

RELIABILITY REPORT
FOR
MAX16834ATP+
PLASTIC ENCAPSULATED DEVICES

March 18, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

| |
|-----------------------------------|
| Approved by |
| Ken Wendel |
| Quality Assurance |
| Director, Reliability Engineering |

Conclusion

The MAX16834ATP+ 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.

Table of Contents

| | |
|--|---|
| I.Device Description | V.Quality Assurance Information |
| II.Manufacturing Information | VI.Reliability Evaluation |
| III.Packaging Information | IV.Die Information |
|Attachments | |

I. Device Description

A. General

The MAX16834 is a current-mode high-brightness LED (HB LED) driver for boost, buck-boost, SEPIC, and highside buck topologies. In addition to driving an n-channel power MOSFET switch controlled by the switching controller, it also drives an n-channel PWM dimming switch to achieve LED PWM dimming. The MAX16834 integrates all the building blocks necessary to implement a fixed-frequency HB LED driver with wide-range dimming control. The MAX16834 features constant-frequency peak current-mode control with programmable slope compensation to control the duty cycle of the PWM controller. A dimming driver designed to drive an external n-channel MOSFET in series with the LED string provides wide-range dimming control up to 20kHz. In addition to PWM dimming, the MAX16834 provides analog dimming using a DC input at REFI. The programmable switching frequency (100kHz to 1MHz) allows design optimization for efficiency and board space reduction. A single resistor from RT/SYNC to ground sets the switching frequency from 100kHz to 1MHz while an external clock signal at RT/SYNC disables the internal oscillator and allows the MAX16834 to synchronize to an external clock. The MAX16834's integrated highside current-sense amplifier eliminates the need for a separate high-side LED current-sense amplifier in buck-boost applications. The MAX16834 operates over a wide supply range of 4.75V to 28V and includes a 3A sink/source gate driver for driving a power MOSFET in high-power LED driver applications. It can also operate at input voltages greater than 28V in boost configuration with an external voltage clamp. The MAX16834 is also suitable for DC-DC converter applications such as boost or buck-boost. Additional features include external enable/disable input, an on-chip oscillator, fault indicator output (active-low FLT) for LED open/short or overtemperature conditions, and an overvoltage protection sense input (OVP+) for true overvoltage protection. The MAX16834 is available in a thermally enhanced 4mm x 4mm, 20-pin TQFN-EP package and in a thermally enhanced 20-pin TSSOP-EP package and is specified over the automotive -40°C to +125°C temperature range.

II. Manufacturing Information

| | |
|----------------------------------|---|
| A. Description/Function: | High-Power LED Driver with Integrated High-Side LED Current Sense and PWM Dimming MOSFET Driver |
| B. Process: | S4 |
| C. Number of Device Transistors: | 4314 |
| D. Fabrication Location: | Texas |
| E. Assembly Location: | ASAT China, UTL Thailand |
| F. Date of Initial Production: | July 26, 2008 |

III. Packaging Information

| | |
|--|--------------------------|
| A. Package Type: | 20-pin TQFN 4x4 |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive Epoxy |
| E. Bondwire: | Au (1.0 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | # |
| 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: | 77 X 77 mils |
| B. Passivation: | Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide) |
| C. Interconnect: | Aluminum/Si (Si = 1%) |
| 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

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

$\lambda = 22.4$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 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 SP20 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-100 mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX16834ATP+

| 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) 85/85 | Ta = 85°C RH = 85% Biased Time = 1000hrs. | 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