

RELIABILITY REPORT  
FOR  
MAX14677EZA+T  
WAFER LEVEL DEVICES

August 16, 2014

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

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## Conclusion

The MAX14677EZA+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.

## Table of Contents

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

### I. Device Description

#### A. General

The MAX14638/MAX14639/MAX14677 provide a high-efficiency integrated solution for lens positioning, image sensor digital, and I/O power that significantly reduces the power consumption of autofocus camera modules compared to traditional linear circuit topologies. The MAX14638/MAX14677 integrates a low-noise 100mA linear voice-coil motor (VCM) driver, and an ultra-compact 300mA step-down DC-DC converter into a single WLP package. The MAX14639 uses a Class-D amplifier and external filter to drive a VCM module with up to 150mA. The MAX14638/MAX14677 low-EMI linear VCM driver is supplied by the output of the step-down DC-DC converter rather than directly from an external LDO or battery, dramatically reducing excess power consumption and dissipation. The driver features a 0 to 100mA output-current range, programmable with 10-bit resolution. The high-frequency (10MHz) DC-DC converter operates from a 2.5V to 4.4V (4.8V for MAX14677) supply and provides 400mA maximum output current (including VCM current). The MAX14638 output voltage can be selected from 1.04V to 1.35V on the fly, in 10mV increments through software. The MAX14677 output voltage can be selected from 0.80V to 1.10V on the fly in 9.6mV increments through software. The MAX14639 high-frequency Class-D VCM driver exhibits efficiencies greater than 80%, dramatically reducing excess power consumption and dissipation inside the module. An external L-C filter provides filtering of the output stage to create an extremely low-EMI output solution. An optional linear mode removes the need for external components and eliminates switching noise. The MAX14639 driver features a 0 to 150mA output current range programmable with 10-bit resolution. The output is guaranteed monotonic to ensure stable performance in closed-loop autofocus (AF) algorithms. Tunable ringing compensation speeds up actuator settling times for faster AF convergence. Both the VCM driver and DC-DC converter outputs feature overcurrent protection and over temperature protection to improve module reliability. The MAX14638/MAX14639/MAX14677 are available in a 0.86mm x 1.91mm x 0.33mm 8-bump WLP package with 0.4mm pitch, and are specified over the -40°C to +85°C extended temperature range.

## II. Manufacturing Information

A. Description/Function:	Integrated High-Efficiency Voice Coil Motor Driver and Fixed-Frequency DC-DC Converter
B. Process:	S18
C. Number of Device Transistors:	66809
D. Fabrication Location:	USA
E. Assembly Location:	USA
F. Date of Initial Production:	November 27, 2012

## III. Packaging Information

A. Package Type:	8-bump U.thin WLP
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	None
E. Bondwire:	N/A (N/A mil dia.)
F. Mold Material:	None
G. Assembly Diagram:	#05-9000-5009
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:	N/A°C/W
K. Single Layer Theta Jc:	N/A°C/W
L. Multi Layer Theta Ja:	84.7°C/W
M. Multi Layer Theta Jc:	N/A°C/W

## IV. Die Information

A. Dimensions:	76.7716 X 35.4331 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 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)<br>Bryan Preeshl (Vice President of QA)            |
| B. Outgoing Inspection Level:     | 0.1% for all electrical parameters guaranteed by the Datasheet.<br>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 ( $\lambda$ ) 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 S18 Process results in a FIT Rate of 0.05 @ 25°C and 0.93 @ 55°C (0.8 eV, 60% UCL)

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

The AL53-2 die type has been found to have all pins able to withstand an HBM transient pulse of +/-2500V 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  
**MAX14677EZA+T**

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	

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