

RELIABILITY REPORT  
FOR  
MAX11835EWA+T  
WAFER LEVEL DEVICES

March 29, 2015

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

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## Conclusion

The MAX11835EWA+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 MAX11835 haptic (tactile) actuator controller provides a complete solution to drive haptic actuators to add haptic feedback to products featuring user-touch interfaces. The MAX11835 drives actuators including single-layer, multilayer piezo, or electroactive polymer actuators. The device efficiently generates any type of user-programmable waveform including sine waves, trapezoidals, squares, and pulses to drive the piezo loads to create custom haptic sensations. The low-power device directly interfaces with an application processor or host controller through an I<sup>2</sup>C interface and integrates various blocks including a boost regulator, pattern storage memory, and waveform generator block in one package, thus providing a complete haptic feedback controller solution. The MAX11835 contains a boost regulator that uses an external flyback to efficiently generate high-voltage waveforms up to 250V to drive haptic actuators while limiting current drain. The boost regulator features an internal n-channel MOSFET with current limit to control the drain from the battery or power supply. The MAX11835 features user-programmable haptic feedback pattern storage memory that drives the waveform generator with piecewise linear data using 8-bit resolution. The device also offers a single trigger interface to allow the implementation of fast haptics directly from the touch controller. This allows use of multiple controllers in parallel to provide haptic sensations for larger displays. The device provides smart low-power and standby modes to reduce power consumption before, during, and after waveform generation. The MAX11835 enters low-power mode after a haptic event to automatically save power. The MAX11835 offers a fast 400kHz I<sup>2</sup>C serial interface to allow programming of various modes of operation, status checking, and haptic waveforms. The operating supply range is 1.7V to 3.6V for the digital supply (DVDD) and 2.7V to 5.25V for the boost supply (BVDD) and analog supply (AVDD).

## II. Manufacturing Information

A. Description/Function:	Efficient, High-Voltage, TacTouch(tm) Haptic Actuator Controller with I <sup>2</sup> C Interface
B. Process:	S45
C. Number of Device Transistors:	89250
D. Fabrication Location:	USA
E. Assembly Location:	Japan
F. Date of Initial Production:	July 30, 2010

## III. Packaging Information

A. Package Type:	25-bump 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:	#05-9000-4168
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:	52°C/W
M. Multi Layer Theta Jc:	N/A°C/W

## IV. Die Information

A. Dimensions:	86 X 81 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:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 24.4 \times 10^{-9}$$

$$\lambda = 24.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S45 Process results in a FIT Rate of 0.04 @ 25°C and 0.69 @ 55°C (0.8 eV, 60% UCL)

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

The FP03 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 +/-100mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX11835EWA+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	43	0	

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