:	31 x 30 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Copper/Si
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:	2.7 mil. Sq.
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

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

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 160 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 6.79 \times 10^{-9} \quad \lambda = 6.79 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5255) 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 CM61-1 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 $\pm 250\text{mA}$ and/or $\pm 20\text{V}$.

Table 1
Reliability Evaluation Test Results
MAX986Exx

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		160	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 96hrs.	DC Parameters & functionality	SC70	77	0
			SOT23	77	0
			SO	77	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

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

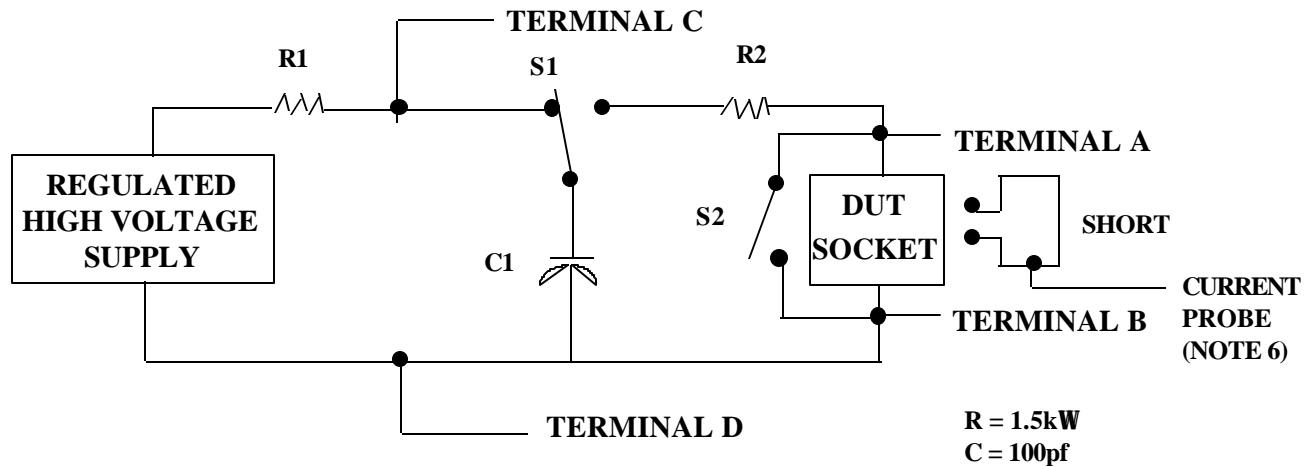
1/ Table II is restated in narrative form in 3.4 below.

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).

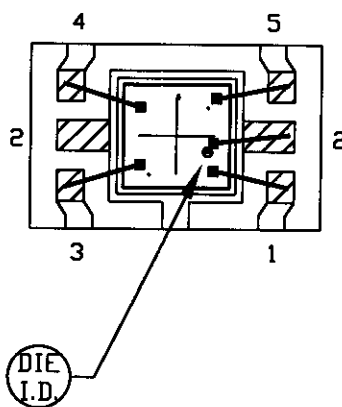
3.4 Pin combinations to be tested.

- 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.
- 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.
- 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. MAX DIE SIZE: 31x30
2. MIN. WIRE LENGTH: 21 MILS.



USE NON-CONDUCTIVE EPOXY

▨ BONDABLE AREA

NOTE: CAVITY DOWN

PKG. CODE:	X5-1	
CAV./PAD SIZE:	35x34	PKG. DESIGN

SIGNATURES

DATE

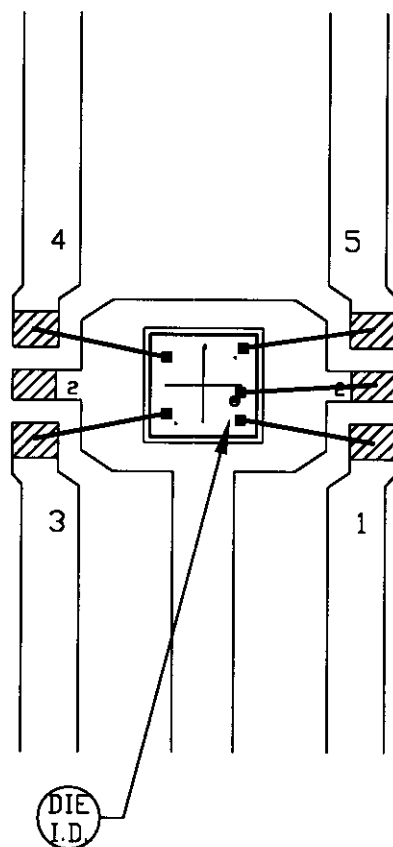
MAXIM
CONFIDENTIAL & PROPRIETARY

BOND DIAGRAM #:

05-1501-0200

REV:


B

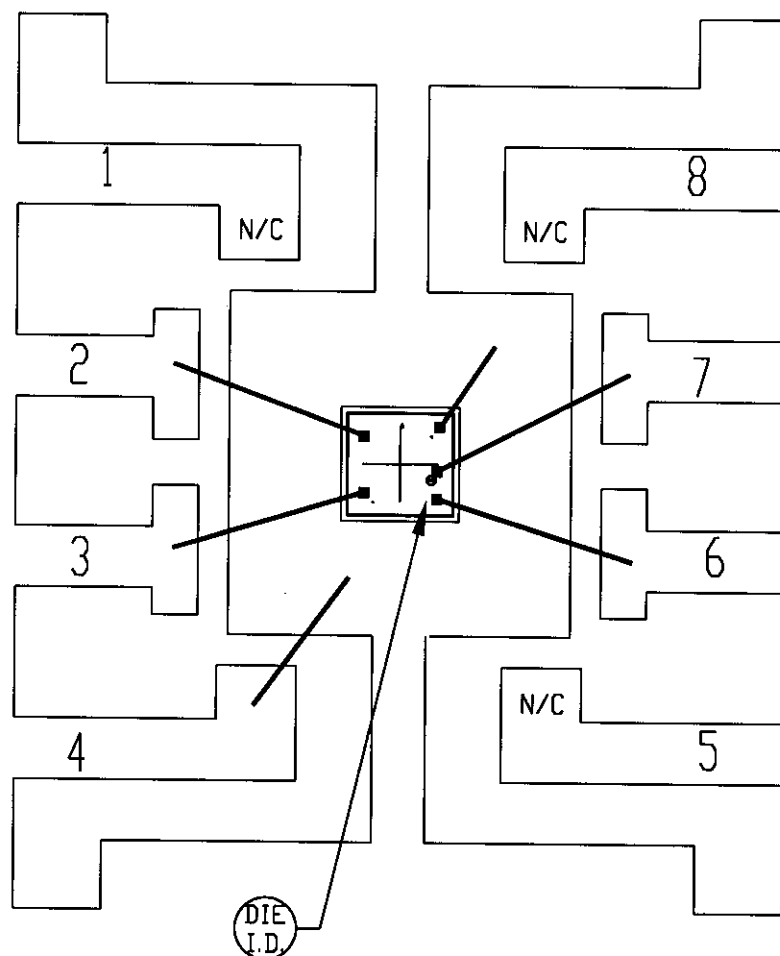



USE NON-CONDUCTIVE EPOXY

▨ - BONDING AREA

NOTE: CAVITY DOWN

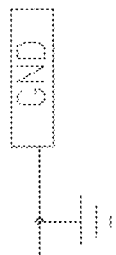
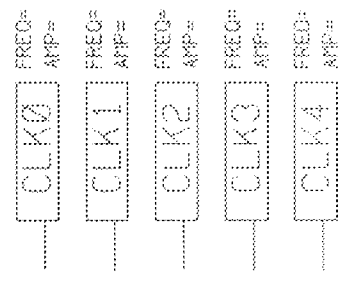
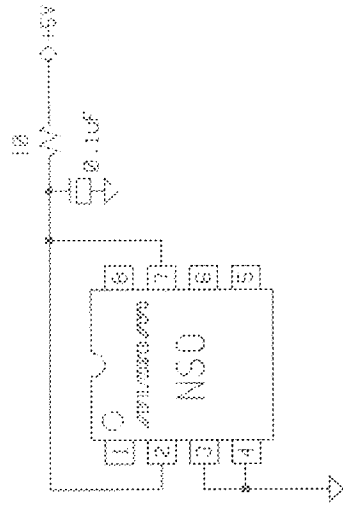
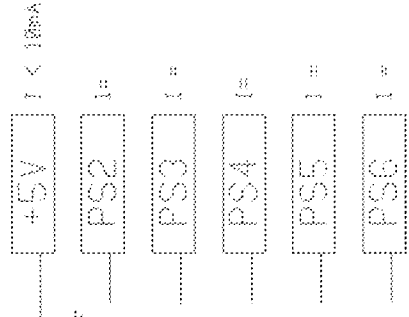
PKG. CODE: U5-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 64X45	PKG. DESIGN			BOND DIAGRAM #: 05-1501-0201	REV: B



PKG. CODE: S8-2		SIGNATURES ,	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 90 X 90	PKG. DESIGN				

ONCE PER BOARD

ONCE PER DEVICE



--STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1005.
--BURN-IN IS PER MIL-STD-883 METHOD 1015. COND. 9

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 150 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR [X] CORPCTAL [X] HR/993

SPEC. NO. 06-5255 REV: A

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

DATE: 12/18/96

DRAWN BY:

MAX985/6/7/8