

RELIABILITY REPORT  
FOR  
MAX745EAP+  
PLASTIC ENCAPSULATED DEVICES

November 14, 2008

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
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## Conclusion

The MAX745EAP+ 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 MAX745 provides all functions necessary for charging lithium-ion (Li+) battery packs. It provides a regulated charging current of up to 4A without getting hot, and a regulated voltage with only  $\pm 0.75\%$  total error at the battery terminals. It uses low-cost, 1% resistors to set the output voltage, and a low-cost N-channel MOSFET as the power switch. The MAX745 regulates the voltage set point and charging current using two loops that work together to transition smoothly between voltage and current regulation. The per-cell battery voltage regulation limit is set between 4V and 4.4V using standard 1% resistors, and then the number of cells is set from 1 to 4 by pin-strapping. Total output voltage error is less than  $\pm 0.75\%$ . For a similar device with an SMBus and microcontroller interface and the ability to charge NiCd and NiMH cells, refer to the MAX1647 and MAX1648. For a low-cost Li+ charger using a linear-regulator control scheme, refer to the MAX846A.

## II. Manufacturing Information

A. Description/Function:	Switch-Mode Lithium-Ion Battery-Charger
B. Process:	S12
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	ATP Philippines, Carsem Malaysia
F. Date of Initial Production:	Pre 1997

## III. Packaging Information

A. Package Type:	20-pin SSOP
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:	#05-1101-0088
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:	125°C/W
K. Single Layer Theta Jc:	33°C/W

## IV. Die Information

A. Dimensions:	86 X 130 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (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:	SiO <sub>2</sub>
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 pending. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 77 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 13.9 \times 10^{-9}$$

$$\lambda = 13.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 @ 25C and 1.48 @ 55C, 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 PX04 die type has been found to have all pins able to withstand a HBM transient pulse of +/-600 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

**MAX745EAP+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	77	0
<b>Moisture Testing</b> (Note 2) 85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (Note 2) Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.

Note 2: Generic Package/Process data