RELIABILITY REPORT

FOR

MAX8790AETP+

PLASTIC ENCAPSULATED DEVICES

September 29, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Conclusion

The MAX8790AETP+ 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 MAX8790A is a high-efficiency driver for white light-emitting diodes (LEDs). It is designed for large liquid-crystal displays (LCDs) that employ an array of LEDs as the light source. A current-mode step-up controller drives up to six parallel strings of multiple series-connected LEDs. Each string is terminated with ballast that achieves ±1.5% current regulation accuracy, ensuring even brightness for all LEDs. The MAX8790A has a wide input-voltage range from 4.5V to 26V, and provides a fixed 20mA or adjustable 15mA to 27mA full-scale LED current. The MAX8790A has two dimming control modes to enable a wide variety of applications. In direct DPWM mode, the LED current is directly turned on and off by a PWM signal. In analog dimming mode, an internal phase-locked loop (PLL) circuit translates the PWM signal into an analog signal and linearly controls the LED current down to 12.5%. Below 12.5%, digital dimming is added to allow lower average LED current down to 1%. Both control methods provide 100:1 dimming range. The MAX8790A has multiple features to protect the controller from fault conditions. Separate feedback loops limit the output voltage if one or more LEDs fail open or short. The controller features cycle-by-cycle current limit to provide consistent operation and soft-start capability. A thermal-shutdown circuit provides another level of protection. The step-up controller uses an external MOSFET, which provides good efficiency and allows for scalable output power and maximum operating voltage. Low feedback voltage at each LED string (450mV) helps reduce power loss. The MAX8790A features selectable switching frequency (500kHz, 750kHz, or 1MHz), which allows trade-offs between external component size and operating efficiency. The MAX8790A is available in a thermally enhanced, lead-free, 20-pin, 4mm x 4mm, Thin QFN package.

II. Manufacturing Information

A. Description/Function:	Six-String White LED Driver with Active Current Balancing for LCD Panel Applications
B. Process:	S45
C. Number of Device Transistors:	
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Thailand
F. Date of Initial Production:	10/21/2006

III. Packaging Information

A. Package Type:	20-pin TQFN 4x4
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:	#05-9000-2310
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:	59°C/W
K. Single Layer Theta Jc:	5.7°C/W
L. Multi Layer Theta Ja:	39°C/W
M. Multi Layer Theta Jc:	5.7°C/W

IV. Die Information

A. Dimensions:	81 X 74 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
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)

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

λ = 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 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 S45 Process results in a FIT Rate of 0.49 @ 25C and 8.49 @ 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 PE02-1 die type has been found to have all pins able to withstand a transient pulse of:

HBM: +/-2500 V per JESD22 A114

CDM: +/-750 V per JESD22 C101

MM: +/-250 V per JESD22 A115.

Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1

Reliability Evaluation Test Results

MAX8790AETP+

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)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	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