RELIABILITY REPORT

FOR

MAX8647ETE+T

PLASTIC ENCAPSULATED DEVICES

April 22, 2011

# MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

| Approved by |
| --- |
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| Quality Assurance |
| Manager, Reliability Engineering |

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**Conclusion**

The MAX8647ETE+T 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 MAX8647/MAX8648 drive up to six white LEDs or two sets of RGB LEDs with regulated constant current for display backlight and fun light applications. By utilizing an inverting charge pump and extremely low-dropout adaptive current regulators, these ICs achieve very high efficiency over the full 1-cell Li+ battery voltage range and even with large LED forward voltage mismatch. The 1MHz fixed-frequency switching allows for tiny external components. The regulation scheme is optimized to ensure low EMI and low input ripple. The MAX8647/MAX8648 include thermal shutdown, open- and short-circuit protection. The MAX8647 features an I²C serial port, while the MAX8648 features a three-wire serial-pulse logic interface. Both devices support independent on/off and dimming for main and subbacklights. The dimming ranges are pseudo-logarithmic from 24mA to 0.1mA and off in 32 steps. Both devices include a temperature derating function to safely allow bright 24mA full-scale output current setting while automatically reducing current to protect LEDs at high ambient temperatures above +60°C. The MAX8647/MAX8648 are available in a 16-pin, 3mm x 3mm thin QFN package (0.8mm max height).

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**II. Manufacturing Information**

| | |
|---|---|
| A. Description/Function: | Ultra-Efficient Charge Pumps for Six White/RGB LEDs in 3mm x 3mm Thin QFN |
| B. Process: | S45 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | California, Texas or Japan |
| E. Assembly Location: | China, Malaysia, Taiwan and Thailand |
| F. Date of Initial Production: | April 20, 2007 |

**III. Packaging Information**

| | |
|---|---|
| A. Package Type: | 16-pin TQFN 3x3 |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive |
| E. Bondwire: | Au (1.3 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-2454 |
| 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: | 68°C/W |
| K. Single Layer Theta Jc: | 10°C/W |
| L. Multi Layer Theta Ja: | 48°C/W |
| M. Multi Layer Theta Jc: | 10°C/W |

**IV. Die Information**

| | |
|---|---|
| A. Dimensions: | 70 X 70 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 |

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**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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 48 \times 2}$$ (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 (lot T960CQ001G, D/C 0709)

The PP52 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.

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**Table 1**
Reliability Evaluation Test Results

**MAX8647ETE+T**

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|---|---|---|---|---|---|
| **Static Life Test** (Note 1) | | | | | |
| | Ta = 135°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | 48 | 0 | T961CQ001A, D/C 0707 |

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

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