RELIABILITY REPORT

FOR

MAX3970U/D

DIE

February 14, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Quality Assurance
Executive Director
Conclusion

The MAX3970 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 MAX3970 is a compact, low-power transimpedance amplifier (TIA) optimized for use in 10Gbps optical receivers. The TIA provides transimpedance at 590V/A with 50Ω differential CML outputs. The MAX3970 has a typical input-referred noise of 1.1µA, and when coupled with a high-speed photodiode, achieves -18dBm sensitivity and +2mA input overload. A received-signal strength indicator (RSSI) simplifies optical assembly. The circuit operates from a single +3.3V supply over a junction temperature range from 0°C to +110°C.

B. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Voltage</td>
<td></td>
</tr>
<tr>
<td>Voltage VCC1 and VCC2</td>
<td>-0.3V to +5V</td>
</tr>
<tr>
<td>Voltage at Filter</td>
<td>-0.3V to (VCC1 + 0.3V)</td>
</tr>
<tr>
<td>Voltage at OUT+, OUT-, RSSI</td>
<td>0V to (VCC+0.5V)</td>
</tr>
<tr>
<td>Input Current IN, TEST</td>
<td>-5mA to +5mA</td>
</tr>
<tr>
<td>Operating Temp. Range</td>
<td>-40°C to +125°C</td>
</tr>
<tr>
<td>Storage Temp. Range</td>
<td>-60°C to +150°C</td>
</tr>
<tr>
<td>Die Attach Process Temp</td>
<td>+400°C</td>
</tr>
</tbody>
</table>
II. Manufacturing Information

A. Description/Function: 10 Gbps, 3.3V Low-Power Transimpedance Amplifier with RSSI

B. Process: F60 Process

C. Number of Device Transistors: 125

D. Fabrication Location: Oregon, USA

E. Assembly Location: n/a

F. Date of Initial Production: March, 2001

III. Packaging Information

A. Package: n/a

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

IV. Die Information

A. Dimensions: 34 x 53 mils

B. Passivation: Si₃N₄/SiO₂ (Silicon nitride/ Silicon dioxide)

C. Interconnect: Poly / 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: SiO₂

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. 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 HF98 die type has been found to have all pins able to withstand a transient pulse of $\pm 100V$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 100mA$ and/or $\pm 20V$. 
# Table 1
Reliability Evaluation Test Results

MAX3970U/D

<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Life Test</td>
<td>Ta = 150°C</td>
<td>DC Parameters</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 192 hrs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Testing</td>
<td>Ta = 121°C</td>
<td>DC Parameters</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>Pressure Pot</td>
<td>P = 15 psi.</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RH = 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 168hrs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85/85</td>
<td>Ta = 85°C</td>
<td>DC Parameters</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>RH = 85%</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 1000hrs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Stress</td>
<td>Ta = -65°C/150°C</td>
<td>DC Parameters</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>Cycle</td>
<td>1000 Cycles</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method 1010</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Life Test Data on packaged die.
Note 2: Generic process data.
TABLE II. Pin combination to be tested. 1/ 2/

<table>
<thead>
<tr>
<th></th>
<th>Terminal A (Each pin individually connected to terminal A with the other floating)</th>
<th>Terminal B (The common combination of all like-named pins connected to terminal B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>All pins except $V_{PS1}$ 3/</td>
<td>All $V_{PS1}$ pins</td>
</tr>
<tr>
<td>2.</td>
<td>All input and output pins</td>
<td>All other input-output pins</td>
</tr>
</tbody>
</table>

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.

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**Mil Std 883D**
**Method 3015.7**
**Notice 8**