RELIABILITY REPORT

FOR

MAX6972ATJ+
(MAX6972/MAX6973)

PLASTIC ENCAPSULATED DEVICES

March 4, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
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Conclusion

The MAX6972ATJ+ 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 MAX6972/MAX6973 precision current-sinking, 16-output PWM LED drivers drive red, green, and/or blue LEDs for full-color graphic message boards and video displays. Each output has an individual 12-bit (MAX6972) or 14-bit (MAX6973) PWM-intensity (hue) control and 7-bit (MAX6972) or 5-bit (MAX6973) global PWM intensity (luminance) control. The MAX6972/MAX6973 also feature open-circuit LED fault-detection circuitry, as well as a watchdog timer. The driver has two banks of eight outputs, with each bank intended to drive a different color in RGB applications. The standard application uses three MAX6972/MAX6973s to drive eight RGB LEDs. The full-scale current for each bank of eight outputs is adjustable from 11mA to 55mA in 256 steps (0.3125% per step) to calibrate each color. The MAX6972/MAX6973 can optionally multiplex by using outputs active-low MUX0 and active-low MUX1, which each drive an external pnp transistor. Multiplexing doubles the MAX6972/MAX6973 drive capability to 32 LEDs. The MAX6972/MAX6973 operate from a 3.0V to 3.6V power supply. The LED power supply can range from 3V to 7V. The LED drivers require only 0.8V headroom above the LEDs' forward-voltage drop. Using a separate LED supply voltage for each LED minimizes power consumption. The serial interface uses differential signaling for the high-speed clock and data signals to reduce EMI and improve signal integrity. The MAX6972/MAX6973 buffer all interface signals to simplify cascading devices in modules that use a large number of drivers. An internal watchdog timer, when enabled, automatically clears the pixel-data registers and blanks the display if any of the signal inputs fail to toggle within 40ms. The MAX6972/MAX6973 are available in 32-pin TQFN packages and operate over the -40°C to +125°C temperature range. Refer to the MAX6974/MAX6975 data sheet for a 24-output, 6mA to 30mA software-compatible device.

II. Manufacturing Information

A. Description/Function:	16-Output PWM LED Drivers for Message Boards
B. Process:	S4
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	ASAT China, UTL Thailand, Unisem Malaysia
F. Date of Initial Production:	April 22, 2006

III. Packaging Information

A. Package Type:	32-pin TQFN 5x5
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:	#05-9000-1886
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:	47°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2.7°C/W

IV. Die Information

A. Dimensions:	108 X 108 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide
C. Interconnect:	Aluminum/Cu (Cu = 0.4%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
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 (λ) is calculated as follows:

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

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

$\lambda = 22.4 \times 10^{-9}$

$\lambda = 22.4$ 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 S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 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 DW76 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 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

MAX6972ATJ+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
Moisture Testing (Note 2)				
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
Mechanical Stress (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