RELIABILITY REPORT

FOR

MAX4163ExA

PLASTIC ENCAPSULATED DEVICES

September 14, 2005

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

Jim Pedicord
Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX4163 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 MAX4163 is a dual, micropower operational amplifier that combines an exceptional bandwidth to power consumption ratio with true rail-to-rail inputs and outputs. It consumes a mere 25µA quiescent current per amplifier, yet achieves 200kHz gain-bandwidth product and are unity-gain stable while driving any capacitive load. The MAX4163 operates from either a single supply (+2.7V to +10V) or dual supplies (±1.35V to ±5V), with an input common-mode voltage range that extends 250mV *beyond* either supply rail. This amplifier uses proprietary architecture to achieve a very high input common-mode rejection ratio without the mid-swing nonlinearities present in other Rail-to-Rail® op amps. This architecture also maintains high open-loop gain and output swing while driving substantial loads.

The combination of excellent bandwidth/power performance, single-supply operation, and miniature footprint makes this op amp ideal for portable equipment and other low-power, single-supply applications. The MAX4163 is available in an 8-pin µMAX or SO.

B. Absolute Maximum Ratings

Item	Rating
Supply Voltage (VDD to VSS)	11V
IN+, IN-, OUT Voltage	(VDD + 0.3V) to (VSS - 0.3V)
Short-Circuit Duration (to either rail)	Continuous
Continuous Power Dissipation (TA = +70°C)	
8-Pin SO (derate 5.88mW/°C above +70°C)	471mW
8-Pin µMAX (derate 4.1mW/°C above +70°C)	330mW
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C

II. Manufacturing Information

A. Description/Function:	Micropower, Single-Supply, 10V, Rail-to-Rail I/O Op Amps
B. Process:	S12 (Standard 1.2 micron silicon gate CMOS)
C. Number of Device Transistors:	496
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Malaysia, Philippines and Thailand
F. Date of Initial Production:	April, 1997

III. Packaging Information

	8-Pin uMAX	**8-NSO**
A. Package Type:		
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Silver Plate or 100% Matte Tin	Silver Plate or 100% Matte Tin
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.0 mil dia.)	Gold (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-3001-0020	# 05-3001-0019
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C:	Level 1	Level 1

IV. Die Information

A. Dimensions:	57 x 79 mils
B. Passivation:	Si_3N_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 (Managing Director of QA**)**

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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 160 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 6.87 \times 10^{-9}$

λ = 6.87 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 once 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. # 06-5209) 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-1N**). Current monitor data for the B12/S12 Process results in a FIT Rate of 0.10 @ 25C and 1.73 @ 55C (0.8 eV, 60% UCL)

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 OP02 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.

Table 1
Reliability Evaluation Test Results

MAX4163ExA

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 = 168hrs.	DC Parameters & functionality	SOT	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

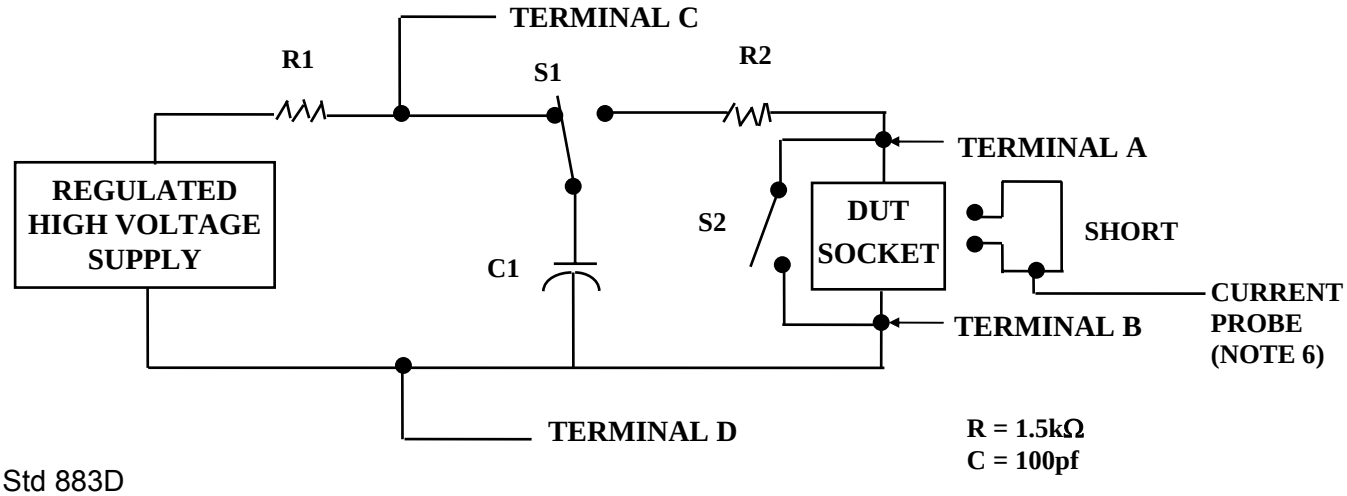
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

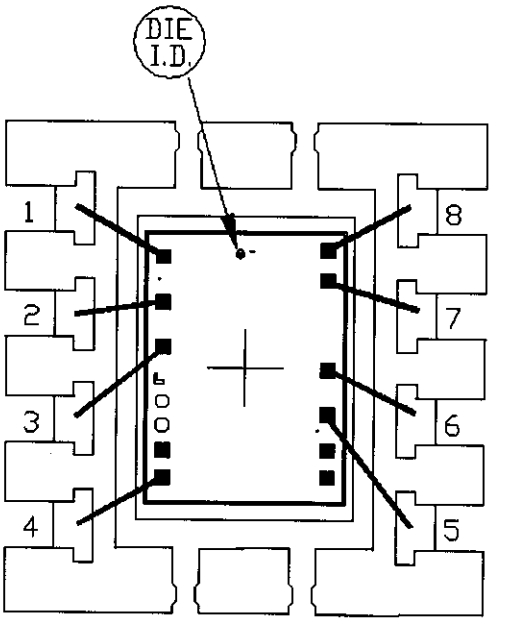
3.4 Pin combinations to be tested.

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.

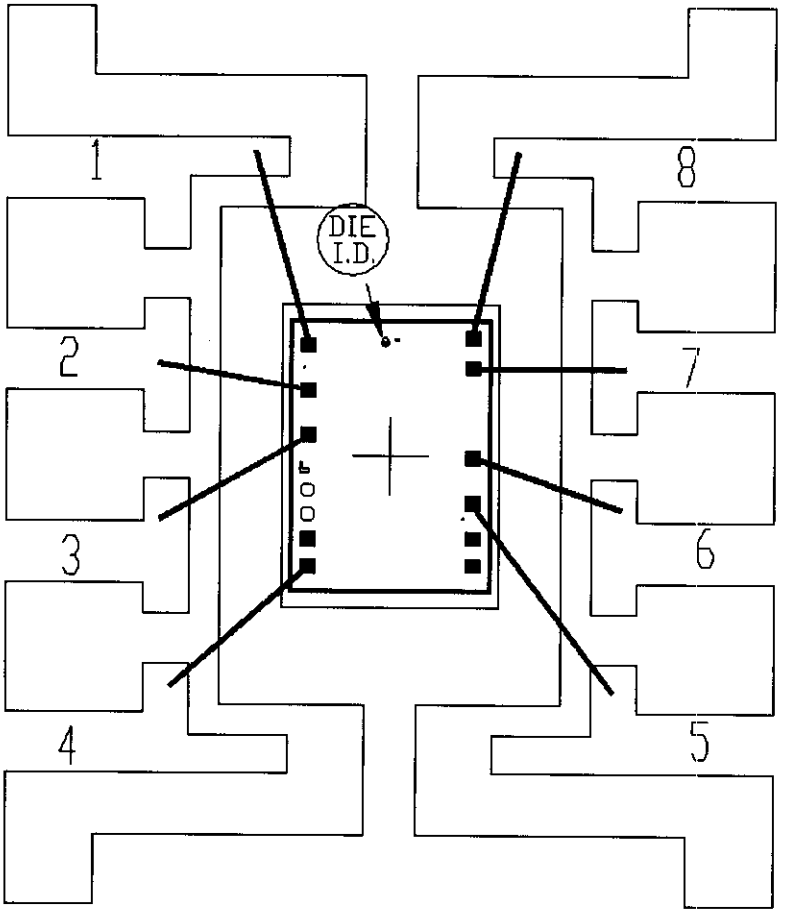
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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





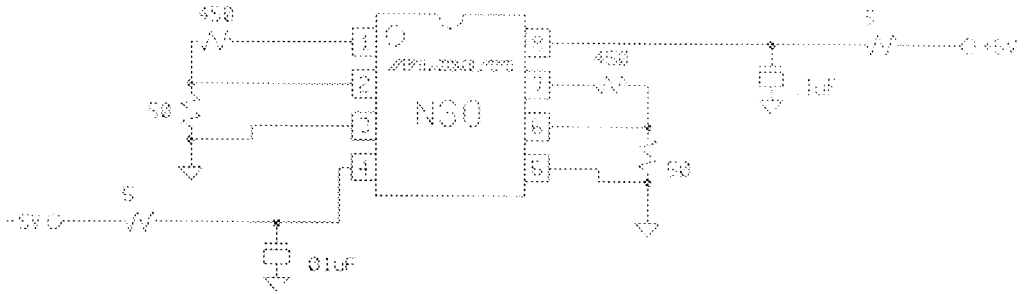
PKG.CODE: U8-1		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 68X94	PKG. DESIGN			BUILDSHEET NUMBER: 05-3001-0020	REV.: A



PKG.CODE: S8-4		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 90 X 130	PKG. DESIGN			BUILDSHEET NUMBER: 05-3001-0019	REV.: A

ONCE PER BOARD

ONCE PER DEVICE



+5V 1 x 15mA
100 pF
-5V 1 x 15mA
100 pF
PS2 1 =
PS4 1 =
PS5 1 =
PS6 1 =

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: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR [X] COMMERCIAL
   [X] MP/883

SPEC. NO. 06-5209 REV:C

DATE: 8/20/99

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

MAX410/4153 MAX4225/4227
MAX411/4116 MAX 4184