

RELIABILITY REPORT

FOR

**MAX3934xE/D**

Die

June 19, 2003

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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## Conclusion

The MAX3934 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 MAX3934 is a compact +5V or -5.2V laser driver designed to directly modulate a laser diode at data rates up to 10.7Gbps. The driver provides externally programmable laser biasing and modulation currents. DC-coupling with an integrated compensation network, consisting of a series-damping resistor and a shunt RC, makes the MAX3934 ideal for compact subassemblies.

The MAX3934 accepts a differential CML or PECL data signal and includes 50 $\Omega$  on-chip termination resistors. It delivers a 1mA to 60mA laser bias current and a 20mA to 80mA laser modulation current with a typical edge speed of 25ps (20% to 80%). A high-bandwidth, fully differential signal path is internally implemented to minimize jitter accumulation. Additional features include a data polarity control, bias current, and modulation current monitors.

### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage (VCC - VEE)	-0.5V to +6.0V
Voltage at IN+, IN- PLRT, BIASMON, MODMON BIASSET MODSET	(VCC - 1.2V) to (VCC + 0.5V) (VEE - 0.5V) to (VCC + 0.5V) (VEE - 0.5V) to (VEE + 2.6V) (VEE - 0.5V) to (VEE + 1.4V)
Current into IN+, IN-	-24mA to +30.5mA
Current into OUT1+, OUT2+,OUT1-, OUT2-	-20mA to +200mA
Current into BIAS	-20mA to +100mA
Storage Temperature Range	-55°C to +150°C
Operating Junction Temperature Range	-55°C to +150°C
Processing Temperature (die)	+400°C

## II. Manufacturing Information

A. Description/Function:	10.7Gbps Compact Laser Diode Driver
B. Process:	GST4-F60
C. Number of Device Transistors:	884
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	N/A
F. Date of Initial Production:	December, 2002

## III. Packaging Information

A. Package Type:	<b>Die</b>
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	N/A
E. Bondwire:	N/A
F. Mold Material:	N/A
G. Assembly Diagram:	N/A
H. Flammability Rating:	N/A
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	N/A

## IV. Die Information

A. Dimensions:	53 x 51 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> (Silicon nitride)
C. Interconnect:	Au
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1: 1.2; Metal2: 1.2; Metal3: 1.2; Metal4: 5.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1: 1.6; Metal2: 1.6; Metal3: 1.6; Metal4: 4.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)  
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 150°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 9823 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 10.78 \times 10^{-8} \quad \lambda = 10.78 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. Attached Burn-In Schematic (Spec. # 06-7070) shows the static Burn-In circuit. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Reports (**RR-1M & RR-B3A**).

### 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 HT27 die type has been found to have all pins able to withstand a transient pulse of 400V, 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

**MAX3934xE/D**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)				
	Ta = 150°C Biased Time = 192 hrs.	DC Parameters & functionality	45	0
<b>Moisture Testing</b> (Note 2)				
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (Note 2)				
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters	77	0

Note 1: Life Test Data represents packaged devices.

Note 2: Generic 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.

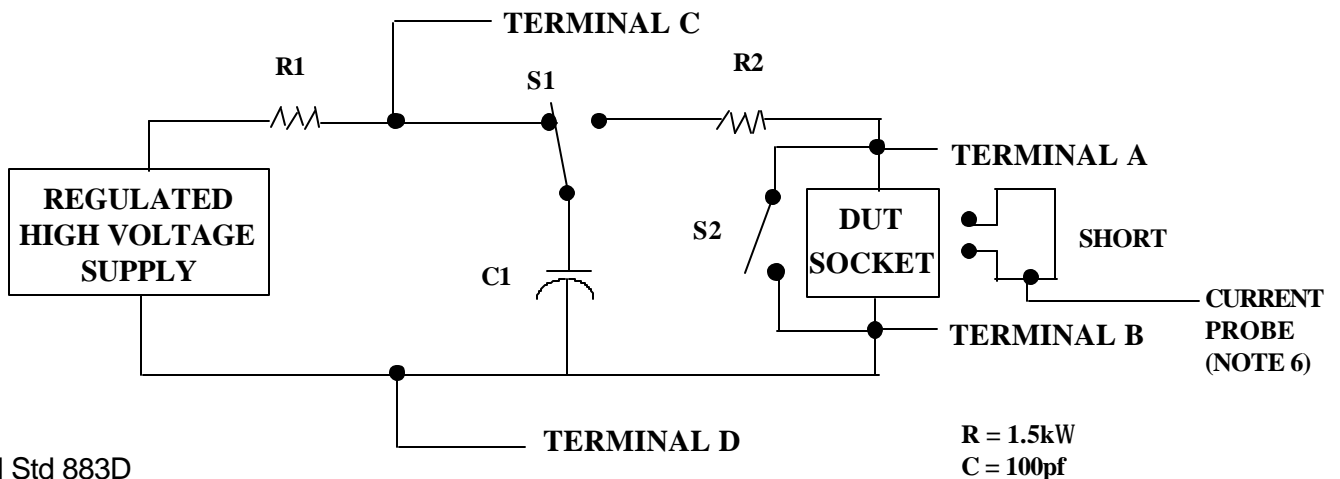
2/ No connects are not to be tested.

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).

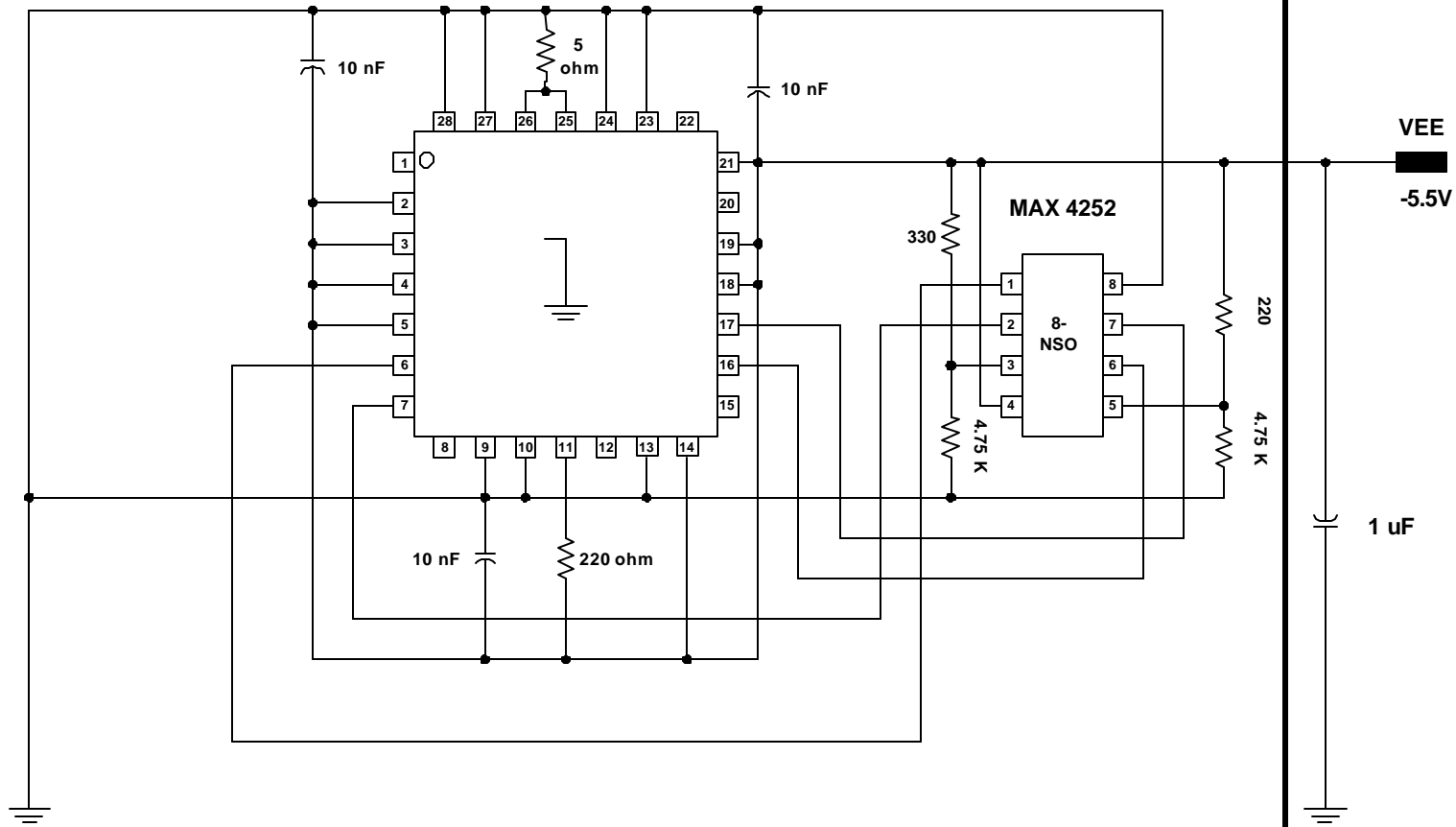
### 3.4 Pin combinations to be tested.

- 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.



ONCE PER SOCKET

ONCE PER BOARD



**DEVICES: MAX3934E (HT27Z-4)**  
**PACKAGE: 28-QFN (5x5-THIN)**  
**MAX. EXPECTED CURRENT = 270 mA**

**DRAWN BY: TODD BEJSOVEC**  
**NOTES: Vee is conected to edge fingers 7 & 8. GND is at fingers 4/5/6. (std.)**  
**Place 10nF caps as close to DUT pins as possible. Leave the op amp**  
**(MAX4252) unsoldered in the 8-NSO socket so it can be replaced.**  
**Paddle is connected to ground.**