RELIABILITY REPORT
FOR
MAX1645AEEI+
PLASTIC ENCAPSULATED DEVICES

May 21, 2009

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

Approved by
Ken Wendel
Quality Assurance
Director, Reliability Engineering
Conclusion

The MAX1645AEEI+ 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 MAX1645 is a high-efficiency battery charger capable of charging batteries of any chemistry type. It uses the Intel® System Management Bus (SMBus™) to control voltage and current charge outputs.

When charging lithium-ion (Li+) batteries, the MAX1645 automatically transitions from regulating current to regulating voltage. The MAX1645 can also limit line input current so as not to exceed a predetermined current drawn from the DC source. A 175sec charge safety timer prevents "runaway charging" should the MAX1645 stop receiving charging voltage/current commands.

The MAX1645 employs a next-generation synchronous buck control circuitry that lowers the minimum input-to-output voltage drop by allowing the duty cycle to exceed 99%. The MAX1645 can easily charge one to four series Li+ cells.
II. Manufacturing Information

A. Description/Function: Advanced-Chemistry-Independent, Level-2 Battery Chargers with Input Current Limiting
B. Process: S12
C. Number of Device Transistors: 
D. Fabrication Location: Oregon
E. Assembly Location: Carsem Malaysia, ATP Philippines, UTL Thailand
F. Date of Initial Production: October 23, 1999

III. Packaging Information

A. Package Type: 28 Pin QSOP
B. Lead Frame: Cu Alloy
C. Lead Finish: Matte Sn Plate
D. Die Attach: Conductive Epoxy
E. Bondwire: Au (1.0 mil dia.)
F. Mold Material: Epoxy with silica filler
G. Assembly Diagram: 
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: 93°C/W
K. Single Layer Theta Jc: 27°C/W
L. Multi Layer Theta Ja: 79°C/W
M. Multi Layer Theta Jc: 27°C/W

IV. Die Information

A. Dimensions: 86 X 159 mils
B. Passivation: Si₃N₄/SiO₂ (Silicon nitride/Silicon dioxide)
C. Interconnect: Aluminum/0.5% Cu
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 (λ) is calculated as follows:

   \[ \lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 397 \times 2} \]  
   \[ \text{(Chi square value for MTTF upper limit)} \]

   \[ \lambda = 2.7 \times 10^{-9} \]

   \[ \lambda = 2.7 \text{ F.I.T. (60% confidence level @ 25°C)} \]

   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 PX07-1 die type has been found to have all pins able to withstand a HBM transient pulse of \(+/-200\) V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of \(+/-250\) 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>Static Life Test</td>
<td>Ta = 135°C</td>
<td>DC Parameters &amp; functionality</td>
<td>397</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>Moisture Testing</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>Mechanical Stress</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>
<td></td>
</tr>
</tbody>
</table>

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