

RELIABILITY REPORT
FOR
MAX5976AETE+T
PLASTIC ENCAPSULATED DEVICES

October 19, 2015

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

Approved by
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Conclusion

The MAX5976AETE+T 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 MAX5976A/MAX5976B are integrated solutions for hot-swap applications requiring the safe insertion and removal of circuit line cards from a live backplane. The devices integrate a hot-swap controller, 24m power MOSFET, and electronic circuit-breaker protection in a single package. The ICs are designed for protection of 2.7V to 18V supply voltages. The devices provide inrush current control and short-circuit detection during startup. During normal operation, the devices provide circuit-breaker protection against overload and short-circuit conditions. The circuit-breaker function disconnects the power to the load if the load current exceeds the circuit-breaker limit. The devices are factory-calibrated to deliver accurate overcurrent protection with $\pm 10\%$ accuracy. During a fault condition, the MAX5976A enters an autoretry mode while the MAX5976B latches off. Both versions feature a resistor-adjustable variable speed circuit-breaker threshold and overtemperature protection. Additional features include power-good and fault indicator outputs. The ICs are available in a 16-pin, 5mm x 5mm, TQFN-EP package and fully specified over the -40°C to $+85^{\circ}\text{C}$ operating temperature range.

II. Manufacturing Information

A. Description/Function:	2.7V to 18V, 7A, Hot-Swap Solutions
B. Process:	S18
C. Number of Device Transistors:	9510
D. Fabrication Location:	California
E. Assembly Location:	Taiwan, Thailand
F. Date of Initial Production:	September 24, 2010

III. Packaging Information

A. Package Type:	16-pin TQFN 5x5
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:	#05-9000-4089
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:	48°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	30°C/W
M. Multi Layer Theta Jc:	1.7°C/W

IV. Die Information

A. Dimensions:	93.70X91.73 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: 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

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

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

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 (lot SJ8ZCQ002C, D/C 1028)

The NQ57 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX5976AETE+T

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	SJ8ZDQ002E, D/C 1109

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