

RELIABILITY REPORT  
FOR  
MAX1536ETI+  
PLASTIC ENCAPSULATED DEVICES

August 4, 2009

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

<b>Approved by</b>
Ken Wendel
Quality Assurance
Director, Reliability Engineering

## Conclusion

The MAX1536ETI+ 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

<b>I. ....Device Description</b>	<b>V. ....Quality Assurance Information</b>
<b>II. ....Manufacturing Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>III. ....Packaging Information</b>	<b>IV. ....Die Information</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX1536 constant-off-time, pulse-width-modulated (PWM) step-down DC-to-DC converter is ideal for use in +5.0V and +3.3V to low voltages for notebook and subnotebook computers. The MAX1536 features an internal PMOS power switch and internal synchronous rectification for high efficiency and reduced component count. No external Schottky diode is required across the internal synchronous rectifier switch. The internal 54m PMOS power switch and 47m NMOS synchronous-rectifier switch easily deliver continuous load currents up to 3.6A. The MAX1536 produces dynamically adjustable output voltages for chipsets and graphics processor cores using a logic-level control signal. The MAX1536 achieves efficiencies as high as 96%. The MAX1536 uses a unique current-mode, constant-off-time, PWM control scheme. It has selectable Idle Mode(tm) to maintain high efficiency during light-load operation, or fixed-PWM mode for low output ripple. The programmable constant-off-time architecture allows a wide range of switching frequencies up to 1.4MHz, optimizing performance trade-offs between efficiency, output switching noise, component size, and cost. The MAX1536 features a digital soft-start to limit surge currents during startup, a 100% duty-cycle mode for low-dropout operation, and a low-power shutdown mode that disconnects the input from the output and reduces supply current below 1 $\mu$ A. The MAX1536 is available in a 28-pin thin QFN package with an exposed backside pad.

## II. Manufacturing Information

A. Description/Function:	3.6A, 1.4MHz, Low-Voltage, Internal-Switch Step-Down Regulator with Dynamic Output Voltage Control
B. Process:	B8
C. Number of Device Transistors:	
D. Fabrication Location:	California or Texas
E. Assembly Location:	China, Thailand, Unisem
F. Date of Initial Production:	January 24, 2003

## 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 (2 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-0360
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:	2.1°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2.1°C/W

## IV. Die Information

A. Dimensions:	108 X 128 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:	0.8 microns (as drawn)
F. Minimum Metal Spacing:	0.8 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)

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

$\lambda = 22.4$  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 B8 Process results in a FIT Rate of 1.29 @ 25C and 15.6 @ 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 PD27 die type has been found to have all pins able to withstand a transient pulse of:

HBM ESD: +/-400 V per Mil-Std 883 Method 3015.7.  
CDM ESD: +/-750 V per JESD22-C101

Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX1536ETI+**

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