RELIABILITY REPORT

FOR

MAX11836EWA+T

WAFER LEVEL PRODUCT

July 15, 2010

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX11836EWA+T successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

Table of Contents

I. Device Description

A. General

The MAX11836 haptic (tactile) actuator controller provides a complete solution for touch-pressure measurement and haptic feedback for products featuring user touch interfaces. The MAX11836 integrates drive and sense circuitry for connecting up to four external force-sense resistors (FSRs) to measure touch pressure. The MAX11836 drives actuators including single layer, multilayer piezos, or electroactive polymer actuators. The device efficiently generates any type of user-programmable waveforms including sine waves, trapezoidals, squares, and pulses to drive the tactile feedback loads to create custom haptic sensations. This device integrates various blocks including an I2C interface, boost regulator, pattern storage memory and waveform generator, force-sense resistor controller, and a 5-channel, 10-bit ADC block in one package. The device provides a complete touch-pressure sensing and haptic feedback controller solution. The MAX11836 scans the FSR inputs at a user programmable rate and measures touch pressure to detect touch in a low-power mode. The system touch-screen controller can stay in shutdown mode, saving system power. Upon a touch, the MAX11836 notifies the host of the touch event and in return the host wakes up the touch-screen controller to scan for the location of the touch and triggers the MAX11836 to fire haptic events. Touch detection through the FSR inputs is controlled through a pressure threshold setting which is user programmable. All FSR inputs are summed and compared to the threshold value, and if exceeded, the MAX11836 generates and interrupts the host controller, allowing the removal of false touches. The MAX11836 contains a boost regulator that uses an external flyback to efficiently generate high-voltage waveforms typically 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 MAX11836 features user-programmable haptic feedback pattern storage memory that drives the waveform generator with piecewise linear data using 8-bit resolution. The MAX11836 provides a fast 1MHz I2C serial interface to allow programming of various modes of operation, status checking, and playback of haptic waveforms. The MAX11836 can automatically power down to save power, making the device ideal for portable applications.

II. Manufacturing Information

A. Description/Function:	TacTouch(tm) Haptic Actuator and Touch-Pressure Measurement Controller with I2C Interface
B. Process:	S45
C. Number of Device Transistors:	89250
D. Fabrication Location:	California, Texas or Japan
E. Assembly Location:	Japan
F. Date of Initial Production:	June 25, 2010

III. Packaging Information

A. Package Type:	25-bump WLP 5x5 array
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:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-3875
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:	°C/W
K. Single Layer Theta Jc:	°C/W
L. Multi Layer Theta Ja:	52°C/W
M. Multi Layer Theta Jc:	11°C/W

IV. Die Information

A. Dimensions:	86 X 81 mils
B. Passivation:	Si_3N_4/SiO_2 (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:	5 mil. Sq.
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Richard Aburano (Manager, Reliability Operations) Bryan Preeshl (Managing Director 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 (λ) is calculated as follows:

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

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

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

$\lambda = 22.9$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at http://www.maxim-ic.com/qa/reliability/monitor. Cumulative monitor data for the S45 Process results in a FIT Rate of 0.49 @ 25C and 8.49 @ 55C (0.8 eV, 60% UCL)

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

The FP04 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, except VFB (bump B3) which passes -80mA/+100mA.

Table 1
Reliability Evaluation Test Results

MAX11836EWA+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0

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