



RELIABILITY REPORT
FOR
MAX5974DETE+T
PLASTIC ENCAPSULATED DEVICES

April 6, 2011

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX5974DETE+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 MAX5974_ provide control for wide-input-voltage, active-clamped, current-mode PWM, forward converters in Power-over-Ethernet (PoE) powered device (PD) applications. The MAX5974A/MAX5974C are well-suited for universal or telecom input range, while the MAX5974B/MAX5974D also accommodate low input voltage down to 10.5V. The devices include several features to enhance supply efficiency. The AUX driver recycles magnetizing current instead of wasting it in a dissipative clamp circuit. Programmable dead time between the AUX and main driver allows for zero-voltage switching (ZVS). Under light-load conditions, the devices reduce the switching frequency (frequency foldback) to reduce switching losses. The MAX5974A/MAX5974B feature unique circuitry to achieve output regulation without using an optocoupler, while the MAX5974C/MAX5974D utilize the traditional optocoupler feedback method. An internal error amplifier with a 1% reference is very useful in nonisolated design, eliminating the need for an external shunt regulator. The devices feature a unique feed-forward maximum duty-cycle clamp that makes the maximum clamp voltage during transient conditions independent of the line voltage, allowing the use of a power MOSFET with lower breakdown voltage. The programmable frequency dithering feature provides low-EMI, spread-spectrum operation. The MAX5974_ are available in 16-pin TQFN-EP packages and are rated for operation over the -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	Active-Clamped, Spread-Spectrum, Current-Mode PWM Controllers
B. Process:	S18
C. Number of Device Transistors:	5708
D. Fabrication Location:	California
E. Assembly Location:	Taiwan and Thailand
F. Date of Initial Production:	September 23, 2010

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 (0.8 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-4132
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:	64°C/W
K. Single Layer Theta Jc:	6.9°C/W
L. Multi Layer Theta Ja:	48°C/W
M. Multi Layer Theta Jc:	6.9°C/W

IV. Die Information

A. Dimensions:	49.61 X 45.28 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.18µm
F. Minimum Metal Spacing:	0.18µm
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: 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 (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)

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

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

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 S18 Process results in a FIT Rate of 0.40 @ 25C and 6.96 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot SL6YAQ001B, D/C 1014)

The NQ56-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 2000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/- 250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX5974

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	SL6ZAQ001B, D/C 1014

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