RELIABILITY REPORT

FOR

MAX9611AUB+T

PLASTIC ENCAPSULATED DEVICES

October 26, 2014

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
Eric Wright
Quality Assurance
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Conclusion

The MAX9611AUB+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 MAX9611/MAX9612 are high-side current-sense amplifiers with an integrated 12-bit ADC and a gain block that can be configured either as an op amp or comparator, making these devices ideal for a number of industrial and automotive applications. The high-side, current-sense amplifiers operate over a wide 0V to 60V input common-mode voltage range. The programmable full-scale voltage (440mV, 110mV, and 55mV) of these amplifiers offers wide dynamic range, accurate current measurement, and application flexibility in choosing sense resistor values. A choice of either an internal op amp or a comparator is provided to the user. The internal amplifier can be used to limit the inrush current or to create a current source in a closed-loop system. The comparator can be used to monitor fault events for fast response. An I2C-controlled 12-bit, 500sps analog-to-digital converter (ADC) can be used to read the voltage across the sense resistor (VSENSE), the input common-mode voltage (VRSCM), op-amp/comparator output (VOUT), op-amp/comparator reference voltage (VSET), and internal die temperature. The I2C bus is compatible with 1.8V and 3.3V logic, allowing modern microcontrollers to interface to it. The MAX9611 features a non-inverting input-to-output configuration while the MAX9612 features an inverting input-to-output configuration. The MAX9611/MAX9612 operate with a 2.7V to 5.5V supply voltage range, are fully specified over the -40°C to +125°C automotive temperature range, and are available in a 3mm x 5mm, 10-pin µMAX® package.

II. Manufacturing Information

A. Description/Function:	High-Side, Current-Sense Amplifiers with 12-Bit ADC and Op Amp/Comparator
B. Process:	S45
C. Number of Device Transistors:	20445
D. Fabrication Location:	USA
E. Assembly Location:	USA, Philippines, Thailand, Malaysia
F. Date of Initial Production:	September 24, 2010

III. Packaging Information

A. Package Type:	10-pin uMAX
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:	#05-9000-3611
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:	180°C/W
K. Single Layer Theta Jc:	42°C/W
L. Multi Layer Theta Ja:	113.1°C/W
M. Multi Layer Theta Jc:	42°C/W

IV. Die Information

A. Dimensions:	62 X 69 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

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 (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 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 OY36 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.

With the following exceptions:
OUT pin passes +100mA/-20mA per JEDEC JESD78
RS(+) pin passes +100mA/-60mA per JEDEC JESD78
RS(-) pin passes +100mA/-5mA per JEDEC JESD78

Table 1

Reliability Evaluation Test Results

MAX9611AUB+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
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.