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RELIABILITY REPORT

FOR

MAX6656MEE

PLASTIC ENCAPSULATED DEVICES

February 3, 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX6656 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.

Table of Contents

I. ....Device Description
II. ....Manufacturing Information
III. ....Packaging Information
IV. ....Die Information
V. ....Quality Assurance Information
VI. ....Reliability Evaluation
......Attachments

I. Device Description

A. General

The MAX6656 is a precise voltage and temperature monitor. The digital thermometer reports the temperature of two remote sensors and its own die temperature. The remote sensors are diode-connected transistors—typically a low-cost, easily mounted 2N3906 PNP type—that replace conventional thermistors or thermocouples. Remote accuracy is ±1°C for multiple transistor manufacturers with no calibration necessary. The remote channels can also measure the die temperature of other ICs, such as microprocessors, that contain a substrate-connected PNP with its collector grounded and its base and emitter available for temperature-sensing purposes. The temperature is digitized with 11-bit resolution.

The MAX6656 also measure it's own supply voltage and three external voltages with 8-bit resolution. Each voltage input's sensitivity is set to give approximately 3/4-scale output code when the input voltage is at its nominal value. The MAX6656 operates on a +3.3V supply and its second voltage monitor is 5V.

The 2-wire serial interface accepts standard SMBus™ Write Byte, Read Byte, Send Byte, and Receive Byte commands to program the alarm thresholds and to read data. The MAX6656 also provide SMBus alert response and timeout functions. The MAX6656 measures automatically and autonomously, with the conversion rate programmable. The adjustable rate allows the user to control the supply current.

In addition to the SMBus ALERT -bar output, the MAX6656 features an OVERT -bar output, which is used as a temperature reset that remains active only while the temperature is above the maximum temperature limit. The OVERT-bar output is optimal for fan control or for system shutdown.

B. Absolute Maximum Ratings

Item	Rating
VCC to GND	-0.3V to +6V
DXN_ to GND	-0.3V to +0.8V
SMBCLK, SMBDATA, ALERT, STBY, OVERT to GND	-0.3V to +6V
VIN1 to GND	-0.3V to +16V
VIN2 to GND	-0.3V to +6V
VIN3 to GND	-0.3V to +6V
All Other Pins to GND	-0.3V to (VCC + 0.3V)
SMBDATA, ALERT, OVERT Current	-1mA to +50mA
DXN_ Current	±1mA
Operating Temperature Range	-55°C to +125°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (+70°C)	
16-Pin QSOP	667mW
Derates above +70°C	
16-Pin QSOP	8.3mW/°C

II. Manufacturing Information

A. Description/Function: Dual Remote/Local Temperature Sensors and Four-Channel Voltage Monitors

B. Process: B8 (Standard 0.8 micron silicon gate CMOS)

C. Number of Device Transistors: 26,783

D. Fabrication Location: California, USA

E. Assembly Location: Thailand or Philippines

F. Date of Initial Production: July, 2001

III. Packaging Information

A. Package Type: **16-Lead QSOP**

B. Lead Frame: Copper

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 # 05-2901-0011

H. Flammability Rating: Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1

IV. Die Information

A. Dimensions: 86 x 144 mils

B. Passivation: Si_3N_4/SiO_2 (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_2

I. Die Separation Method: Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts: Jim Pedicord (Manager, Reliability Operations)
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 (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 239 \times 2}$$ (Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 4.54 \times 10^{-9}$ λ = 4.54 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. # 06-5744) 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 TS06-1 die type has been found to have all pins able to withstand a transient pulse of ±1500V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX6656MEE

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	239	0
Moisture Testing (Note 2)				
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	100	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	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} 3/	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

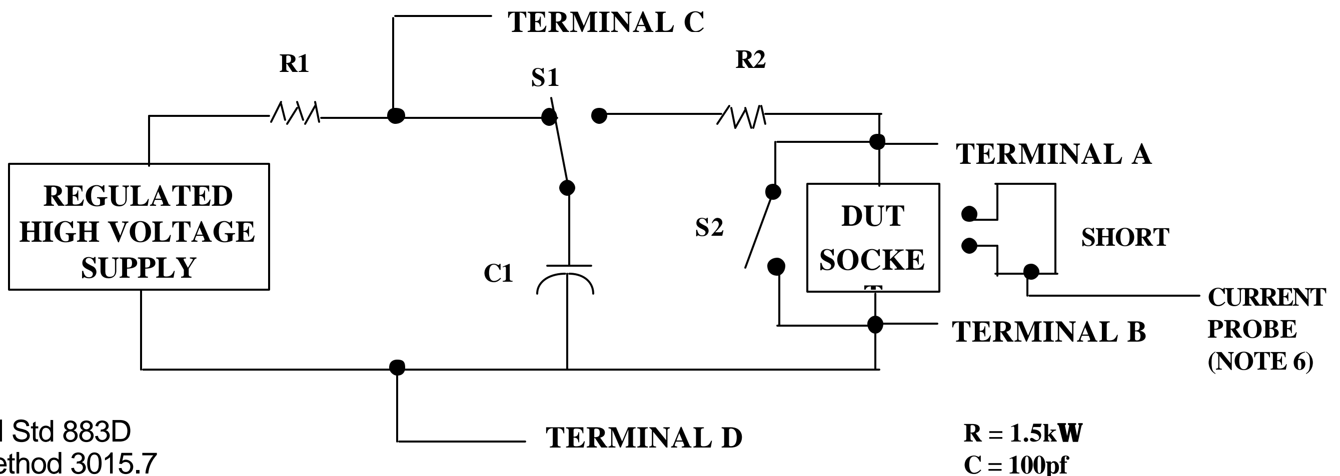
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

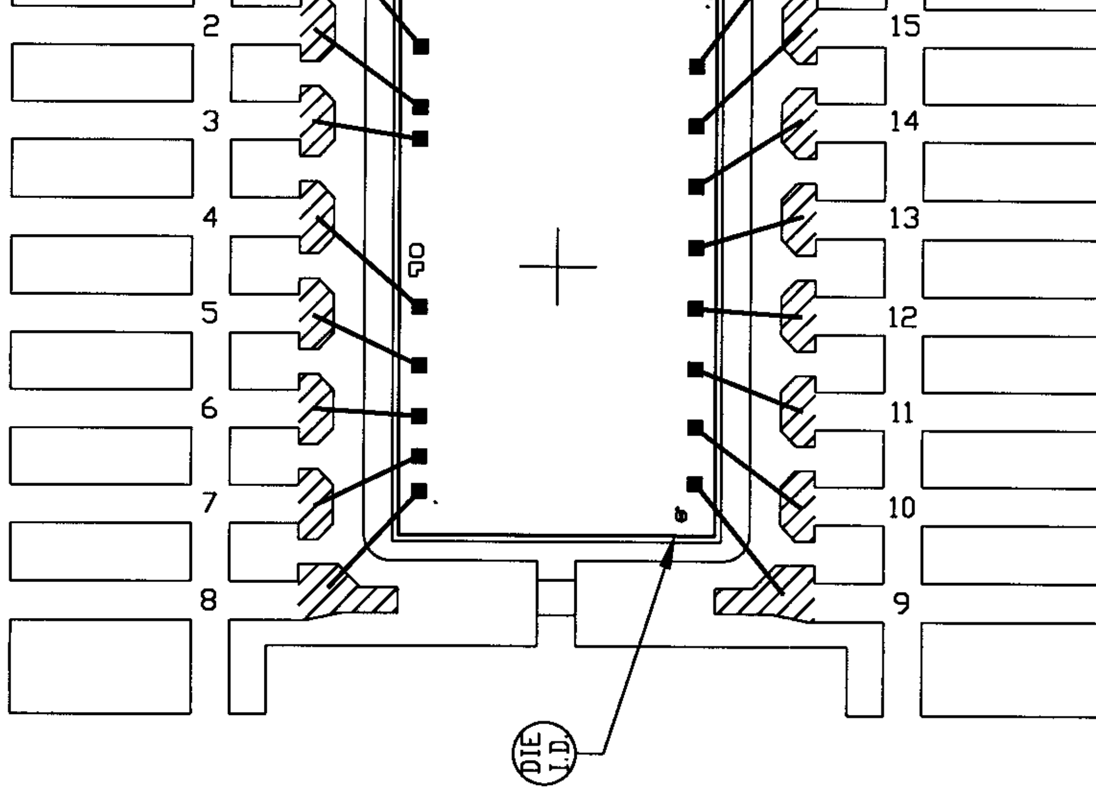
3.4 Pin combinations to be tested.

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.

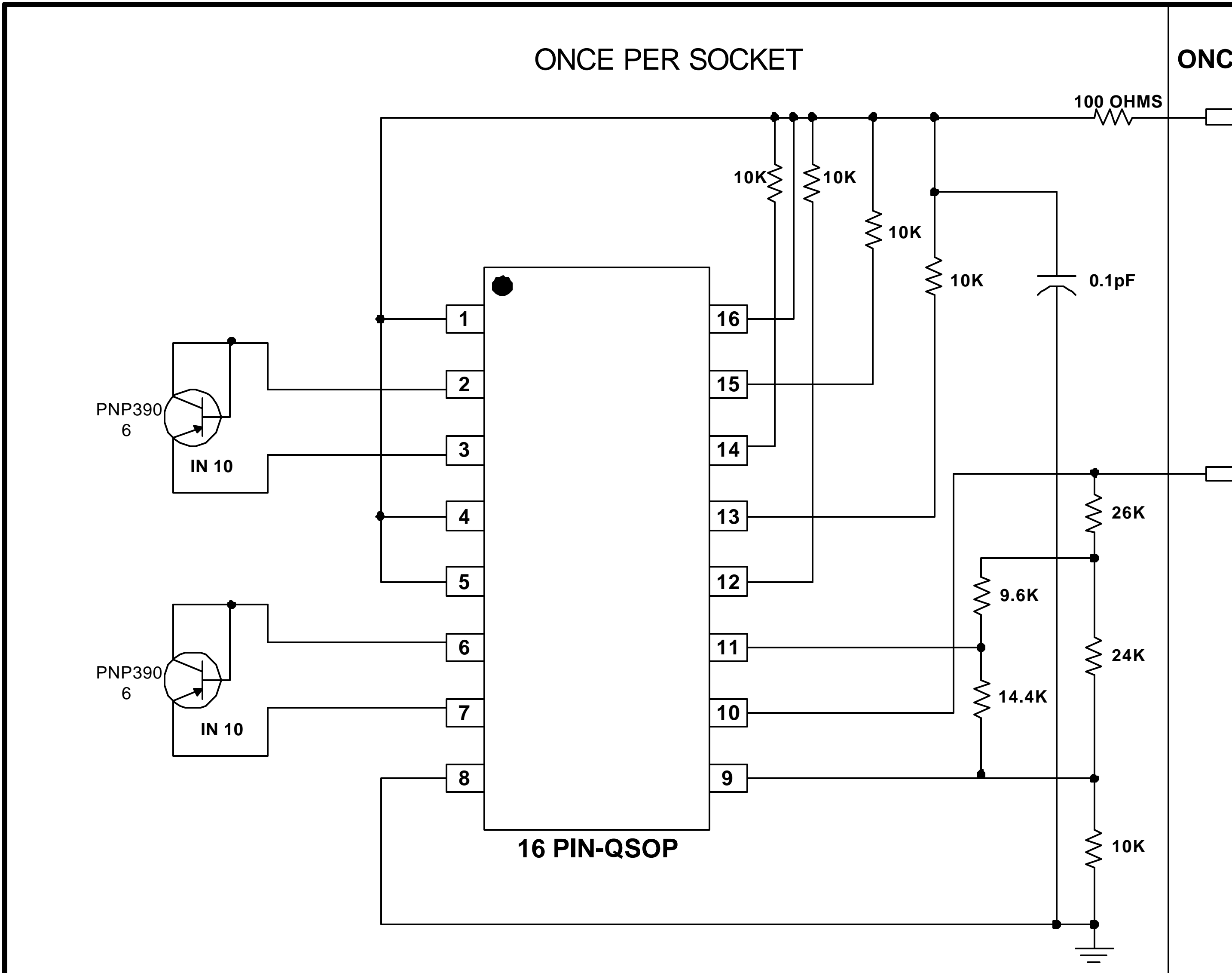
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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





PKG. CODE: E16-5		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 101×154	PKG.	[signature]	9/13/00	BOND DIAGRAM #: 05-2901-0011	REV: A
	DESIGN	[signature]	9/13/00		



DEVICES: MAX 6655/6656

MAX. EXPECTED CURRENT = 5mA

DRAWN BY: HAK TAN

NOTES:

DOCUMENT I.D. 06-5744	REVISION A	*MAXIM* TITLE: **BI Circuit (MAX6655/6656)**