RELIABILITY REPORT

FOR

MAX6002EUR

PLASTIC ENCAPSULATED DEVICES

February 19, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by  Reviewed by

Jim Pedicord  Bryan J. Preeshl
Quality Assurance  Quality Assurance
Reliability Lab Manager  Executive Director
Conclusion

The MAX6002 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 MAX6002 SOT23, low-cost series voltage reference meets the cost advantage of shunt references and offers the power-saving advantage of series references, which traditionally cost more. Unlike conventional shunt-mode (two-terminal) references that must be biased at the load current and require an external resistor, this device eliminates the need for an external resistor and offers a supply current that is virtually independent of the supply voltage.

This micropower, low-dropout, low-cost device is ideal for high-volume, cost-sensitive 3V and 5V battery-operated systems with wide variations in supply voltage that require very low power dissipation. Additionally, this device is internally compensated and does not require an external compensation capacitor, saving valuable board area in space-critical applications.

B. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumes Referenced to GND</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>-0.3V to +13.5V</td>
</tr>
<tr>
<td>OUT</td>
<td>-0.3V to (VIN + 0.3V)</td>
</tr>
<tr>
<td>Output Short Circuit to GND or IN (VIN &lt; 6V)</td>
<td>Continuous</td>
</tr>
<tr>
<td>Output Short Circuit to GND or IN (VIN &gt; 6V)</td>
<td>60sec</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Lead Temperature (soldering, 10sec)</td>
<td>+300°C</td>
</tr>
<tr>
<td>Continuous Power Dissipation (TA = +70°C)</td>
<td>320mW</td>
</tr>
<tr>
<td>3-Pin SOT23</td>
<td></td>
</tr>
<tr>
<td>Derates above +70°C</td>
<td>4.0mW/°C</td>
</tr>
<tr>
<td>3-Pin SOT23</td>
<td></td>
</tr>
</tbody>
</table>
II. Manufacturing Information

A. Description/Function: Low-Cost, Low-Power, Low-Dropout, SOT23-3 Voltage Reference

B. Process: S12 (SG1.2) - Standard 1.2 micron silicon gate CMOS

C. Number of Device Transistors: 70

D. Fabrication Location: California or Oregon, USA

E. Assembly Location: Malaysia

F. Date of Initial Production: October, 1998

III. Packaging Information

A. Package Type: 3-Lead SOT23

B. Lead Frame: Alloy 42 or Copper

C. Lead Finish: Solder Plate

D. Die Attach: Silver-filled Epoxy

E. Bondwire: Gold (1 mil dia.)

F. Mold Material: Epoxy with silica filler

G. Assembly Diagram: Buildsheet # 05-0901-0151

H. Flammability Rating: Class UL94-V0

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

IV. Die Information

A. Dimensions: 44 x 31 mils

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

C. Interconnect: Aluminum/Copper/Si

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: 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

\[ \lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 240 \times 2} \]  
\[ \text{Temperature Acceleration factor assuming an activation energy of } 0.8eV \]

\[ \lambda = 4.52 \times 10^{-9} \quad \text{λ = 4.52 F.I.T. (60% confidence level @ 25°C)} \]

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 Burn-In Schematic (Spec. # 06-5630) 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 RF23-7 die 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.
Table 1
Reliability Evaluation Test Results

MAX6002EUR

<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 (Note 1)</td>
<td>Ta = 135°C Biased Time = 192 hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>179</td>
<td>0</td>
</tr>
<tr>
<td>Moisture Testing</td>
<td>Pressure Pot Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>85/85 Ta = 85°C RH = 85% Biased Time = 1000hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>Mechanical Stress</td>
<td>Temperature Cycle -65°C/150°C 1000 Cycles Method 1010</td>
<td>DC Parameters</td>
<td>77</td>
<td>0</td>
</tr>
</tbody>
</table>

Note 1: Life Test Data may represent plastic D.I.P. qualification lots.
Note 2: Generic Package/Process Data
TABLE II. Pin combination to be tested. 1/ 2/

<table>
<thead>
<tr>
<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. All pins except V_{PS1} 3/</td>
<td>All V_{PS1} pins</td>
</tr>
<tr>
<td>2. 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
DEVICES: MAX 6012 / 6021 / 6025 / 6030 / 6041 / 6050 / 6018

NOTES: + 5.5V for the MAX6018 only
Max current is 125uA and +10V for MAX6061-6068

MAX. EXPECTED CURRENT = 35 uA