RELIABILITY REPORT FOR

MAX14001AAP+T / MAX14002AAP+T

PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

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Conclusion

The MAX14001AAP+T / MAX14002AAP+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 MAX14001/MAX14002 are isolated, single-channel analog-to-digital converters (ADCs) with programmable voltage comparators and inrush current control optimized for configurable binary input applications. 3.75kVRMS of integrated isolation is provided between the binary input side (field-side) and the comparator output/SPI-side (logic-side) of the MAX14001/MAX14002. An integrated, isolated, DC-DC converter powers all field-side circuitry, and this allows running field-side diagnostics even when no input signal is present. The 20-pin SSOP package provides 5.5mm of creepage and clearance with group II CTI rating. These devices continually digitize the input voltage on the field-side of an isolation barrier and transmit the data across the isolation barrier to the logic-side of the device where the magnitude of the input voltage is compared to programmable thresholds. The binary comparator output pin is high when the input voltage is above the upper threshold and low when it is below the lower threshold. Response time of the comparator to an input change is less than 150s with filtering disabled. With filtering enabled, the comparator uses the moving average of the last 2, 4, or 8 ADC readings. Both filtered and unfiltered ADC readings are available through the 5MHz SPI port, which is also used to set comparator thresholds and other device configuration. The MAX14001/MAX14002 control the current of a binary input through an external, high-voltage FET. This current cleans relay contacts and attenuates input noise. An inrush comparator monitoring the ADC readings triggers the inrush current, or wetting pulse. The inrush trigger threshold, current magnitude, and current duration are all programmable in the MAX14001 but are fixed in the MAX14002. When the high-voltage FET is not providing inrush current, it switches to bias mode. Bias mode places a small current load on the binary input to attenuate capacitively coupled noise. The level of bias current is programmable between 50A and 3.75mA in both the MAX14001 and MAX14002. This allows optimization of the tradeoff between noise attenuation and power dissipation.

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II. Manufacturing Information

A. Description/Function:	Configurable, Isolated 10-bit ADCs for Multi-Range Binary Inputs
B. Process:	S18
C. Fabrication Location:	USA
D. Assembly Location:	Thailand, Malaysia
E. Date of Initial Production:	June 24, 2016

III. Packaging Information

A. Package Type:	20-pin SSOP
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:	#05-100137
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°C/W
M. Multi Layer Theta Jc:	32°C/W

IV. Die Information

A. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
B. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
C. Backside Metallization:	None
D. Minimum Metal Width:	0.23 microns (as drawn)
E. Minimum Metal Spacing:	0.23 microns (as drawn)
F. Isolation Dielectric:	SiO_2
G. Die Separation Method:	Wafer Saw

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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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{1000 \times 4340 \times 80 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 2.64 \times 10^{-9}$

λ = 2.64 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 0.5@ 25C and 0.93@ 55C (0.8 eV, 60% UCL)

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

The RV16-0 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.

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Table 1

Reliability Evaluation Test Results

MAX14001AAP+T / MAX14002AAP+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135C Biased Time = 1000 hrs.	DC Parameters & functionality	80	0	

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

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