MAX4147ESD
Rev. A

RELIABILITY REPORT

FOR

MAX4147ESD

PLASTIC ENCAPSULATED DEVICES

February 23, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX4147 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 MAX4147 differential line driver offers high-speed performance while consuming only 100mW of power. Its amplifier has fully symmetrical inputs and outputs and uses laser-trimmed, matched, thin-film resistors to deliver 70dB CMR at 10MHz. Using current-feedback techniques, the MAX4147 achieves a 300MHz bandwidth and a 2000V/µs slew rate.

Optimized for differential, high-output-current applications such as transformer drivers, the MAX4147 drives ±2.6V into a 26.5Ω?load (single-ended) or ±5.6V into a 53Ω?load (differential). This device is preset for a closed-loop gain of 2V/V. Its ultra-low 0.008%/0.03° differential gain/phase allow for a variety of video and RF signal-processing applications.

For power-sensitive applications, the MAX4147 has a shutdown function that reduces supply current to less than 1mA. In addition, superior SFDR (-82dBc at 10kHz, $R_L = 33\Omega$) makes it ideal as a transformer driver for HDSL applications.

For a complete differential transmission link, use the MAX4147 with the MAX4144 line receiver (see the MAX4144 data sheet for more information).

B. Absolute Maximum Ratings

Item	Rating
Supply Voltage (V_{CC} to V_{EE})	12V
Voltage on Any Input to Ground	(V_{CC} + 0.3V) to (V_{EE} - 0.3V)
Storage Temp.	-65°C to +160°C
Lead Temp. (10 sec.)	+300°C
Continuous Power Dissipation (TA = +70°C)	
16-Pin NSO	666.7mW
Derates above +70°C	
16-Pin NSO	8.3mW/°C

II. Manufacturing Information

A. Description/Function: 300MHz, Low-Power, High-Output-Current, Differential Line Driver

B. Process: CPi - Recessed-Oxide-Isolated, High Speed Complementary Bipolar Process

C. Number of Device Transistors: 495

D. Fabrication Location: Oregon, USA

E. Assembly Location: Philippines or Thailand

F. Date of Initial Production: June, 1996

III. Packaging Information

A. Package Type: **14-Lead Small Outline**

B. Lead Frame: Copper

C. Lead Finish: Solder Plate

D. Die Attach: Silver-filled Epoxy

E. Bondwire: Gold (1.3 mil dia.)

F. Mold Material: Epoxy with silica filler

G. Assembly Diagram: Buildsheet # 05-0601-0469

H. Flammability Rating: Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-A: Level 1

IV. Die Information

A. Dimensions: 85 x 48 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 (as drawn)

F. Minimum Metal Spacing: 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 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:

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

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 4.52 \times 10^{-9}$ $\lambda = 4.52$ 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. # 06-5151) 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 OA92 die type has been found to have all pins able to withstand a transient pulse of ±2000V, 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

MAX4147ESD

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		80	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	NSO	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

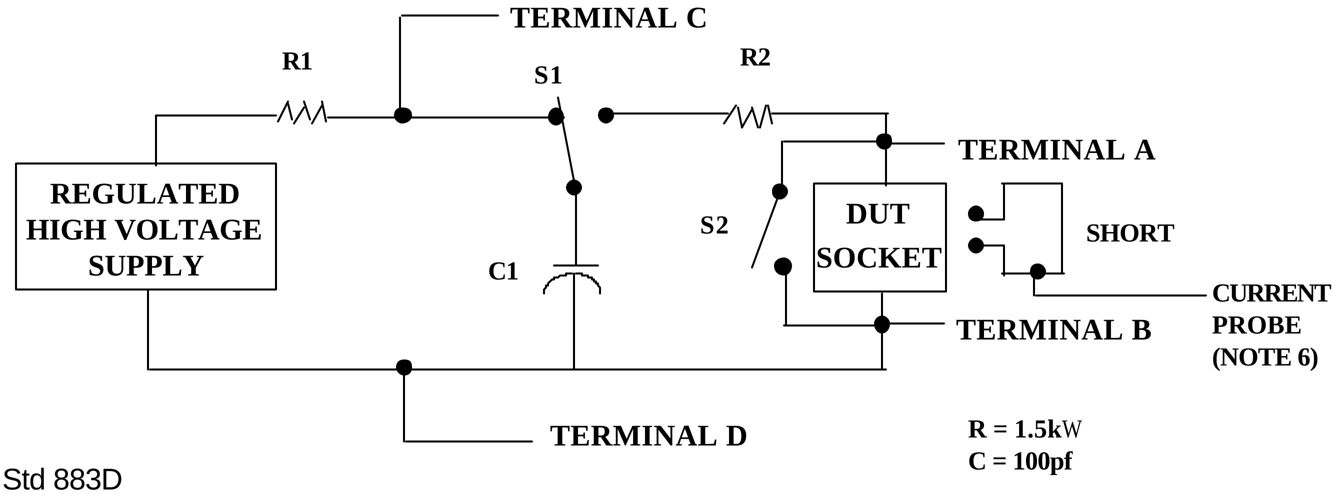
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_{S,}$ $-V_S$, V_{REF}, etc).

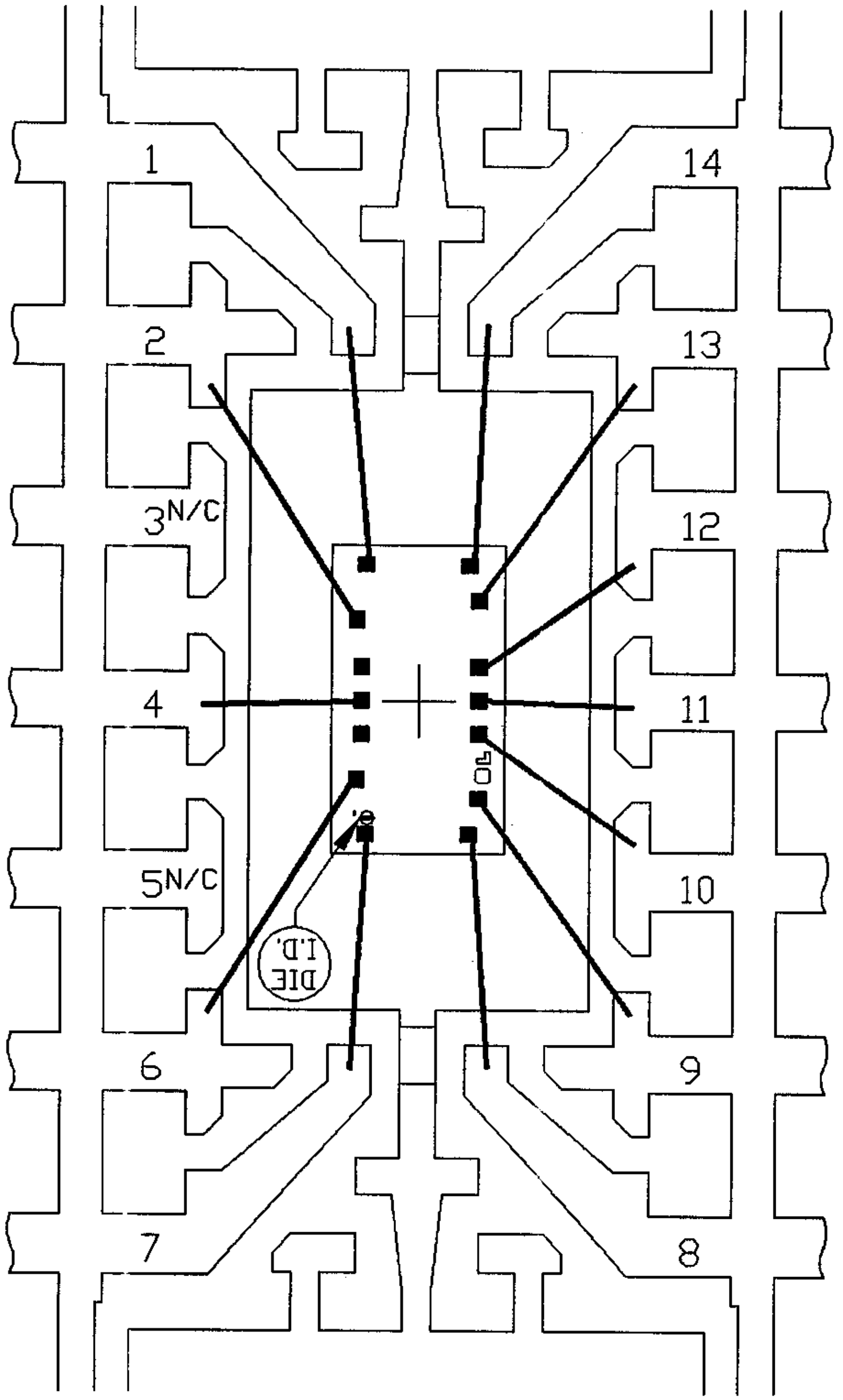
3.4 Pin combinations to be tested.

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.

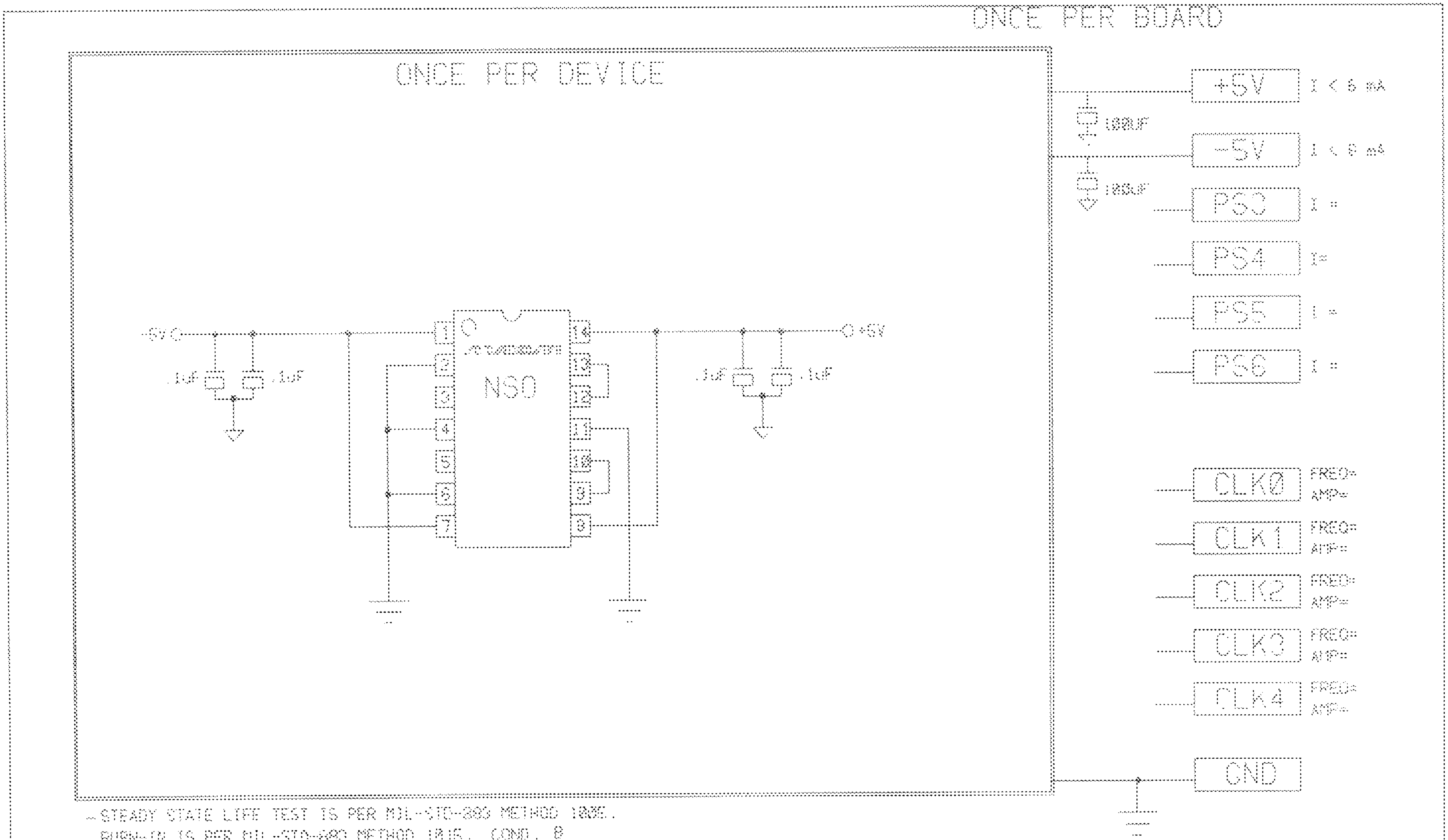
c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.





PKG.CODE: S14-4		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 95X170	PKG. DESIGN			BUILDSHEET NUMBER: 05-0601-0469

REV: A



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

SPEC. NO. 06-5151 REV: A

DATE: 10/9/95

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

MAX4142/3/7/8/9