

RELIABILITY REPORT  
FOR  
**MAX6641AUBxx**  
PLASTIC ENCAPSULATED DEVICES

February 14, 2006

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

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## Conclusion

The MAX6641 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 MAX6641 temperature sensor and fan controller accurately measures the temperature of its own die and the temperature of a remote pn junction. The device reports temperature values in digital form using a 2-wire serial interface. The remote pn junction is typically the emitter-base junction of a common-collector pnp on a CPU, FPGA, or ASIC.

The 2-wire serial interface accepts standard System Management Bus (SMBus)™ write byte, read byte, send byte, and receive byte commands to read the temperature data and program the alarm thresholds. The temperature data controls a PWM output signal to adjust the speed of a cooling fan, thereby minimizing noise when the system is running cool, but providing maximum cooling when power dissipation increases. The device also features an over-temperature alarm output to generate interrupts, throttle signals, or shut down signals. The MAX6641 operates from supply voltages in the 3.0V to 5.5V range and typically consumes 500µA of supply current.

The MAX6641 is available in a slim 10-pin µMAX® package and is available over the automotive temperature range (-40°C to +125°C).

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
VCC, OT, SMBDATA, SMBCLK, PWMOUT	-0.3V to +6V
DXP	-0.3V to (VCC + 0.3V)
DXN	-0.3V to +0.8V
ESD Protection (all pins, Human Body Model)	±2000V
Continuous Power Dissipation (TA = +70°C)	
10-Pin µMAX (derate 5.6mW/°C above +70°C)	444mW
Operating Temperature Range	-40°C to +125°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

## II. Manufacturing Information

- A. Description/Function: SMBus-Compatible Temperature Monitor with Automatic PWM Fan-Speed Controller
- B. Process: B8 (Standard 0.8 micron silicon gate CMOS)
- C. Number of Device Transistors: 18,769
- D. Fabrication Location: California, USA
- E. Assembly Location: Thailand, Malaysia or Philippines
- F. Date of Initial Production: April, 2004

## III. Packaging Information

- A. Package Type: **10-Pin uMAX**
- B. Lead Frame: Copper
- C. Lead Finish: Solder Plate or 100% Matte Tin
- D. Die Attach: Silver-Filled Epoxy
- E. Bondwire: Gold (1 mil dia.)
- F. Mold Material: Epoxy with silica filler
- G. Assembly Diagram: # 05-9000-1021
- H. Flammability Rating: Class UL94-V0
- I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C: Level 1

## IV. Die Information

- A. Dimensions: 62 x 87 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:  $\text{SiO}_2$
- I. Die Separation Method: Wafer Saw

## V. Quality Assurance Information


- A. Quality Assurance Contacts: Jim Pedicord (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 135°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 47 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

 Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 23.39 \times 10^{-9}$$
$$\lambda = 23.39 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. Attached Burn-In Schematic (Spec. # 06-6324) shows the static Burn-In circuit. Maxim performs failure analysis on any lot that exceeds this reliability control level. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (**RR-1N**). Current monitor data for the S8/B8 Process results in a FIT Rate of 0.27 @ 25C and 4.64 @ 55C (0.8 eV, 60% UCL)

### 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 TS60 die type has been found to have all pins able to withstand a transient pulse of  $\pm 2500\text{V}$ , 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

**MAX6641AUBxx**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		47	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	uMAX	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
<b>Mechanical Stress</b> (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.

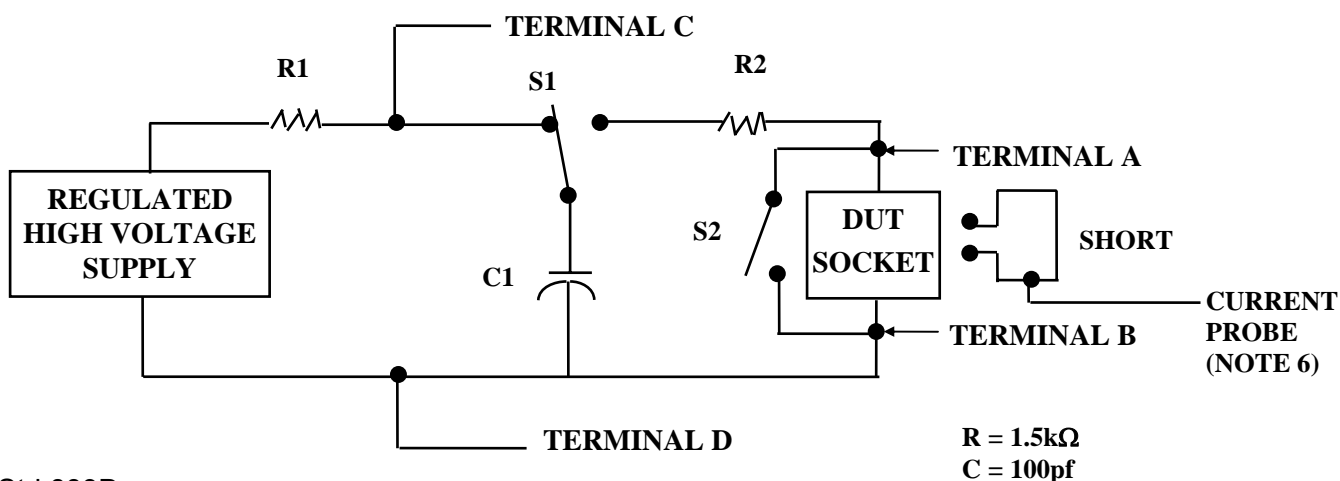
2/ No connects are not to be tested.

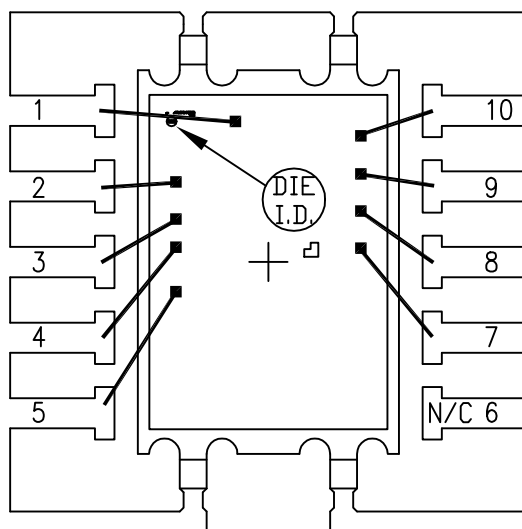
3/ Repeat pin combination I for each named Power supply and for ground

(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.

- 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.
- 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.
- 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.





PKG. CODE: U10-2		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 68x94	PKG. DESIGN			BOND DIAGRAM #: 05-9000-1021	REV: A

