RELIABILITY REPORT

FOR

MAX14521EETG+

PLASTIC ENCAPSULATED DEVICES

January 18, 2010

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
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Conclusion

The MAX14521EETG+ 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 MAX14521E is a quad-output high-voltage DC-AC converter that drives four electroluminescent (EL) lamps. The device features a 2.7V to 5.5V input range that allows the device to accept a variety of voltage sources such as single-cell lithium-ion (Li+) batteries. The lamp outputs of the device generate up to 300VP-P for maximum lamp brightness. The high-voltage outputs are ESD protected up to ±15kV Human Body Model (HBM), ±6kV Contact Discharge, and ±8kV Air Gap Discharge, as specified in IEC 61000-4-2. The MAX14521E uses a high-voltage full-bridge output stage to convert the high voltage generated by the boost converter to a sinusoidal output waveform. The MAX14521E utilizes a high-frequency spread-spectrum oscillator to reduce the amount of EMI/EFI generated by the boost-converter circuit. The MAX14521E provides an I²C interface to set the boost converter and EL output switching frequencies through an 8-bit register and the peak output voltages with 5 bits of resolution. The MAX14521E also provides an adjustable automatic ramping feature that slowly increases or decreases the peak output voltage when a change is made to the output amplitude. The slew rate of the automatic ramp is set with 3 bits of resolution through the I²C interface and it is independent for each channel. The MAX14521E features an audio auxiliary input AUX that modulates the EL output voltage and frequency for dynamic lighting effects. The MAX14521E is available in a small, 4mm x 4mm, 24-pin TQFN package, and specified over the extended -40°C to +85°C operating temperature range.

II. Manufacturing Information

A. Description/Function:	Quad, High-Voltage EL Lamp Driver with I²C Interface	
B. Process:	EL03: BCD250	EL02: S45
C. Number of Device Transistors:		
D. Fabrication Location:	Oregon	Texas
E. Assembly Location:	Thailand	
F. Date of Initial Production:	1/8/2009	

III. Packaging Information

A. Package Type:	24-pin TQFN 4x4
B. Lead Frame:	Copper Alloy
C. Lead Finish:	Matte Sn Plate
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#31-4854
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:	48°C/W
K. Single Layer Theta Jc:	3°C/W
L. Multi Layer Theta Ja:	36°C/W
M. Multi Layer Theta Jc:	3°C/W

IV. Die Information

A. Dimensions:	39 x 100 mils	41 x 98 mils
B. Passivation:	SiO_2/Si_3N_4	SiO_2/Si_3N_4
C. Interconnect:	Al/0.5%Cu	Al/0.5%Cu
D. Backside Metallization:	None	None
E. Minimum Metal Width:	Metal1 = 1.5µm / Metal2 = 3.0µm	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns
F. Minimum Metal Spacing:	Metal1 = 1.5µm / Metal2 = 3.0µm	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns
G. Bondpad Dimensions:	5 mil. Sq.	5 mil. Sq.
H. Isolation Dielectric:	SiO_2	SiO_2
I. Die Separation Method:	Saw	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 BCD250 Process results in a FIT Rate of 0.43 @ 25C and 7.42 @ 55C (0.8 eV, 60% UCL. 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 EL04 die type has been found to have all pins able to withstand a HBM transient pulse of +/-500 V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250 mA, 1.5x VCCMax Overvoltage per JESD78

Table 1

Reliability Evaluation Test Results

MAX14521EETG+

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