

RELIABILITY REPORT  
FOR  
MAX864EEE+  
PLASTIC ENCAPSULATED DEVICES

February 20, 2014

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
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**Conclusion**

The MAX864EEE+ 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 MAX864 CMOS, charge-pump, DC-DC voltage converter produces a positive and a negative output from a single positive input, and requires only four capacitors. The charge pump first doubles the input voltage, then inverts the doubled voltage. The input voltage ranges from +1.75V to +6.0V. The internal oscillator can be pin-programmed from 7kHz to 185kHz, allowing the quiescent current, capacitor size, and switching frequency to be optimized. The 55 output impedance permits useful output currents up to 20mA. The MAX864 also has a 1 $\mu$ A logic-controlled shutdown. The MAX864 comes in a 16-pin QSOP package that uses the same board area as a standard 8-pin SOIC. For more space-sensitive applications, the MAX865 is available in an 8-pin  $\mu$ MAX® package, which uses half the board area of the MAX864.

## II. Manufacturing Information

A. Description/Function:	Dual-Output Charge Pump with Shutdown
B. Process:	M5
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	Pre 1997

## III. Packaging Information

A. Package Type:	16-pin QSOP
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:	#05-1701-0274
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:	120°C/W
K. Single Layer Theta Jc:	37°C/W
L. Multi Layer Theta Ja:	103.7°C/W
M. Multi Layer Theta Jc:	37°C/W

## IV. Die Information

A. Dimensions:	85X120 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/1.0%Si
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.7 \times 10^{-9}$$

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 M5 Process results in a FIT Rate of 0.21 @ 25C and 3.61 @ 55C (0.8 eV, 60% UCL).

### B. E.S.D. and Latch-Up Testing (lot NSRAEQ001A, D/C 9925)

The PW82 die type has been found to have all pins able to withstand a HBM transient pulse of +/-3000V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX864EEE+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	80	0	XSRADS003B, D/C 9649

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