

RELIABILITY REPORT
FOR
MAX9928TAUA+
(MAX9928/MAX9929)
PLASTIC ENCAPSULATED DEVICES

March 5, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
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Approved by
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Quality Assurance
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Conclusion

The MAX9928TAUA+ 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.

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I. Device Description

A. General

The MAX9928/MAX9929 low-cost, uni-/bidirectional, high-side, current-sense amplifiers are ideal for monitoring battery charge and discharge currents in notebooks, cell phones, and other portable equipment. These devices feature a wide -0.1V to +28V input common-mode voltage range, low 20 μ A supply current with VOS less than 0.4mV, and a gain accuracy better than 1.0%. The input common-mode range is independent of the supply voltage, ensuring that the current-sense information remains accurate even when the measurement rail is shorted to ground. The MAX9928F/MAX9928T feature a current output with transconductance ratios of 5 μ A/mV and 2 μ A/mV, respectively. An external resistor converts the output current to a voltage, allowing adjustable gain so that the input sense voltage can be matched to the maximum ADC input swing. The MAX9929F/MAX9929T have a voltage output and integrate a 10k Ω output resistor for fixed voltage gains of 50V/V and 20V/V, respectively. A digital SIGN output indicates direction of current flow, so the user can utilize the full ADC input range for measuring both charging and discharging currents. The MAX9928/MAX9929 are fully specified over the -40°C to +125°C automotive temperature range, and available in 6-bump UCSP(tm) (1mm x 1.5mm) and 8-pin μ MAX® packages. The UCSP package is bump-to-bump compatible with the MAX4372_EBT.

II. Manufacturing Information

A. Description/Function:	-0.1V to +28V Input Range, Micropower, Uni-/Bidirectional, Current-Sense Amplifiers
B. Process:	B12
C. Number of Device Transistors:	293
D. Fabrication Location:	Oregon
E. Assembly Location:	Unisem
F. Date of Initial Production:	July 26, 2008

III. Packaging Information

A. Package Type:	8-pin uMAX
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
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:	221°C/W
K. Single Layer Theta Jc:	41.9°C/W
L. Multi Layer Theta Ja:	206.3°C/W
M. Multi Layer Theta Jc:	41.9°C/W

IV. Die Information

A. Dimensions:	62 X 42 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

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|-----------------------------------|---|
| A. Quality Assurance Contacts: | Ken Wendel (Director, Reliability Engineering)
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 pending. Using these results, the Failure Rate (λ) is calculated as follows:

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

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

$$\lambda = 22.4 \times 10^{-9}$$

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the B12 Process results in a FIT Rate of 3.13 @ 25C and 54.16 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The OY28 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX9928TAUA+

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
Moisture Testing (Note 2) 85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
Mechanical Stress (Note 2) Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

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

Note 2: Generic Package/Process data