

RELIABILITY REPORT  
FOR  
**MAX6434UK**  
PLASTIC ENCAPSULATED DEVICES

January 10, 2004

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Reviewed by



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## Conclusion

The MAX6434 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.

## Table of Contents

<b>I. ....Device Description</b>	<b>V. ....Quality Assurance Information</b>
<b>II. ....Manufacturing Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>III. ....Packaging Information</b>	
<b>IV. ....Die Information</b>	<b>.....Attachments</b>

### I. Device Description

The MAX6434 is a single battery monitors with internal hysteresis. This device is offered with single low-battery output indicators, which can be used to indicate three battery conditions: battery is good (operate system in normal mode), battery is weak (operate system in low-power mode), or battery is empty (disable the system).

This device is ideal for monitoring single lithium-ion (Li+) cells or multicell alkaline/NiCd/NiMH power supplies. When the power-supply voltage drops below the specified low threshold, the low-battery output asserts. When the voltage rises above the specified high threshold, the low-battery output is deasserted following a 140ms minimum timeout period. The timeout period ensures that the supply voltages have stabilized before power-converter or microprocessor activity is enabled.

The MAX6434 has a user-adjustable threshold voltages permitting the user to select the hysteresis range, and consequently the sensitivity of the system to noise. A wide hysteresis range also prevents chattering that can result due to battery recovery after load removal. Single low-battery outputs are supplied by the MAX6433.

The device is offered in a small, 5-lead SOT23 package and is fully specified over temperature.

### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
BATT, VDD to GND	-0.3V to +6.0V
HTHIN, LTHIN Inputs to GND	-0.3V to (VDD + 0.3V)
Open-Drain LBO/LBO, LBOH/LBOH, LBOL/LBOL to GND	-0.3V to +6.0V
Input Current (all pins)	20mA
Output Current (all pins)	20mA
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
5-Pin SOT23	571mW
Derates above +70°C	
5-Pin SOT23	7.1mW/°C

## II. Manufacturing Information

A. Description/Function:	Low-Power, Single/Dual-Level Battery Monitors with Hysteresis
B. Process:	S8 (Standard 0.8 micron silicon gate CMOS)
C. Number of Device Transistors:	905
D. Fabrication Location:	California, USA
E. Assembly Location:	Malaysia or Thailand
F. Date of Initial Production:	January, 2002

## III. Packaging Information

A. Package Type:	<b>5-Lead SOT23</b>
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-Filled Epoxy
E. Bondwire:	Gold (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	Buildsheet # 05-1601-0164
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1

## IV. Die Information

A. Dimensions:	44 x 31 mils
B. Passivation:	$\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Copper/Silicon
D. Backside Metallization:	None
E. Minimum Metal Width:	.8 microns (as drawn)
F. Minimum Metal Spacing:	.8 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	$\text{SiO}_2$
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

### A. Quality Assurance Contacts:

Jim Pedicord (Manager, Reliability 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 78 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Thermal acceleration factor assuming a 0.8eV activation energy

$$\lambda = 13.93 \times 10^{-9} \quad \lambda = 13.93 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. #06-5886) 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 MS66-7 die type has been found to have all pins able to withstand a transient pulse of +/-2000V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of  $\pm 250\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX6434UK**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	78	0
<b>Moisture Testing</b> (Note 2)				
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	77	0
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 D.I.P. qualification lots.

Note 2: Generic package/process data

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except $V_{PS1}$ 3/	All $V_{PS1}$ pins
2.	All input and output pins	All other input-output pins

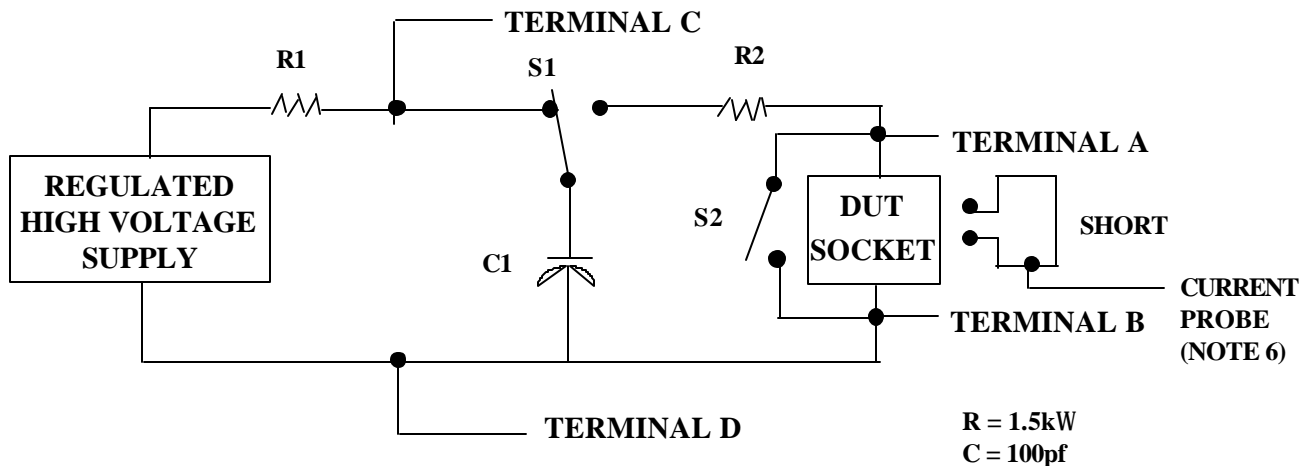
1/ Table II is restated in narrative form in 3.4 below.

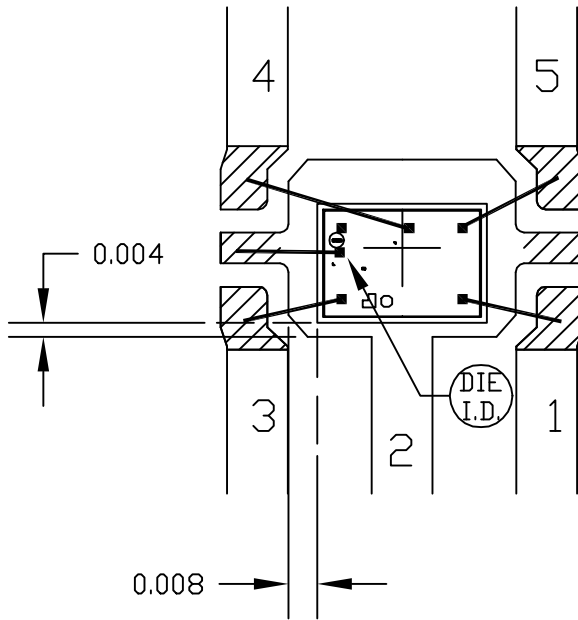
2/ No connects are not to be tested.

3/ Repeat pin combination I for each named Power supply and for ground (e.g., where  $V_{PS1}$  is  $V_{DD}$ ,  $V_{CC}$ ,  $V_{SS}$ ,  $V_{BB}$ , GND,  $+V_S$ ,  $-V_S$ ,  $V_{REF}$ , 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.,  $V_{SS1}$ , or  $V_{SS2}$  or  $V_{SS3}$  or  $V_{CC1}$ , or  $V_{CC2}$ ) 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.



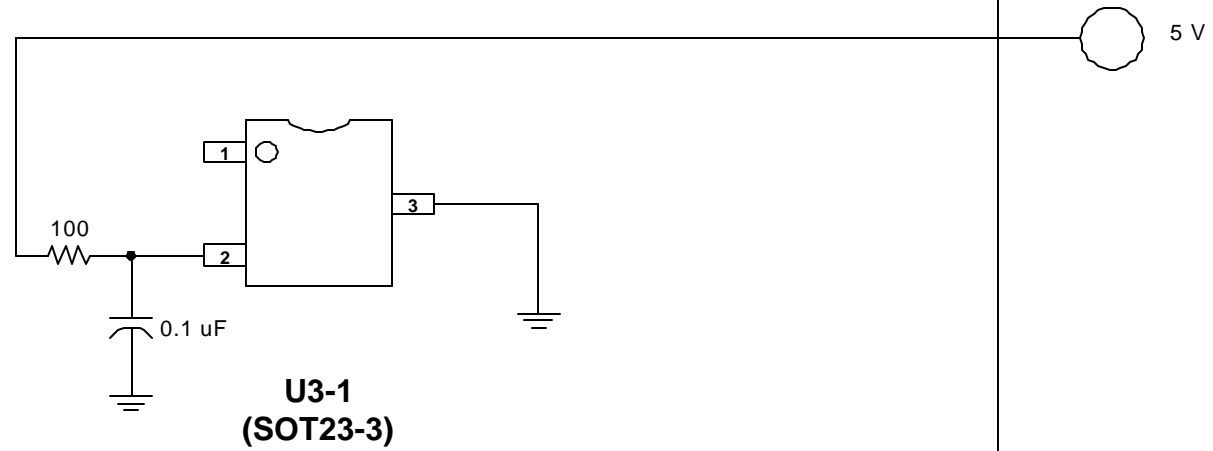


NOTE: CAVITY DOWN

PKG. CODE: U5-2		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 59x46	PKG. DESIGN			BOND DIAGRAM #: 05-1601-0164	REV: A

ONCE PER SOCKET

ONCE PER BOARD



DEVICE S = MAX6427/6428/6429 (MS66Z)  
MAX. EXPECTED CURRENT = 100 mA

DRAWN BY: RITA RODRIGUEZ  
NOTES: