RELIABILITY REPORT

FOR

MAX4451ExK

PLASTIC ENCAPSULATED DEVICES

May 23, 2000

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by:

Jim Pedicord
Quality Assurance

Reviewed by:

Bryan J. Preeshl
Quality Assurance

Reliability Labs Manager Executive Director

Conclusion

The MAX4451 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 MAX4451 single op amp is a unity-gain-stable device that combines high-sped performance with Rail-to-Rail® output. This device operates from a +4.5V to +11V single supply or from ±2.25V to ±5.5 dual supplies. The common-mode input voltage range extends beyond the negative power-supply rail (ground in single-supply applications).

The MAX4451 requires only 6.5mA of quiescent supply current per op amp while achieving a 210MHz –3dB bandwidth and a 485V/µs slew rate. This device is an excellent solution in low-power/low-voltage systems that require wide bandwidth, such as video, communications, and instrumentation.

B. Absolute Maximum Ratings

Item	Rating
Supply Voltage (V_{CC} to V_{EE})	+12V
IN_-, IN_+, OUT_	(V_{EE} – 0.3V) to (V_{CC} + 0.3V)
Output Short-Circuit Current to V_{CC} or V_{EE}	150mA
Storage Temp.	-65°C to +150°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	
8-Lead SOT23	421mW
8-Lead SO	471mW
Derates above +70°C	
8-Lead SOT23	5.26mW/°C
8-Lead SO	5.9mW/°C

II. Manufacturing Information

A. Description/Function: Ultra-Small, Low-Cost, 210MHz, Single-Supply Op Amp with Rail-to-Rail Output

B. Process: CB20

C. Number of Device Transistors: 170

D. Fabrication Location: Oregon, USA

E. Assembly Location: Malaysia, Philippines, Thailand

F. Date of Initial Production: January 19, 2000

III. Packaging Information

A. Package Type:	**8 Lead SOT-23**	**8-Lead SO**
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Non-Conductive	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:	Buildsheet # 05-2501-0007	Buildsheet # 05-2501-0008

H. Flammability Rating: Class UL94-V0

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

IV. Die Information

A. Dimensions: 67 x 24 mils

B. Passivation: Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)

C. Interconnect: Gold

D. Backside Metallization: None

E. Minimum Metal Width: 2 microns

F. Minimum Metal Spacing: 2 microns

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:

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:

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

1.83 (Chi square value for MTTF upper limit)

192 x 4389 x 80 x 2 → Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 13.57 \times 10^{-9}$ $\lambda = 13.57$ 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 the 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 lots exceeding this level. 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-1L)**.

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 OX14die type has been found to have all pins able to withstand a transient pulse of ±2500V, 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

MAX4450ExK

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

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

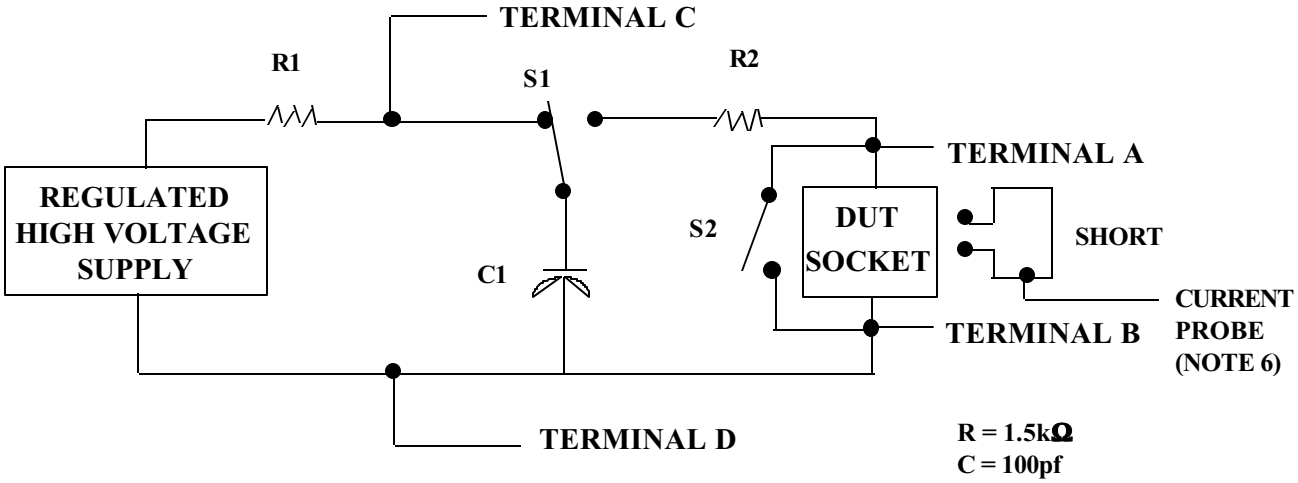
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

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.

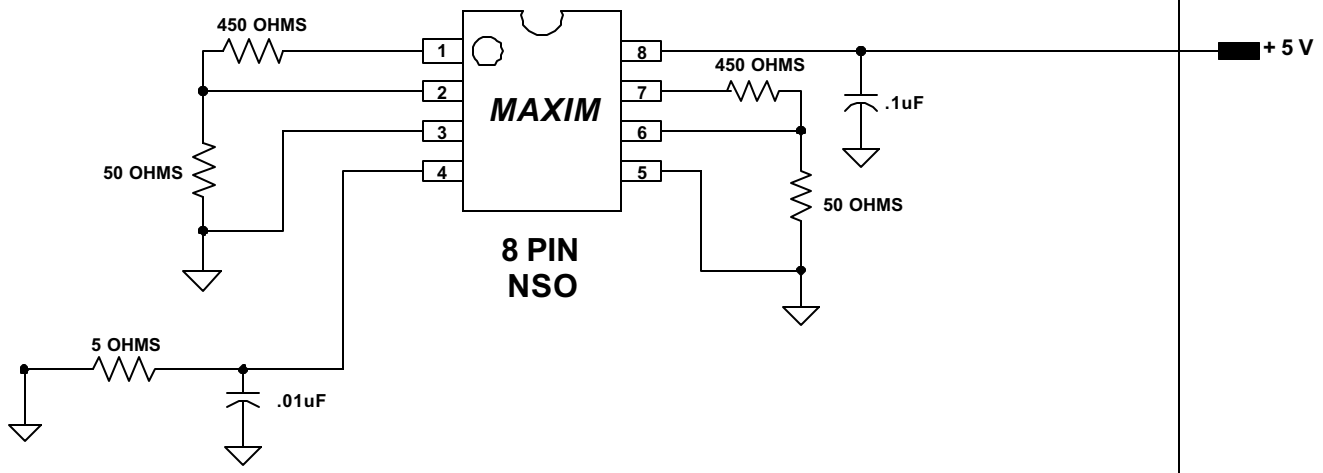
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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



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
MAX. EXPECTED CURRENT = 15mA

DRAWN BY: HAK TAN
NOTES: Max current for MAX4092
is .5mA