



RELIABILITY REPORT  
FOR MAX16821BATI+  
PLASTIC ENCAPSULATED DEVICES

October 4, 2009

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX16821BATI+ 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 MAX16821A/MAX16821B/MAX16821C pulse-width-modulation (PWM) LED driver controllers provide high output-current capability in a compact package with a minimum number of external components. The MAX16821A/MAX16821B/MAX16821C are suitable for use in synchronous and nonsynchronous step-down (buck), boost, buck-boost, SEPIC, and Cuk LED drivers. A logic input (MODE) allows the devices to switch between synchronous buck and boost modes of operation. These devices are the first high-power drivers designed specifically to accommodate common-anode HB LEDs. The ICs offer average current-mode control that enable the use of MOSFETs with optimal charge and on-resistance figure of merit, thus minimizing the need for external heatsinking even when delivering up to 30A of LED current. The differential sensing scheme provides accurate control of the LED current. The ICs operate from a 4.75V to 5.5V supply range with the internal regulator disabled (VCC connected to IN). These devices operate from a 7V to 28V input supply voltage with the internal regulator enabled. The MAX16821A/MAX16821B/MAX16821C feature a clock output with 180° phase delay to control a second out-of-phase LED driver to reduce input and output filter capacitor size and to minimize ripple currents. The wide switching frequency range (125kHz to 1.5MHz) allows the use of small inductors and capacitors. Additional features include programmable overvoltage protection and an output enable function.

**II. Manufacturing Information**

A. Description/Function:	High-Power Synchronous HB LED Drivers with Rapid Current Pulsing
B. Process:	B12
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon, California or Texas
E. Assembly Location:	N
F. Date of Initial Production:	Pre 1997

**III. Packaging Information**

A. Package Type:	28-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-2785
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:	47°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	1.7°C/W

**IV. Die Information**

A. Dimensions:	114 X 110 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:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
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 ( $\lambda$ ) 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)

$$\lambda = 22.9 \times 10^{-9}$$
$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 B12 Process results in a FIT Rate of 0.06 @ 25C and 1.06 @ 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 SP14-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000 per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX16821BATI+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (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