

RELIABILITY REPORT  
FOR  
MAX1665SESA+  
PLASTIC ENCAPSULATED DEVICES

November 5, 2008

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
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## Conclusion

The MAX1665SESA+ 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 MAX1665 provides protection against overvoltage, undervoltage, overcharge current, and overdischarge current for 2-cell to 4-cell lithium-ion (Li+) battery packs. Very low operating current ensures that cells are not overdischarged during long storage periods. The MAX1665 controls two external N-channel MOSFETs to limit the charge and discharge voltages. Charging is allowed when the per-cell voltage is below +4.3V. When the voltage on any cell rises above +4.3V (overvoltage limit), the MAX1665 turns off the charge MOSFET. This safety feature prevents overcharge of any cell within the battery pack. Discharge is allowed when the per-cell voltage is above +2.5V (undervoltage limit). If the voltage across any cell falls below +2.5V, the MAX1665 turns off the discharge MOSFET. This safety feature prevents overdischarge of any cell within the battery pack. Charging and discharging are allowed if the voltage between PKN and BN is less than 250mV. This safety feature prevents excessive pack current.

**II. Manufacturing Information**

A. Description/Function:	Drop and Use Li+ Battery Pack Protector
B. Process:	S12
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon, California or Texas
E. Assembly Location:	ATP Philippines, Carsem Malaysia, OSEP Philippines, UTL Thailand, Unisem Malaysia
F. Date of Initial Production:	2000

**III. Packaging Information**

A. Package Type:	8-pin SOIC (N)
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.3 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:	170°C/W
K. Single Layer Theta Jc:	40°C/W
L. Multi Layer Theta Ja:	132°C/W
M. Multi Layer Theta Jc:	38°C/W

**IV. Die Information**

A. Dimensions:	78 X 103 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 shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 240 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 15.2 \times 10^{-9}$$

$$\lambda = 15.2 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 PX28-2 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX1665SESA+**

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	240	2
<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