

RELIABILITY REPORT  
FOR  
MAX6971AUG+T  
PLASTIC ENCAPSULATED DEVICES

July 11, 2011

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

|                                  |
|----------------------------------|
| <b>Approved by</b>               |
| Richard Aburano                  |
| Quality Assurance                |
| Manager, Reliability Engineering |

## Conclusion

The MAX6971AUG+T 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 MAX6971 serial-interfaced LED driver provides 16 open-drain, constant-current-sinking LED driver outputs rated at 36V. The MAX6971 operates from a 3V to 5.5V supply. The MAX6971 supply and the LEDs' supply or supplies can power up in any order. The constant-current outputs are programmed together to up to 55mA using a single external resistor. The MAX6971 operates with a 25Mb, industry-standard, 4-wire serial interface. The MAX6971 uses the industry-standard, shift-register-plus-latch-type serial interface. The driver accepts data shifted into a 16-bit shift register using data input DIN and clock input CLK. Input data appears at the DOUT output 16 clock cycles later to allow cascading of multiple MAX6971s. The latch-enable input, LE, loads the 16 bits of shift register data into a 16-bit output latch to set which LEDs are on and which are off. The active-low output-enable, OE, gates all 16 outputs on and off, and is fast enough to be used as a PWM input for LED intensity control. For applications requiring LED fault detection, refer to the MAX6983, which automatically detects open-circuit LEDs. For safety-related applications requiring a watchdog timer, refer to the MAX6983, which includes a fail-safe feature that blanks the display if the serial interface becomes inactive for more than 1s. The MAX6971 is one of a family of 12 shift-register-plus-latch-type LED drivers. The family includes 8-port and 16-port types, with 5.5V- or 36V-rated LED outputs, with and without open-circuit LED detection and watchdog. All versions operate from a 3V to 5.5V supply, and are specified over the -40°C to +125°C temperature range.

## II. Manufacturing Information

|                                  |  |
|----------------------------------|--|
| A. Description/Function:         | 16-Port, 36V Constant-Current LED Driver |
| B. Process:                      | B8                                       |
| C. Number of Device Transistors: |  |
| D. Fabrication Location:         | California, Texas or Oregon              |
| E. Assembly Location:            | Malaysia, Philippines and Thailand       |
| F. Date of Initial Production:   | July 23, 2005                            |

## III. Packaging Information

|  |                          |
|--|--------------------------|
| A. Package Type:   | 24-pin TSSOP             |
| B. Lead Frame:   | Copper                   |
| C. Lead Finish:  | 100% matte Tin           |
| D. Die Attach:   | Conductive               |
| E. Bondwire:   | Au (1 mil dia.)          |
| F. Mold Material:  | Epoxy with silica filler |
| G. Assembly Diagram:   | #05-9000-2608            |
| 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:  | 82°C/W                   |
| K. Single Layer Theta Jc:  | 15°C/W                   |
| L. Multi Layer Theta Ja:   | 72°C/W                   |
| M. Multi Layer Theta Jc:   | 13°C/W                   |

## IV. Die Information

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 107 X 119 mils  |
| B. Passivation:            | Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide) |
| C. Interconnect:           | Al/0.5%Cu with Ti/TiN Barrier   |
| 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:     |   |
| H. Isolation Dielectric:   | SiO <sub>2</sub>  |
| I. Die Separation Method:  | Wafer Saw   |

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)  
Don Lipps (Manager, Reliability Engineering)  
Bryan Preeshl (Vice President 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

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

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the B8 Process results in a FIT Rate of 0.06 @ 25C and 0.99 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing

The DW87 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 2500V per JEDEC JESD22-A114 (lot SXU0BQ001B, D/C 0516). Latch-Up testing has shown that this device withstands a current of 250mA (lot SXU0BQ001C, D/C 0516).

**Table 1**  
Reliability Evaluation Test Results

**MAX6971AUG+T**

| TEST ITEM                        | TEST CONDITION                          | FAILURE IDENTIFICATION           | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS             |
|----------------------------------|---|----------------------------------|-------------|--------------------|----------------------|
| <b>Static Life Test</b> (Note 1) | Ta = 135°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | 48          | 0                  | SXU0BQ001C, D/C 0516 |

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