

RELIABILITY REPORT  
FOR  
MAX16840ATB+T  
PLASTIC ENCAPSULATED DEVICES

September 24, 2013

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
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## Conclusion

The MAX16840ATB+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 MAX16840 is an LED driver IC for lighting applications. It includes all the necessary features to design low-component-count LED drivers for 12V AC and 24V AC input (e.g., MR16) light bulbs. A proprietary input-current control scheme allows LED lamps based on this device to be compatible with electronic transformers, and dimmable with standard trailing-edge dimmers (where electronic transformers are present). The IC can be used in buck, boost, and buck-boost topologies and features. It has an integrated 0.2 (max), 48V switching MOSFET. The IC uses constant-frequency average current-mode control. It senses the input current through the voltage at the FB pin, and regulates its average. An input pin (REFI) allows the setting of the input-current level. When the voltage at this pin is set below a certain threshold, the input current is proportional to this voltage, while when that voltage is beyond the threshold, the input current is set at a fixed, predefined level. This nonlinear behavior of REFI allows its use to achieve thermal foldback, by connecting it to an NTC resistor. The IC also features an internal overvoltage protection on the IN pin to protect the internal switching MOSFET from damage if the LED string is open or if the voltage on the LED string is too high. The IC has a separate EXT pin that can be used to guarantee that there is a kick-start of current at turn-on for low-input voltages for proper operation with electronic transformers. EXT drives an external npn transistor. Once the UVLO threshold of 5.5V is crossed on IN, EXT is pulled to ground and the external npn transistor is turned off. The IC is available in a 3mm x 3mm, 10-pin TDFN power package, and is rated over the -40°C to +125°C operating temperature range.

## II. Manufacturing Information

A. Description/Function:	LED Driver with Integrated MOSFET for MR16 and Other 12V AC Input Lamps
B. Process:	S18
C. Number of Device Transistors:	5440
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	December 22, 2010

## III. Packaging Information

A. Package Type:	10-pin TDFN 3x3
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Cu (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-4129
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:	9°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	9°C/W

## IV. Die Information

A. Dimensions:	46.85 X 61.42 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) 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 S18 Process results in a FIT Rate of 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot SI8ZCQ001A, D/C 1048)

The SP26 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 +/- 100mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX16840ATB+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	SI8ZCQ001A, D/C 1048

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