RELIABILITY REPORT

FOR

MAX1441GUP/V+

PLASTIC ENCAPSULATED DEVICES

April 1, 2012

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Approved by
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Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX1441GUP/V+ 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 MAX1441 proximity and touch sensor IC is designed for capacitive proximity sensing in automotive Passive Remote Keyless Entry (PRKE) and other applications. This device provides signal processing to support two independent touch/proximity sensor channels. The device features two open-drain output pins with high-voltage capability up to 28V as well as five digital I/Os to indicate sensing events. During manufacturing JTAG programming uses four digital I/Os. The device uses grounded electrode capacitive sensing to measure capacitance between one of the two sense pins and the ground. A hand approaching a sense electrode attached to these sense pins causes a change in measured capacitance indicating the presence (touch or proximity) of the object. Active guard outputs shield the sense electrode from unwanted sources without adding parasitic capacitance. Spread-spectrum techniques in the sensor excitation circuit reduce both electromagnetic emissions and susceptibility to interfering signals. In addition, the sensing excitation frequency is programmable from 100kHz to 500kHz in 10kHz steps to avoid interference. The sensor input signals are converted to a 12-bit digital data and are available to an on-chip microcontroller (µC). The device provides independent offset-compensation of up to 63pF for each input channel. Each channel can be programmed to 5pF, 10pF, or 20pF full-scale range. The device features an internal MAXQ® microcontroller with 2kword of flash for user programs and 128 bytes of SRAM. This feature provides the ability to implement customized signal processing and discrimination algorithms that optimize performance in the systems. The device offers user-configurable general-purpose digital I/O lines. Power-on-reset circuitry provides consistent startup of the device, and a watchdog timer ensures long-term reliable operation of the user's software. The device is available in a 20-pin TSSOP package and is specified over the -40°C to +105°C automotive temperature range.

II. Manufacturing Information

A. Description/Function:	Automotive, Two-Channel Proximity and Touch Sensor
B. Process:	S4
C. Number of Device Transistors:	132300
D. Fabrication Location:	USA and Japan
E. Assembly Location:	Thailand
F. Date of Initial Production:	June 24, 2010

III. Packaging Information

A. Package Type:	20-pin TSSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#31-4860
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:	91°C/W
K. Single Layer Theta Jc:	20°C/W
L. Multi Layer Theta Ja:	73.8°C/W
M. Multi Layer Theta Jc:	20°C/W

IV. Die Information

A. Dimensions:	19 X 76 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:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

A. Dimensions:	108 X 130 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al 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)
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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 135C 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 S4 Process results in a FIT Rate of 0.06 @ 25C and 1.00 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot NFTUBAD, D/C 1009)

The SC22 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 1500V 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

MAX1441GUP/V+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135 Biased Time = 192 hrs.	DC Parameters & functionality	48	0	NFTUBAD, D/C 1009

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