RELIABILITY REPORT FOR

MAX16814/MAX16814B

PLASTIC ENCAPSULATED DEVICES

December 4, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX16814/MAX16814B 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 MAX16814 high-efficiency, high-brightness LED (HB LED) driver provides up to four integrated LED current-sink channels. An integrated current-mode switching DC-DC controller drives a DC-DC converter that provides the necessary voltage to multiple strings of HB LEDs. The MAX16814 accepts a wide 4.75V to 40V input voltage range and withstands direct automotive load-dump events. The wide input range allows powering HB LEDs for small to medium-sized LCD displays in automotive and general lighting applications.

An internal current-mode switching DC-DC controller supports the boost, coupled-inductor buck-boost, or SEPIC topologies and operates in an adjustable frequency range between 200kHz and 2MHz. It can also be used for single-inductor buck-boost topology in conjunction with the MAX15054 and an additional MOSFET. The current-mode control with programmable slope compensation provides fast response and simplifies loop compensation. The MAX16814 also features an adaptive output-voltage control scheme that minimizes the power dissipation in the LED current-sink paths.

The MAX16814 consists of four identical linear current source channels to drive four strings of HB LEDs. The channel current is adjustable from 20mA to 150mA with an accuracy of ±3% using an external resistor. The external resistor sets all 4-channel currents to the same value. The device allows connecting multiple channels in parallel to achieve higher current per LED string. The MAX16814 also features pulsed dimming control on all four channels through a logic input (DIM). In addition, MAX16814A__ and MAX16814U__ include a unique feature that allows a very short minimum pulse width as low as 1us.

The MAX16814 includes an output overvoltage, open- LED detection and protection, programmable shorted LED detection and protection, and overtemperature protection. The device operates over the -40°C to +125°C automotive temperature range. The MAX16814 is available in the 6.5mm x 4.4mm, 20-pin TSSOP and 4mm x 4mm, 20-pin TQFN packages.

II. Manufacturing Information

A. Description/Function:	Integrated, 4-Channel, High-Brightness LED Driver with High-Voltage DC-DC Controller
B. Process:	S45
C. Number of Device Transistors:	1194
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	China, Thailand (TQFN-20) and China, Philippines (TSSOP-20)
F. Date of Initial Production:	July 25, 2009

III. Packaging Information

A. Package Type:	20-pin TQFN 4mm x 4mm and 20-pin TSSOP 6.5mm x 4.4mm
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:	#05-9000-3626 (TQFN-20) and #05-9000-3627 (TSSOP-20)
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 (TQFN-20) / 46°C/W (TSSOP-20)
K. Single Layer Theta Jc:	5.7°C/W (TQFN-20) / 2°C/W (TSSOP-20)
L. Multi Layer Theta Ja:	39°C/W (TQFN-20) / 37.7°C/W (TSSOP-20)
M. Multi Layer Theta Jc:	5.7°C/W (TQFN-20) / 2°C/W (TSSOP-20)

IV. Die Information

A. Dimensions:	80 X 77 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 = 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:

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

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

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

$\lambda = 22.9$ 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 S45 Process results in a FIT Rate of 0.49 @ 25C and 8.49 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The SP21/SP21-1 die type has been found to have all pins able to withstand a transient pulse of

ESD-HBM:	+/- 2500V per JEDEC JESD22-A114
ESD-MM:	+/- 250V per JEDEC JESD22-A115
ESD-CDM:	+/- 750V per JEDEC JESD22-C101

Latch-Up testing has shown that this device withstands a current of +/- 100mA and Overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX16814/MAX16814B

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

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