

RELIABILITY REPORT
FOR
MAX5986AETE+
PLASTIC ENCAPSULATED DEVICES

August 27, 2013

MAXIM INTEGRATED

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Approved by
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Conclusion

The MAX5986AETE+ successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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I. Device Description

A. General

The MAX5986A/MAX5986B/MAX5987A provide a complete power-supply solution as IEEE® 802.3af-compliant Class 1/Class 2 Powered Devices (PDs) in a Power-over-Ethernet (PoE) system. The devices integrate the PD interface with an efficient DC-DC converter, offering a low external part count PD solution. The MAX5987A includes a low-dropout regulator and the MAX5986A/MAX5986B include sleep and ultra-low power modes. The PD interface provides a detection signature and a Class 1/Class 2 classification signature with a single external resistor. The PD interface also provides an isolation power MOSFET, a 60mA (max) inrush current limit, and a 201mA (MAX5986A) or 323mA (MAX5986B/MAX5987A) operating current limit. The integrated step-down DC-DC converter uses a peak current-mode control scheme and provides an easy-to-implement architecture with a fast transient response. The step-down converter operates in a wide input voltage range from 8.7V to 60V and supports up to 3.84W (MAX5986A) or 6.49W (MAX5986B/MAX5987A) of input power. The MAX5986A operates at a fixed 275kHz switching frequency, while the MAX5986B/MAX5987A operate at a fixed 215kHz switching frequency. The DC-DC converter operates at a fixed 275kHz switching frequency, with an efficiency-boosting frequency foldback that reduces the switching frequency by half at light loads. The devices feature an input undervoltage-lockout (UVLO) with wide hysteresis and long deglitch time to compensate for twisted-pair cable resistive drop and to assure glitch-free transition during power-on/-off conditions. The devices also feature overtemperature shutdown, short-circuit protection, output overvoltage protection, and hiccup current limit for enhanced performance and reliability. The MAX5986A/MAX5986B/MAX5987A are available in a 16-pin, 5mm x 5mm, TQFN power package and operate over the -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	IEEE 802.3af-Compliant, High-Efficiency, Class 1/Class 2, Powered Devices with Integrated DC-DC Converter
B. Process:	S18
C. Number of Device Transistors:	25710
D. Fabrication Location:	California
E. Assembly Location:	Taiwan
F. Date of Initial Production:	March 30, 2012

III. Packaging Information

A. Package Type:	16L TQFN
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:	#05-9000-4862
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	48°C/W
K. Single Layer Theta Jc:	2.7°C/W
L. Multi Layer Theta Ja:	35°C/W
M. Multi Layer Theta Jc:	2.7°C/W

IV. Die Information

A. Dimensions:	93.7008X88.5827 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:	0.18um
F. Minimum Metal Spacing:	0.18um
G. Bondpad Dimensions:	
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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 79 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.9 \times 10^{-9}$$

$$\lambda = 13.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the S18 Process results in a FIT Rate of 0.05 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (ESD lot SADS8Q001B D/C 1201, Latch-Up lot SAIT1Q001C D/C 1232)

The NQ86-0 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA.

Table 1
Reliability Evaluation Test Results

MAX5986AETE+

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	79	0	SAIT1Q001C, D/C 1232

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