Conclusion

The MAX1686HEUA+ 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 MAX1686 provides power for dual-voltage subscriber ID module (SIM) cards in portable applications such as GSM cellular phones. Designed to reside in the portable unit (cellular phone handset), the 1MHz charge pump converts a 2.7V to 4.2V input to regulated 5V output. The MAX1686H has a nominal output voltage of 5.0V, while the MAX1686 is set to 4.75V to reduce SIM card current drain. The charge pump has only 45µA quiescent supply current, which reduces to 3µA when a 3V-capable SIM card is being powered and the charge pump is disabled. An internal input/output shorting switch provides power for 3V SIM cards. The MAX1686/MAX1686H require only three external capacitors around their space-saving, thin (1mm) 8-pin µMAX® packages.
II. Manufacturing Information

A. Description/Function: 3V to 5V Regulating Charge Pumps for SIM Cards
B. Process: S12
C. Number of Device Transistors: 
D. Fabrication Location: Oregon
E. Assembly Location: UTL Thailand, Unisem Malaysia
F. Date of Initial Production: June 16, 1998

III. Packaging Information

A. Package Type: 8-pin uMAX
B. Lead Frame: Copper
C. Lead Finish: 100% matte Tin
D. Die Attach: Conductive Epoxy
E. Bondwire: Gold (1.3 mil dia.)
F. Mold Material: Epoxy with silica filler
G. Assembly Diagram: #05-1101-0071
H. Flammability Rating: Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C Level 1
J. Single Layer Theta Ja: 221°C/W
K. Single Layer Theta Jc: 41.9°C/W
L. Multi Layer Theta Ja: 206.3°C/W
M. Multi Layer Theta Jc: 41.9°C/W

IV. Die Information

A. Dimensions: 54 X 70 mils
B. Passivation: Si₃N₄/SiO₂ (Silicon nitride/ Silicon dioxide
C. Interconnect: Aluminum/Si (Si = 1%)
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:
   Ken Wendel (Director, Reliability Engineering)
   Bryan Preeshl (Managing Director of QA)

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:

$$\frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 240 \times 2}$$

(Chi square value for MTTF upper limit)

$$\chi = \frac{4.5 \times 10^{-9}}{4.5 \text{ F.I.T. (60% confidence level @ 25°C)}}$$

The following failure rate represents data collected from Maxim’s reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at http://www.maxim-ic.com/. Current monitor data for the S12 Process results in a FIT Rate of 0.09 @ 25°C and 1.48 @ 55°C, data limited (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

C. E.S.D. and Latch-Up Testing

The PX46-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-150 mA.
Table 1  
Reliability Evaluation Test Results

<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><strong>Static Life Test</strong></td>
<td>Ta = 135°C</td>
<td>DC Parameters &amp; functionality</td>
<td>240</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time = 192 hrs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moisture Testing</strong></td>
<td>Ta = 85°C</td>
<td>DC Parameters &amp; functionality</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>RH = 85%</td>
<td></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><strong>Mechanical Stress</strong></td>
<td>-65°C/150°C</td>
<td>DC Parameters &amp; functionality</td>
<td>77</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1000 Cycles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method 1010</td>
<td></td>
<td></td>
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</tbody>
</table>

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data