RELIABILITY REPORT

FOR

MAX4782ExE

PLASTIC ENCAPSULATED DEVICES

April 3, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by
Jim Pedicord
Quality Assurance
Reliability Lab Manager

Reviewed by
Bryan J. Preeshl
Quality Assurance
Executive Director
Conclusion

The MAX4782 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  V. Quality Assurance Information
II. Manufacturing Information  VI. Reliability Evaluation
III. Packaging Information  IV. Die Information
.....Attachments

I. Device Description

A. General

The MAX4782 is a high-speed, low-voltage, low on-resistance, CMOS analog multiplexers/switches configured as dual 4-channel multiplexers.

This device operates with a +1.6V to +3.6V single supply. When powered from a +3V supply, MAX4782 features a 1\Omega max on-resistance (R_{ON}), with 0.4\Omega (max) R_{ON} matching between channels, and 0.2\Omega (max) R_{ON} flatness. This device handles Rail-to-Rail® analog signals and offer fast switching times of less than 25ns while consuming less than 3\muW of quiescent power. It is available in space-saving 16-pin thin QFN (3mm x 3mm) and TSSOP packages.

B. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltages Referenced to GND</td>
<td>-0.3V to +4V</td>
</tr>
<tr>
<td>VCC, A, B, C, and ENABLE</td>
<td></td>
</tr>
<tr>
<td>Voltage at Any Other Terminal (Note 1)</td>
<td>-0.3V to (VCC + 0.3V)</td>
</tr>
<tr>
<td>Continuous Current into A, B, C, ENABLE</td>
<td>±10mA</td>
</tr>
<tr>
<td>Continuous Current into X, Y, Z, X_, Y_, Z_</td>
<td>±150mA</td>
</tr>
<tr>
<td>Peak Current into X, Y, Z, X_, Y_, Z_ (pulsed at 1ms, 10% duty cycle)</td>
<td>±300mA</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>+150°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>Lead Temperature (soldering, 10s)</td>
<td>+300°C</td>
</tr>
<tr>
<td>Continuous Power Dissipation (TA = +70°C)</td>
<td></td>
</tr>
<tr>
<td>16-Pin Thin QFN</td>
<td>1349mW</td>
</tr>
<tr>
<td>16-Pin TSSOP</td>
<td>457mW</td>
</tr>
<tr>
<td>Derates above +70°C</td>
<td></td>
</tr>
<tr>
<td>16-Pin Thin QFN</td>
<td>16.9mW/°C</td>
</tr>
<tr>
<td>16-Pin TSSOP</td>
<td>5.7mW/°C</td>
</tr>
</tbody>
</table>

Note 1: Signals on X, Y, Z, X_, Y_, and Z_ exceeding VCC or GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.
II. Manufacturing Information

A. Description/Function: High-Speed, Low-Voltage, 1 Ohm CMOS Analog Switches/Multiplexers
B. Process: TC35
C. Number of Device Transistors: 121
D. Fabrication Location: Taiwan
E. Assembly Location: Thailand or Philippines
F. Date of Initial Production: July, 2002

III. Packaging Information

A. Package Type: 16-Pin Thin QFN  16-Pin TSSOP
B. Lead Frame: Copper  Copper
C. Lead Finish: Solder Plate  Solder Plate
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: # 05-9000-1140  # 05-1201-0295
H. Flammability Rating: Class UL94-V0  Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-A: Level 1  Level 1

IV. Die Information

A. Dimensions: 60 x 58 mils
B. Passivation: Si₃N₄/SiO₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect: Aluminum/Si (Si = 1%)
D. Backside Metallization: None
E. Minimum Metal Width: Metal 1 = 0.5 / Metal 2 = 0.6 / Metal 3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing: Metal 1 = 0.45 / Metal 2 = 0.5 / Metal 3 = 0.6 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 (Manager, Reliability Operations)  
   Bryan Preeshl (Executive Director)  
   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 \( \lambda \) is calculated as follows:

   \[
   \lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 42 \times 2} 
   \]

   (Chi square value for MTTF upper limit)

   Temperature Acceleration factor assuming an activation energy of 0.8eV

   \[
   \lambda = 25.85 \times 10^{-9} 
   \]

   \[
   \lambda = 25.85 \text{ F.I.T.} \quad (60\% \text{ confidence level @ 25°C})
   \]

   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 three times 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. # 06-5994) 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-1M).

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 AH82-1 die type has been found to have all pins able to withstand a transient pulse of ±1500V 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
MAX4782ExE

<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>PACKAGE</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static Life Test</strong> (Note 1)</td>
<td>Ta = 135°C</td>
<td>DC Parameters</td>
<td></td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 192 hrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moisture Testing</strong> (Note 2)</td>
<td>Ta = 121°C</td>
<td>DC Parameters</td>
<td>TSSOP</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>P = 15 psi.</td>
<td>&amp; functionality</td>
<td>QFN</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>RH= 100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 168hrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ta = 85°C</td>
<td>DC Parameters</td>
<td></td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>RH = 85%</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 1000hrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical Stress</strong> (Note 2)</td>
<td>-65°C/150°C</td>
<td>DC Parameters</td>
<td></td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1000 Cycles</td>
<td>&amp; functionality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method 1010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Terminal A</th>
<th>Terminal B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Each pin individually connected to terminal A with the other floating)</td>
<td>(The common combination of all like-named pins connected to terminal B)</td>
</tr>
<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.

---

**Mil Std 883D**

**Method 3015.7**

**Notice 8**
DEVICES: MAX4781 (AH82Z)
PACKAGE: 16-TSSOP.
MAX. EXPECTED CURRENT = 5μA.