

RELIABILITY REPORT  
FOR  
MAX6453UT16S+  
(MAX6453-MAX6456)  
PLASTIC ENCAPSULATED DEVICES

November 8, 2008

**MAXIM INTEGRATED PRODUCTS**

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SUNNYVALE, CA 94086

|                                   |
|-----------------------------------|
| <b>Approved by</b>                |
| Ken Wendel                        |
| Quality Assurance                 |
| Director, Reliability Engineering |

## Conclusion

The MAX6453UT16S+ 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 MAX6453-MAX6456 are low-power, dual-voltage  $\mu$ P supervisors featuring separate VCC reset and manual reset outputs. The dual outputs support both soft-system reset (interrupt) and hard-system reset (reboot) functions. The reset output asserts when any of the monitored voltages falls below its specified threshold and remains asserted for the reset timeout (140ms min) after all voltages exceed their respective reset thresholds. All devices are offered with nine factory-fixed reset thresholds for monitoring primary system voltages (VCC) from 1.8V to 5V and an adjustable reset input for monitoring a secondary system voltage down to 0.63V. Each device has a manual reset input, a VCC reset output, and a manual reset output. The MAX6453/MAX6454 manual reset output asserts when the manual reset input is low. It remains asserted for the manual reset timeout period (140ms min) after the manual reset input transitions high. The MAX6453/MAX6354 manual reset input controls only the manual reset output and does not affect the VCC reset output. The manual reset input of the MAX6455/MAX6456 controls both the manual reset and VCC reset outputs. When the manual reset input is low for less than 3.3s (typ), only the manual reset output asserts and remains asserted for the manual reset timeout period (140ms min) after the manual reset input transitions high. If the manual reset input is low for at least 3.3s (typ), the reset output also asserts and remains asserted for the reset timeout period (140ms min) after the manual reset input transitions high. This enhanced feature allows the implementation of a soft/hard-system reset combination. The MAX6453/MAX6455 have active-low push-pull reset and manual reset outputs, and the MAX6454/MAX6456 have active-low open-drain reset and manual reset outputs. All devices are available in small SOT23-6 packages and are fully specified over the extended temperature range (-40°C to +85°C).

**II. Manufacturing Information**

|                                  |   |
|----------------------------------|---|
| A. Description/Function:         | µP Supervisors with Separate V <sub>CC</sub> Reset and Manual Reset Outputs |
| B. Process:                      | B8  |
| C. Number of Device Transistors: |   |
| D. Fabrication Location:         | Texas   |
| E. Assembly Location:            | Carsem Malaysia, UTL Thailand, ASAT China, Unisem Malaysia                  |
| F. Date of Initial Production:   | October 25, 2002  |

**III. Packaging Information**

|  |                          |
|--|--------------------------|
| A. Package Type:   | 6-pin SOT23              |
| B. Lead Frame:   | Copper                   |
| C. Lead Finish:  | 100% matte Tin           |
| D. Die Attach:   | Conductive Epoxy         |
| E. Bondwire:   | Gold (1 mil dia.)        |
| F. Mold Material:  | Epoxy with silica filler |
| G. Assembly Diagram:   | #05-1601-0198            |
| H. Flammability Rating:  | Class UL94-V0            |
| I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C | Level 1                  |
| J. Single Layer Theta Jb:  | 115°C/W                  |
| K. Single Layer Theta Jc:  | 80°C/W                   |

**IV. Die Information**

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 31 X 44 mils  |
| B. Passivation:            | Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide) |
| C. Interconnect:           | Aluminum/Cu (Cu = 0.5%)   |
| D. Backside Metallization: | None  |
| E. Minimum Metal Width:    | 0.8 microns (as drawn)  |
| F. Minimum Metal Spacing:  | 0.8 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 141 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 7.6 \times 10^{-9}$$

$\lambda = 7.6$  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 B8 Process results in a FIT Rate of 2.71 @ 25C and 17.30 @ 55C (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 MS76 die type has been found to have all pins able to withstand a HBM transient pulse of +/-800 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

**MAX6453UT16S+**

| TEST ITEM   | TEST CONDITION                                     | FAILURE IDENTIFICATION           | SAMPLE SIZE | NUMBER OF FAILURES |
|---|--|----------------------------------|-------------|--------------------|
| <b>Static Life Test</b> (Note 1)                          | Ta = 135°C<br>Biased<br>Time = 192 hrs.            | DC Parameters<br>& functionality | 141         | 0                  |
| <b>Moisture Testing</b> (Note 2)<br>85/85                 | Ta = 85°C<br>RH = 85%<br>Biased<br>Time = 1000hrs. | DC Parameters<br>& functionality | 77          | 0                  |
| <b>Mechanical Stress</b> (Note 2)<br>Temperature<br>Cycle | -65°C/150°C<br>1000 Cycles<br>Method 1010          | DC Parameters<br>& functionality | 77          | 0                  |

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

Note 2: Generic Package/Process data