

RELIABILITY REPORT
FOR
MAX861
PLASTIC ENCAPSULATED DEVICES

April 4, 2018

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

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Conclusion

The MAX861 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.

Table of Contents

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

I. Device Description

A. General

The MAX860/MAX861 charge-pump voltage converters invert input voltages ranging from +1.5V to +5.5V, or double input voltages ranging from +2.5V to +5.5V. Because of their high switching frequencies, these devices use only two small, low-cost capacitors. Their 50mA output makes switching regulators unnecessary, eliminating inductors and their associated cost, size, and EMI. Greater than 90% efficiency over most of the load-current range, combined with a typical operating current of only 200 μ A (MAX860), provides ideal performance for both battery-powered and board-level voltage- conversion applications. A frequency-control (FC) pin provides three switching frequencies to optimize capacitor size and quiescent current and to prevent interference with sensitive circuitry. Each device has a unique set of three available frequencies. A shutdown (S — H — D — N —) pin reduces current consumption to less than 1 μ A. The MAX860/MAX861 are suitable for use in applications where the ICL7660 and MAX660's switching frequencies are too low. The MAX860/MAX861 are available in 8-pin μ MAX® and SO packages.

II. Manufacturing Information

A. Description/Function:	50mA, Frequency-Selectable, Switched-Capacitor Voltage Converters
B. Process:	S3
C. Fabrication Location:	USA
D. Assembly Location:	Malaysia, Philippines, Thailand
E. Date of Initial Production:	Pre 1997

III. Packaging Information

A. Package Type:	8-pin SOIC (N)
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Bondwire:	Au (1.3 mil dia.)
E. Mold Material:	Epoxy with silica filler
F. Assembly Diagram:	#05-1701-0181
G. Flammability Rating:	Class UL94-V0
H. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
I. Single Layer Theta Ja:	170°C/W
J. Single Layer Theta Jc:	40°C/W
K. Multi Layer Theta Ja:	132°C/W
L. Multi Layer Theta Jc:	38°C/W

IV. Die Information

A. Dimensions:	58X84 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Minimum Metal Width:	3.0 microns (as drawn)
E. Minimum Metal Spacing:	3.0 microns (as drawn)
F. Isolation Dielectric:	SiO ₂
G. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Eric Wright (Reliability Engineering)
Brian Standley (Manager, Reliability)
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 160 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 6.87 \times 10^{-9}$$

$$\lambda = 6.87 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S3 Process results in a FIT Rate of 0.04 @ 25C and 0.69 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The PW48-1 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM: +/- 2500V per JEDEC JESD22-A114
ESD-CDM: +/- 750V per JEDEC JESD22-C101
ESD-MM: +/- 250 V per JEDEC JESD22-A115

Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX861

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	160	0	

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