

RELIABILITY REPORT
FOR
MAX9017AEKA
PLASTIC ENCAPSULATED DEVICES

September 22, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

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Conclusion

The MAX9017A 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 dual MAX9017A nanopower comparator in a space-saving SOT23 packages features Beyond-the-Rails™ inputs and is guaranteed to operate down to 1.8V. The A-grade packages feature an on-board 1.236V $\pm 1\%$ reference while the B-grade packages feature a 1.24V $\pm 1.75\%$ reference. An ultra-low supply current of 1.2 μ A MAX9017A makes the MAX9017A comparator ideal for all 2-cell battery monitoring/management applications.

The unique design of the MAX9017A output stage limits supply-current surges while switching, which virtually eliminates the supply glitches typical of many other comparators. This design also minimizes overall power consumption under dynamic conditions. The MAX9017A has a push-pull output stage that sinks and sources current. Large internal output drivers allow Rail-to-Rail® output swing with loads up to 6mA. The device is available in the ultra-small 8-pin SOT23 package.

B. Absolute Maximum Ratings

| <u>Item</u> | <u>Rating</u> |
|---|------------------------------|
| Supply Voltage (VCC to VEE) | 6V |
| IN+, IN-, INA+, INB+, INA-, INB-, REF/INA-, REF | (VEE - 0.3V) to (VCC + 0.3V) |
| Output Voltage (OUT_) | (VEE - 0.3V) to (VCC + 0.3V) |
| Output Current (REF, OUT_, REF/INA-) | ± 50 mA |
| Output Short-Circuit Duration (REF, OUT_, REF/INA-) | 10s |
| Operating Temperature Range | -40°C to +85°C |
| Storage Temperature Range | -65°C to +150°C |
| Junction Temperature | +150°C |
| Lead Temperature (soldering, 10s) | +300°C |
| Continuous Power Dissipation (TA = +70°C) | |
| 8-Pin SOT23 | 727mW |
| Derates above +70°C | |
| 8-Pin SOT23 | 9.1mW/°C |

II. Manufacturing Information

- A. Description/Function: SOT23, Dual, Precision, 1.8V, Nanopower Comparators With Reference
- B. Process: B8 (Standard 0.8 micron silicon gate CMOS)
- C. Number of Device Transistors: 349
- D. Fabrication Location: California, USA
- E. Assembly Location: Malaysia or Thailand
- F. Date of Initial Production: July, 2003

III. Packaging Information

- A. Package Type: **8-Pin SOT23**
- B. Lead Frame: Copper
- C. Lead Finish: Solder Plate
- D. Die Attach: Non-Conductive Epoxy
- E. Bondwire: Gold (1.0 mil dia.)
- F. Mold Material: Epoxy with silica filler
- G. Assembly Diagram: # 05-9000-0428
- H. Flammability Rating: Class UL94-V0
- I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112: Level 1

IV. Die Information

- A. Dimensions: 24 x 80 mils
- B. Passivation: $\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
- C. Interconnect: Aluminum/Si (Si = 1%)
- D. Backside Metallization: None
- E. Minimum Metal Width: 0.8 microns (as drawn)
- F. Minimum Metal Spacing: 0.8 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: Jim Pedicord (Manager, Reliability Operations)
Bryan Preeshl (Executive Director)
Kenneth Huening (Vice President)
- 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
B.

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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

\triangle Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 22.62 \times 10^{-9}$$

$$\lambda = 22.62 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-6200) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

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

The CM90 die type has been found to have all pins able to withstand a transient pulse of $\pm 2000\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 250\text{mA}$.

Table 1
Reliability Evaluation Test Results

MAX9017AEKA

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | PACKAGE | 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) | | | | | |
| Pressure Pot | Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs. | DC Parameters & functionality | SOT23 | 77 | 0 |
| 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

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

| | Terminal A (Each pin individually connected to terminal A with the other floating) | Terminal B (The common combination of all like-named pins connected to terminal B) |
|----|---|---|
| 1. | All pins except V_{PS1} <u>3/</u> | All V_{PS1} pins |
| 2. | All input and output pins | All other input-output pins |

1/ Table II is restated in narrative form in 3.4 below.

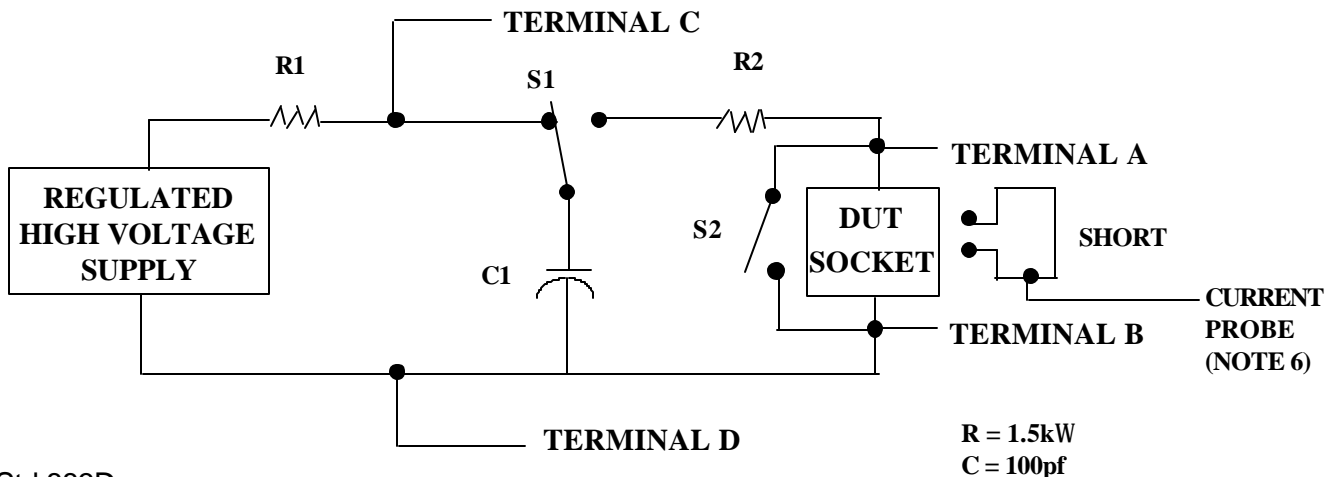
2/ No connects are not to be tested.

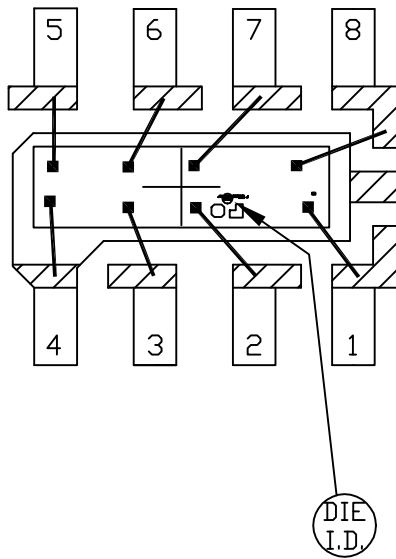
3/ Repeat pin combination I for each named Power supply and for ground

(e.g., where V_{PS1} is V_{DD} , V_{CC} , V_{SS} , V_{BB} , GND, $+V_S$, $-V_S$, V_{REF} , etc).

3.4 Pin combinations to be tested.

- a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.
- b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1} , or V_{SS2} or V_{SS3} or V_{CC1} , or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.
- c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.





NOTE: CAVITY DOWN

 BONDABLE AREA

| | | | | | |
|-------------------------|----------------|------------|------|---|-----------|
| PKG. CODE: K8-5 | | SIGNATURES | DATE |  CONFIDENTIAL & PROPRIETARY | |
| CAV./PAD SIZE: 88x28 | PKG. DESIGN | | | BOND DIAGRAM #: 05-9000-0428 | REV: A |

