

RELIABILITY REPORT
FOR
MAX9041xExx
PLASTIC ENCAPSULATED DEVICES

January 13, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX9041 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 MAX9041 features combinations of low-power comparators and precision voltage references. The operating voltage range makes it ideal for both 3V and 5V systems. The MAX9041 has a single comparator and reference consuming only 40 μ A of supply current. Low-voltage operation and low supply current makes this device ideal for battery-operated systems.

The comparators feature Rail-to-Rail® inputs and outputs, with a common-mode input voltage range that 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 features a unique design that limits supply current surges while switching, virtually eliminating supply glitches typical of many other comparators. This design also minimizes overall power consumption under dynamic conditions. The comparator outputs have rail-to-rail, push-pull output stage that sinks and source up to 8mA. The propagation delay is 400ns, even with the low-operating supply current.

The MAX9041 is offered in two grades: an A grade with 0.4% initial accuracy and 6ppm/°C tempco, and a B grade with 1% initial accuracy and 100ppm/°C tempco. The voltage references feature a proprietary curvature-correction circuit and laser-trimmed thin-film resistors. This series-mode references can sink or source up to 500 μ A of load current.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage (VCC to VEE)	-0.3V to +6V
All Other Pins	(VEE - 0.3V) to (VCC + 0.3V)
Output Short-Circuit Duration (OUT_, REF)	Indefinite Short Circuit to Either Supply
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
6-Pin SOT23	696mW
8-Pin SO	471mW
Derates above +70°C	
6-Pin SOT23	8.7mW/°C
8-Pin SO	5.88mW/°C

II. Manufacturing Information

A. Description/Function:	Micropower, Single-Supply, Comparator + Precision Reference ICs
B. Process:	B12 (Standard 1.2 micron silicon gate CMOS)
C. Number of Device Transistors:	204
D. Fabrication Location:	California, USA
E. Assembly Location:	Philippines, Thailand or Malaysia
F. Date of Initial Production:	October, 2000

III. Packaging Information

	8-Pin SOT	8-Pin NSO
A. Package Type:	8-Pin SOT	8-Pin NSO
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:	# 05-1501-0180	# 05-1501-0178
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1	Level 1

IV. Die Information

A. Dimensions:	35 x 57 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
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 (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 (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 159 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

▲
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 6.83 \times 10^{-9}$$

$$\lambda = 6.83 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5374) 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 CM57/CM57-2 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

MAX9041xExx

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		159	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SOT	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 & 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.

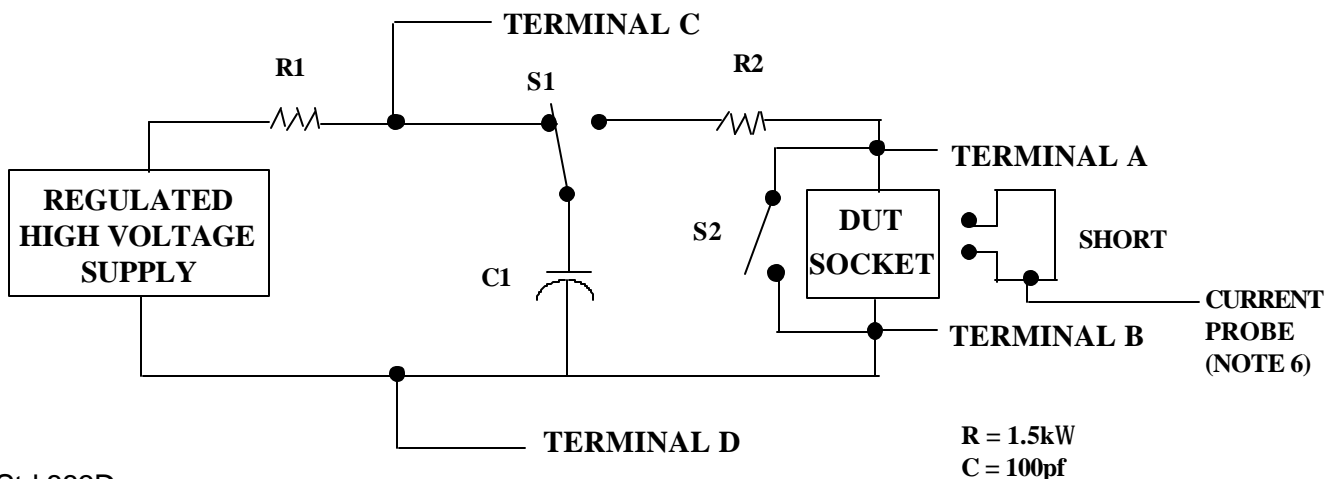
2/ No connects are not to be tested.

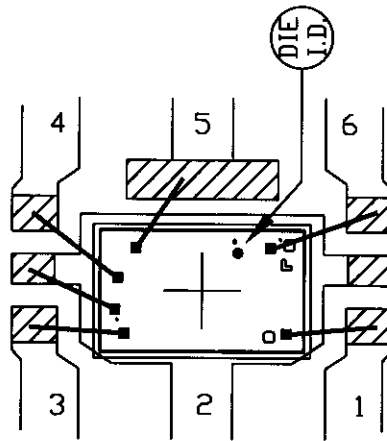
3/ Repeat pin combination I for each named Power supply and for ground

(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.

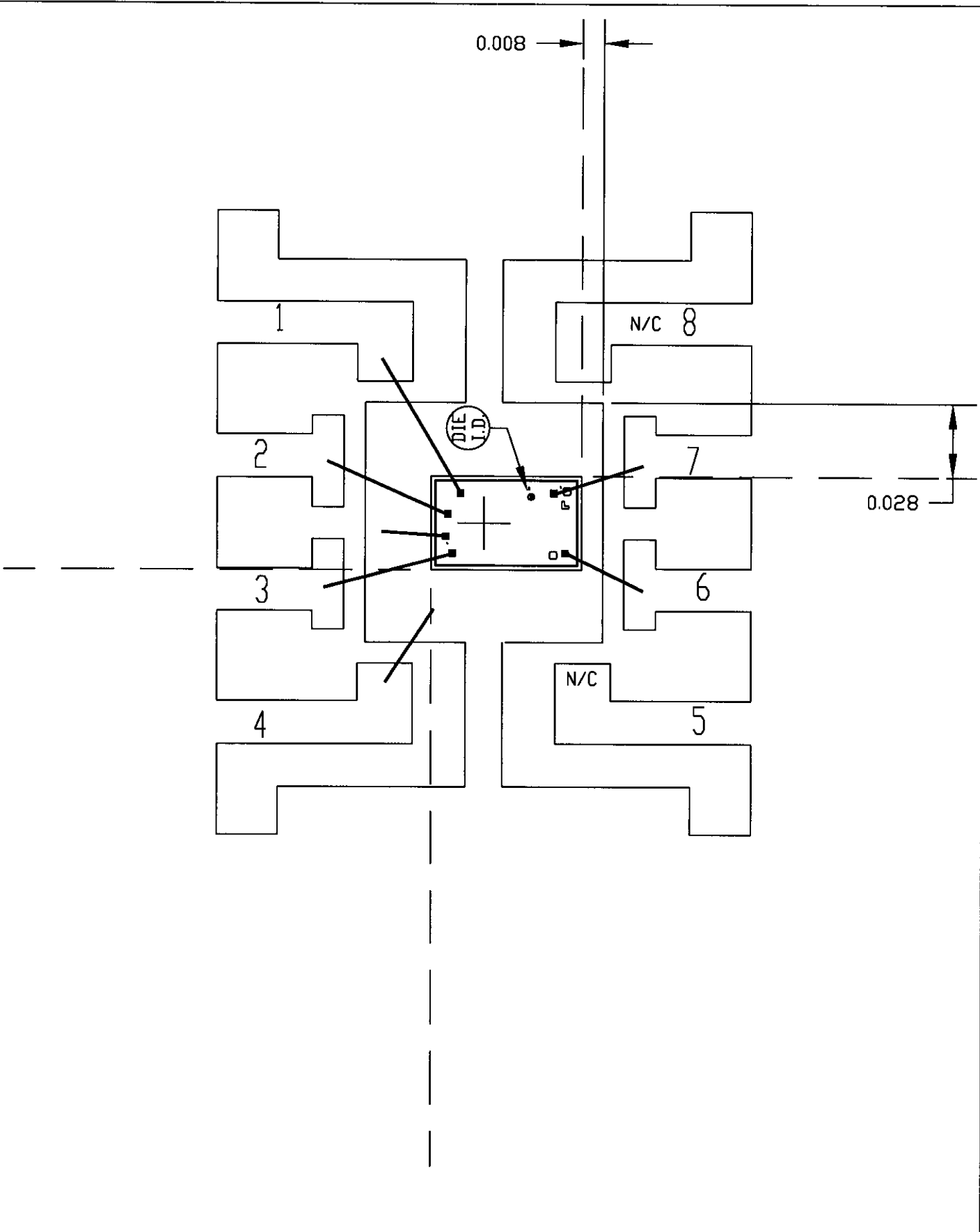
- a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.
- b. Each pin individually connected to terminal A with respect to each different set of a combination of all 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.





NOTE: CAVITY DOWN

PKG.CODE:	U6-1		APPROVALS	DATE	MAXIM
CAV./PAD SIZE:	64x39	PKG. DESIGN			BUILDSHEET NUMBER: 05-1501-0180
					REV.: A



PKG.CODE: S8-2

APPROVALS

DATE



CAV./PAD SIZE:
90 X 90

PKG.
DESIGN

BUILDSHEET NUMBER:
05-1501-0178

REV.:
A

