

RELIABILITY REPORT  
FOR  
**MAX6605MXK**  
PLASTIC ENCAPSULATED DEVICES

June 4, 2002

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Reviewed by



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## Conclusion

The MAX6605 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 MAX6605 precision, low-power, analog output temperature sensor is available in a 5-pin SC70 package. The device has a +2.7V to +5.5V supply voltage range and 10 $\mu$ A supply current over the -55°C to +125°C temperature range. For the -40°C to +105°C temperature range, the supply voltage can go as low as +2.4V. Accuracy is  $\pm 1^\circ\text{C}$  at  $T_A = +25^\circ\text{C}$  and  $\pm 3^\circ\text{C}$  from 0°C to +70°C.

The MAX6605 output voltage is dependent on its die temperature and has a slope of 11.9mV/°C and an offset of 744mV at 0°C. The output typically shows only +0.4°C of nonlinearity over the -20°C to +85°C temperature range.

#### B. Absolute Maximum Ratings

| <u>Item</u>                          | <u>Rating</u>       |
|--------------------------------------|---------------------|
| VCC to GND                           | -0.3V to +6V        |
| OUT,A,B to GND                       | -0.3V to (VCC+0.3V) |
| Current into Any Pin                 | 10mA                |
| Output Short-Circuit Duration        | Continuous          |
| VCC Rise or Fall rate                | 0.05V/ $\mu$ S      |
| Maximum Current (Input/Output)       | 20mA                |
| Operating Temperature Range          | -55°C to +125°C     |
| Storage Temp.                        | -65°C to +150°C     |
| Lead Temp. (10 sec.)                 | +300°C              |
| Continuous Power Dissipation (+70°C) |                     |
| 5-Pin SC70                           | 245mW               |
| Derates above +70°C                  |                     |
| 5-Pin SC70                           | 3.1mW/°C            |

## II. Manufacturing Information

|                                  |                                     |
|----------------------------------|-------------------------------------|
| A. Description/Function:         | Low-Power Analog Temperature Sensor |
| B. Process:                      | S8                                  |
| C. Number of Device Transistors: | 573                                 |
| D. Fabrication Location:         | California, USA                     |
| E. Assembly Location:            | Malaysia or Philippines             |
| F. Date of Initial Production:   | November, 2000                      |

## III. Packaging Information

|   |                           |
|---|---------------------------|
| A. Package Type:  | <b>5-Lead SC70</b>        |
| B. Lead Frame:  | Alloy 42                  |
| C. Lead Finish:   | Solder Plate              |
| D. Die Attach:  | Silver-Filled Epoxy       |
| E. Bondwire:  | Gold (1 mil dia.)         |
| F. Mold Material:   | Epoxy with silica filler  |
| G. Assembly Diagram:  | Buildsheet # 05-2901-0003 |
| H. Flammability Rating:   | Class UL94-V0             |
| I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: | Level 1                   |

## IV. Die Information

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 31 x 30 mils  |
| B. Passivation:            | Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide) |
| C. Interconnect:           | Aluminum/Copper/Si  |
| D. Backside Metallization: | None  |
| E. Minimum Metal Width:    | .8 microns (as drawn)   |
| F. Minimum Metal Spacing:  | .8 microns (as drawn)   |
| G. Bondpad Dimensions:     | 5 mil. Sq.  |
| H. Isolation Dielectric:   | SiO <sub>2</sub>  |
| I. Die Separation Method:  | Wafer Saw   |

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)  
Bryan Preeshl (Executive Director of QA)  
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

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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

↓  
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 13.57 \times 10^{-9} \quad \lambda = 13.57 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure reliability of its processes. The reliability required for lots which receive a burn-in qualification 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 rejects from lots exceeding this level. The attached Burn-In Schematic (Spec. # 06-5603) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1M**).

### B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

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

The TS07 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

**MAX6605MXK**

| <b>TEST ITEM</b>                  | <b>TEST CONDITION</b>                                   | <b>FAILURE IDENTIFICATION</b>    | <b>SAMPLE SIZE</b> | <b>NUMBER OF FAILURES</b> |
|-----------------------------------|---|----------------------------------|--------------------|---------------------------|
| <b>Static Life Test</b> (Note 1)  |   |                                  |                    |                           |
|                                   | Ta = 135°C<br>Biased<br>Time = 192 hrs.                 | DC Parameters<br>& functionality | 80                 | 0                         |
| <b>Moisture Testing</b> (Note 2)  |   |                                  |                    |                           |
| Pressure Pot                      | Ta = 121°C<br>P = 15 psi.<br>RH= 100%<br>Time = 168hrs. | DC Parameters<br>& functionality | 100                | 0                         |
| 85/85                             | Ta = 85°C<br>RH = 85%<br>Biased<br>Time = 1000hrs.      | DC Parameters<br>& functionality | 77                 | 0                         |
| <b>Mechanical Stress</b> (Note 2) |   |                                  |                    |                           |
| Temperature<br>Cycle              | -65°C/150°C<br>1000 Cycles<br>Method 1010               | DC Parameters                    | 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<br>(Each pin individually connected to terminal A with the other floating) | Terminal B<br>(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.

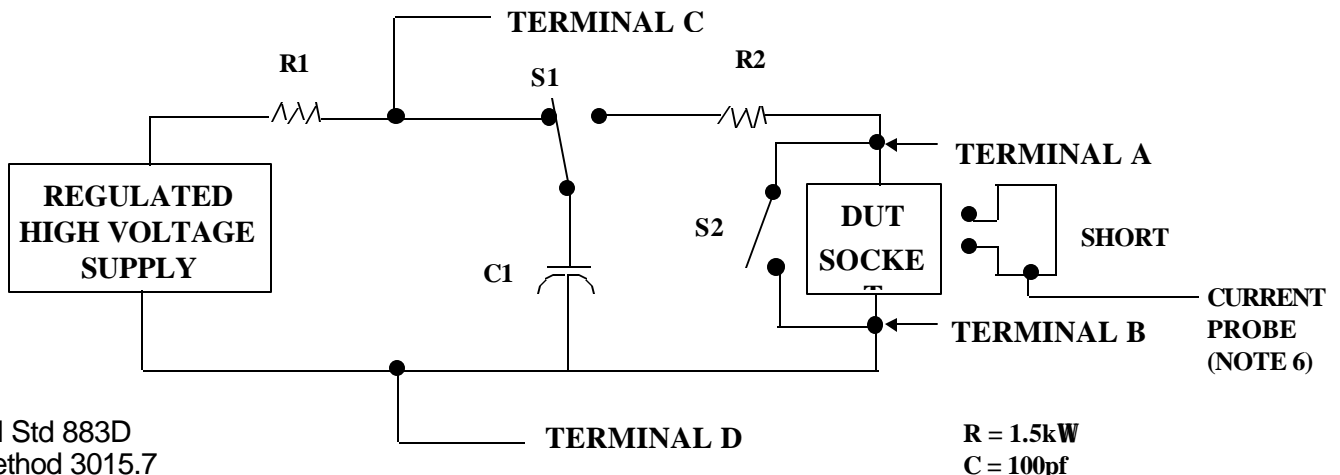
2/ No connects are not to be tested.

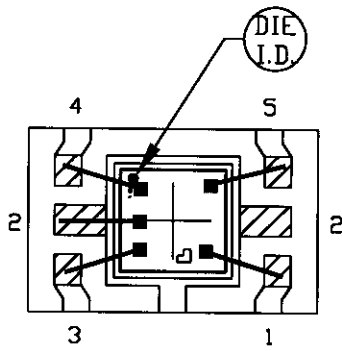
3/ Repeat pin combination I for each named Power supply and for ground

(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.





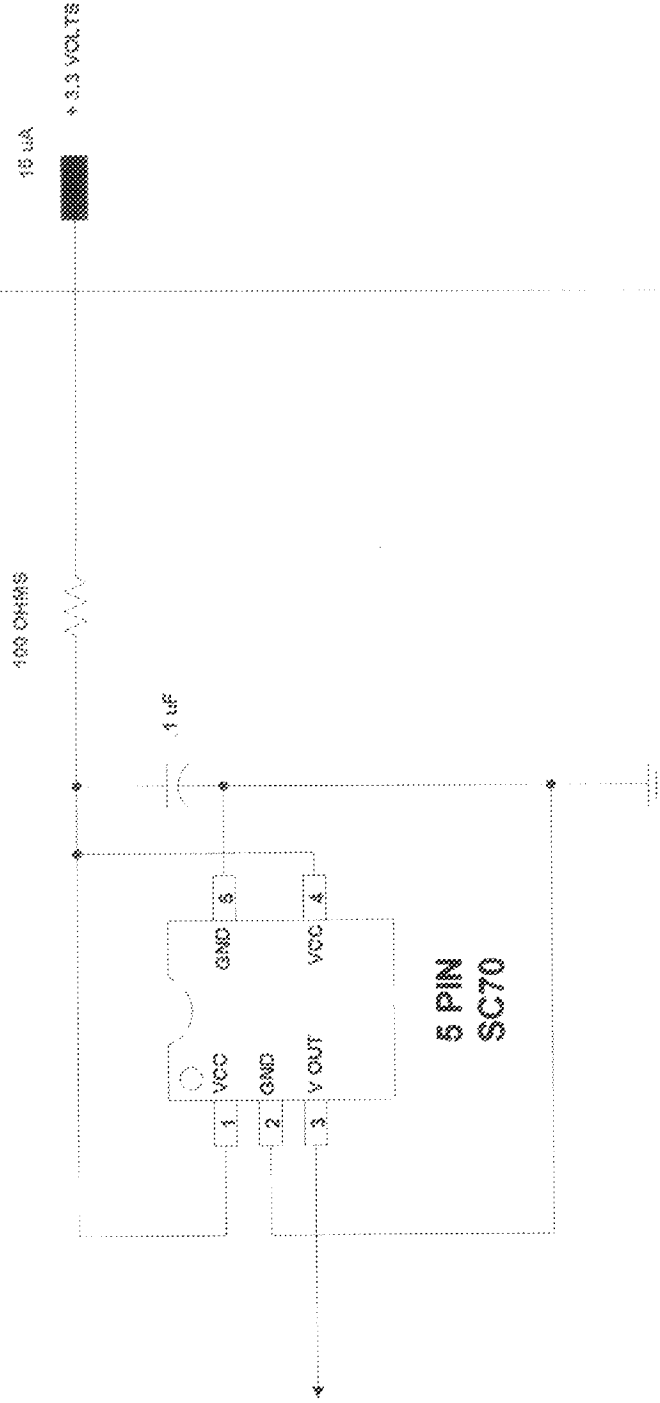
▨ BONDABLE AREA

NOTE: CAVITY DOWN

|                         |                |            |      |  |           |
|-------------------------|----------------|------------|------|--|-----------|
| PKG. CODE:<br>X5-1      |                | SIGNATURES | DATE | <b>MAXIM</b><br>CONFIDENTIAL & PROPRIETARY |           |
| CAV./PAD SIZE:<br>35x34 | PKG.<br>DESIGN |            |      | BOND DIAGRAM #:<br>05-2901-0003            | REV:<br>A |

ONCE PER SOCKET

ONCE PER BOARD



MAXIM BURN-IN SCHEMATIC  
SPEC 06-5603 REV. A  
DATE: 3 / 24 / 2000

DEVICES: MAX 6605

DRAWN BY: CHRIS JAMBARO  
NOTES: All components to  
withstand 150 deegrees operation.