RELIABILITY REPORT

FOR

MAX4990ETD+

PLASTIC ENCAPSULATED DEVICES

Updated: August 16, 2016

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX4990ETD+ 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 MAX4990 high-voltage DC-AC converter is ideal for driving electroluminescent (EL) lamps. The MAX4990 features a wide +2.4V to +5.5V input range that allows the device to accept a wide variety of voltage sources such as single-cell lithium-ion (Li+) batteries and higher voltage battery chargers. The lamp outputs of the device generate up to 250V peak-to-peak output voltage for maximum lamp brightness. The MAX4990 utilizes an inductor-based boost converter to generate the high voltage necessary to drive an EL lamp. The boost-converter switching frequency is set with the combination of an external capacitor connected from SW to GND and an external resistor connected from SLEW to GND. The MAX4990 uses a high-voltage full-bridge output stage to convert the high voltage generated by the boost converter to an AC waveform suitable for driving the EL panel. The EL output switching frequency is set with the combination of an external capacitor connected from EL to GND and an external resistor connected from SLEW to GND. The MAX4990 uses a proprietary acoustic noise-reduction circuit that controls the slew rate of the AC voltage, reducing audible noise from the EL panel. The slew rate is set with an external resistor connected from SLEW to GND. The MAX4990 features an EL lamp dimming control (DIM) that allows the user to set the EL output voltage with a PWM signal, a DC analog voltage, or a resistor connected from the DIM input to GND. A capacitor placed in parallel to the resistor on DIM allows the user to program a slow turn-on/-off time that generates a soft fade on/fade-off effect of the EL lamp. The MAX4990 enters a low-power shutdown mode (100nA max) when the EN and DIM inputs are connected to GND. The MAX4990 also enters thermal shutdown if the die temperature rises above +158°C. The MAX4990 is available in a space-saving, 14-pin, 3mm x 3mm TDFN package and is specified over the extended -40°C to +85°C operating temperature range.

II. Manufacturing Information

A. Description/Function:	High-Voltage, ±15kV ESD-Protected Electroluminescent Lamp Driver
B. Process:	BCD250
C. Number of Device Transistors:	1230
D. Fabrication Location:	USA
E. Assembly Location:	Thailand, Taiwan, JCET
F. Date of Initial Production:	July 27, 2007

III. Packaging Information

A. Package Type:	14L TDFN
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:	#05-9000-2855 / A
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	54°C/W
K. Single Layer Theta Jc:	8°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	8°C/W

IV. Die Information

A. Dimensions:	69 X 92 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 = 1.5µm / Metal2 = 3.0µm
F. Minimum Metal Spacing:	Metal1 = 1.5µm / Metal2 = 3.0µm
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
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 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)

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

λ = 22.9 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)

B. E.S.D. and Latch-Up Testing (lot NFVZBA007A D/C 0748)

The EL01 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX4990ETD+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	NFVZBQ002C, D/C 0728

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

