RELIABILITY REPORT
FOR
MAX4639Exx
PLASTIC ENCAPSULATED DEVICES

June 20, 2003

MAXIM INTEGRATED PRODUCTS
120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

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Conclusion

The MAX4639 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 MAX4639 is a dual 4:1 CMOS analog multiplexers/demultiplexers (muxes/ demuxes). The mux operates from a single +1.8V to +5V supply or dual ±2.5V supplies. This device features 3.5Ω on-resistance ($R_{ON}$) when powered with a single +5V supply and has -75dB of off-isolation and -85dB crosstalk from the output to each off channel. The switching times are 18ns $t_{ON}$ and 7ns $t_{OFF}$. It features a -3dB 85MHz bandwidth and a guaranteed 0.25nA leakage current at +25°C.

A +1.8V to +5.5V operating range makes the MAX4639 ideal for battery-powered, portable instruments. All channels guarantee break-before-make switching. This part features bidirectional operation and can handle Rail-to-Rail® analog signals. All control inputs are TTL/CMOS-logic compatible. Decoding is in standard BCD format, and an enable input is provided to simplify cascading of devices. This devices are available in small 16-pin QFN, TSSOP and SOIC packages, as well as a 20-pin QFN package.

B. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Voltages Referenced to GND)</td>
<td></td>
</tr>
<tr>
<td>$V^+$ to $V^-$</td>
<td>+6V</td>
</tr>
<tr>
<td>$V^+$, $A_-$, $EN$</td>
<td>-0.3V to +6V</td>
</tr>
<tr>
<td>$V^-$</td>
<td>+0.3V to -6V</td>
</tr>
<tr>
<td>$NO_-$, $COM_-$ (Note1)</td>
<td>-0.3V to ($V^+$ + 0.3V)</td>
</tr>
<tr>
<td>Continuous Current $A_-$, $EN$</td>
<td>±30mA</td>
</tr>
<tr>
<td>Continuous Current $NO_-$, $COM_-$</td>
<td>±100mA</td>
</tr>
<tr>
<td>Peak Current ($NO_-$, $COM_-$) (pulsed at 1ms, 10% duty cycle)</td>
<td>±200mA</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>1481mW</td>
</tr>
<tr>
<td>16-Pin QFN (4x4)</td>
<td>1481mW</td>
</tr>
<tr>
<td>16-Pin TSSOP</td>
<td>457mW</td>
</tr>
<tr>
<td>16-Pin SO</td>
<td>696mW</td>
</tr>
<tr>
<td>20-Pin QFN (4x4)</td>
<td>1600mw</td>
</tr>
<tr>
<td>Derates above +70°C</td>
<td></td>
</tr>
<tr>
<td>16-Pin QFN (4x4)</td>
<td>18.5mW/°C</td>
</tr>
<tr>
<td>16-Pin TSSOP</td>
<td>5.7mW/°C</td>
</tr>
<tr>
<td>16-Pin SO</td>
<td>8.7mW/°C</td>
</tr>
<tr>
<td>20-Pin QFN (4x4)</td>
<td>20.0mW/°C</td>
</tr>
</tbody>
</table>

Note 1: Signals on $COM_-$, $NO_-$ exceeding $V^+$ or $V^-$ are clamped by internal diodes. $A_-$ and $EN$ are clamped only to $V^-$ and can exceed $V^+$ up to their maximum ratings. Limit forward-diode current to maximum current rating.
II. Manufacturing Information

A. Description/Function: 3.5Ω, Dual 4:1, Low-Voltage Analog Multiplexers
B. Process: TC05 (0.5 micron CMOS)
C. Number of Device Transistors: 632
D. Fabrication Location: Taiwan, USA
E. Assembly Location: Malaysia, Thailand, Korea or Philippines
F. Date of Initial Production: July, 2000

III. Packaging Information

A. Package Type: 16-Pin QFN(4x4) 16-Pin TSSOP 16-Pin SO
B. Lead Frame: Copper Copper Copper
C. Lead Finish: Solder Plate Solder Plate Solder Plate
D. Die Attach: Silver-filled Epoxy Silver-filled Epoxy Silver-filled Epoxy
E. Bondwire: Gold (1 mil dia.) Gold (1 mil dia.) Gold (1 mil dia.)
F. Mold Material: Epoxy with silica filler Epoxy with silica filler Epoxy with silica filler
G. Assembly Diagram: # 05-1201-0283 # 05-1201-0195 # 05-1201-0196
H. Flammability Rating: Class UL94-V0 Class UL94-V0 Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1 Level 1 Level 1

III. Packaging Information

A. Package Type: 20-Pin QFN (4x4)
B. Lead Frame: 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: # 05-1201-0285
H. Flammability Rating: Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1
IV. Die Information

A. Dimensions: 66 x 70 mils
B. Passivation: Si$_3$N$_4$/SiO$_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect: Al/Si/Cu (Aluminum/ Silicon/ Copper)
D. Backside Metallization: None
E. Minimum Metal Width: Metal 1: 0.5 microns; Metal 2: 0.7 microns (as drawn)
F. Minimum Metal Spacing: Metal 1: 0.5 microns; Metal 2: 0.7 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, Rel 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 ($\lambda$) is calculated as follows:

   $$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 80 \times 2}$$

   (Chi square value for MTTF upper limit)

   $$\lambda = 13.57 \times 10^{-9}$$

   Thermal acceleration factor assuming a 0.8eV activation energy

   $\lambda = 13.57 \text{ F.I.T. (60% confidence level @ 25°C)}$

   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 the 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 lots exceeding this level. The following Burn-In Schematic (Spec #06-5642) 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 AH70-1 die type has been found to have all pins able to withstand a transient pulse of <200V, 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

MAX4639Exx

<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>Static Life Test (Note 1)</td>
<td>Ta = 135°C Biased Time = 192 hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>QFN</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Moisture Testing (Note 2)</td>
<td>Pressure Pot Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.</td>
<td>DC Parameters &amp; functionality</td>
<td>TSSOP</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>SO</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td>Mechanical Stress (Note 2)</td>
<td>Temperature Cycle -65°C/150°C 1000 Cycles Method 1010</td>
<td>DC Parameters &amp; functionality</td>
<td></td>
<td>77</td>
<td>0</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></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 VPS1 3/</td>
<td>All VPS1 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 VPS1 is VDD, VCC, VSS, VBB, GND, +VS, -VS, VREF, 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., VSS1, or VSS2 or VSS3 or VCC1, or VCC2) 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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**Diagram:**
- **Terminal A:**
- **Terminal B:**
- **Terminal C:**
- **Terminal D:**
- **DUT SOCKET:**
- **CURRENT PROBE (NOTE 6):**
- **SHORT:**
- **REGULATED HIGH VOLTAGE SUPPLY:**
- **R1:** 1.5kΩ
- **C1:** 100pf
- **S1:**
- **S2:**

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*Mil Std 883D*
*Method 3015.7*
*Notice 8*
EXPOSED PAD PKG.

Bondable Area

PKG. BODY SIZE: 4×4 mm

PKG. CODE: G1644-1

SIGNATURES

PKG.

DATE

BOND DIAGRAM #: 05-1201-0283

REV: A
DEVICES: MAX 4638
MAX. EXPECTED CURRENT = 10μA

NOTES:
ONCE PER SOCKET

ONCE PER BOARD

DRAWN BY: HAK TAN