

RELIABILITY REPORT
FOR
MAX14514ETD+T
PLASTIC ENCAPSULATED DEVICES

August 1, 2013

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Quality Assurance
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Conclusion

The MAX14514ETD+T successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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I. Device Description

A. General

The MAX14514 is a high-voltage DC-AC converter ideal for driving two electroluminescent (EL) lamps. The MAX14514 features a +2.7V to +5.5V input range that allows the device to accept a wide variety of voltage sources, including single-cell lithium-ion (Li+) batteries. The lamp outputs of the device generate up to 300VP-P for maximum lamp brightness. The MAX14514 utilizes an inductor-based boost converter to generate the high voltage necessary to drive EL lamps and allows the use of a 220 μ H inductor to effectively drive total combined lamp sizes of up to 20nF. The MAX14514 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 panels. An external resistor controls the slew-rate of the rising and falling edges of the AC drive waveform to reduce audible noise output. The high-voltage outputs are ESD protected up to ± 15 kV Human Body Model, ± 4 kV IEC 61000-4-2 Air Gap Discharge, and ± 4 kV IEC 61000-4-2 Contact Discharge. The MAX14514 features dimming/enable controls (DIM1, DIM2) for each output to allow the user to set the peak-to-peak output voltage with a PWM signal, a DC analog voltage, or a resistor connected from DIM_ to GND. The MAX14514 also provides a slow turn-on/-off feature that slowly ramps the output voltage applied to the lamp when enabled or disabled. The MAX14514 enters a low-power shutdown mode when the EN and DIM_ inputs are connected to GND. The device also features thermal shutdown if the die temperature exceeds +158°C (typ). The MAX14514 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:	Dual Electroluminescent Lamp Driver
B. Process:	BCD250
C. Number of Device Transistors:	1852
D. Fabrication Location:	Oregon
E. Assembly Location:	Thailand
F. Date of Initial Production:	April 23, 2010

III. Packaging Information

A. Package Type:	14-pin TDFN 3x3
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:	#05-9000-3471
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:	54°C/W
K. Single Layer Theta Jc:	8.3°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	8.3°C/W

IV. Die Information

A. Dimensions:	70 X 94 mils
B. Passivation:	Si ₃ N 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 = 1.5um
F. Minimum Metal Spacing:	Metal1 = 1.5um
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

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| 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 47 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 23.4 \times 10^{-9}$$

$$\lambda = 23.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the BCD250 Process results in a FIT Rate of 1.9 @ 25C and 32.7 @ 55C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (lot NSWZAQ001E, D/C 0838)

The EL06 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX14514ETD+T

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	47	0	NSWZAQ001E, D/C 0838

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