

RELIABILITY REPORT
FOR
MAX1617MEE
PLASTIC ENCAPSULATED DEVICES

May 7th, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

A handwritten signature in black ink, appearing to read 'J Pedicord'.

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Reviewed by

A handwritten signature in black ink, appearing to read 'Bryan J. Preeshl'.

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Conclusion

The MAX1617 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 MAX1617 (patents pending) is a precise digital thermometer that reports the temperature of both a remote sensor and its own package. The remote sensor is a diode-connected transistor—typically a low-cost, easily mounted 2N3904 NPN type—that replaces conventional thermistors or thermocouples. Remote accuracy is $\pm 3^{\circ}\text{C}$ for multiple transistor manufacturers, with no calibration needed. The remote channel can also measure the die temperature of other ICs, such as microprocessors, that contain an on-chip, diode-connected transistor.

The 2-wire serial interface accepts standard System Management Bus (SMBus™) Write Byte, Read Byte, Send Byte, and Receive Byte commands to program the alarm thresholds and to read temperature data. The data format is 7 bits plus sign, with each bit corresponding to 1°C , in two's complement format. Measurements can be done automatically and autonomously, with the conversion rate programmed by the user or programmed to operate in a single-shot mode. The adjustable rate allows the user to control the supply-current drain.

The MAX1617 is available in a small, 16-pin QSOP surface-mount package.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
VCC to GND	-0.3V to +6V
DXP, ADD_ to GND	-0.3V to (VCC + 0.3V)
DXN to GND	-0.3V to +0.8V
SMBCLK, SMBDATA, ALERT, STBY to GND	-0.3V to +6V
SMBDATA, ALERT Current	-1mA to +50mA
DXN Current	$\pm 1\text{mA}$
ESD Protection (SMBCLK, SMBDATA, ALERT, Human Body Model)	4000V
ESD Protection (other pins, Human Body Model)	2000V
Operating Temperature Range	-55°C to $+125^{\circ}\text{C}$
Junction Temperature	$+150^{\circ}\text{C}$
Storage Temperature Range	-65°C to $+165^{\circ}\text{C}$
Lead Temperature (soldering, 10sec)	$+300^{\circ}\text{C}$
Continuous Power Dissipation (TA = $+70^{\circ}\text{C}$)	
16-Pin QSOP	667mW
Derates above $+70^{\circ}\text{C}$	
16-Pin QSOP	8.3mW/ $^{\circ}\text{C}$

II. Manufacturing Information

A. Description/Function:	Remote/Local Temperature Sensor with SMBus Serial Interface
B. Process:	S12
C. Number of Device Transistors:	1083
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Malaysia, Philippines, Korea or Thailand
F. Date of Initial Production:	July, 1997

III. Packaging Information

A. Package Type:	16-Pin QSOP
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-Filled Epoxy
E. Bondwire:	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	# 05-2301-0004
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1

IV. Die Information

A. Dimensions:	86 x 116 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:	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

- A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)
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

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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{8.35}{192 \times 4389 \times 553 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

↑
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 1.96 \times 10^{-9}$$

$$\lambda = 1.96 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5267) 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-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 PY09 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

MAX1617MEE

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		553	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	QSOP	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} 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.

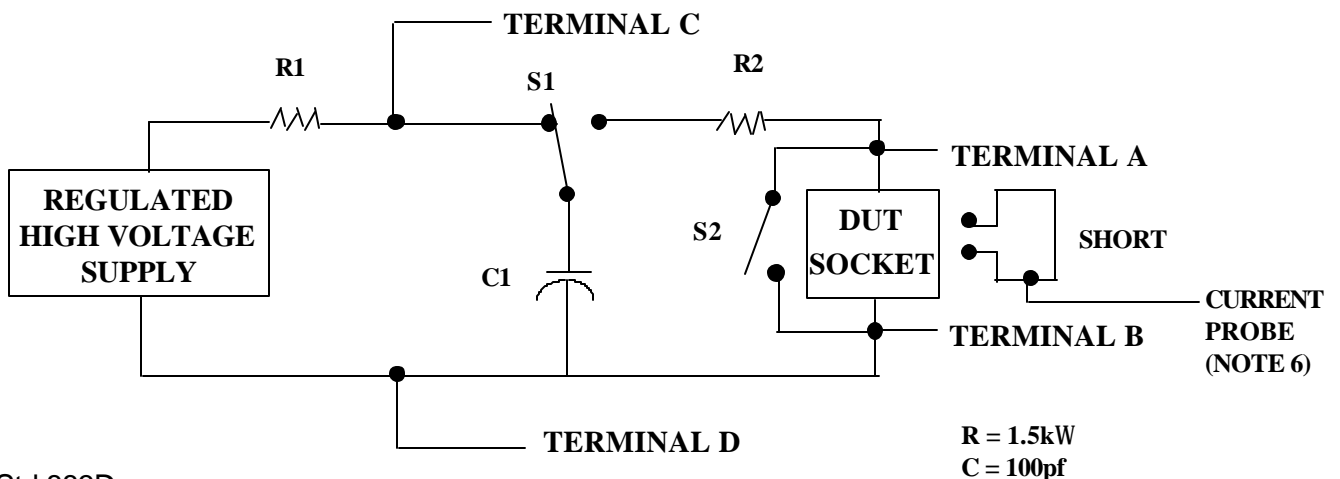
2/ No connects are not to be tested.

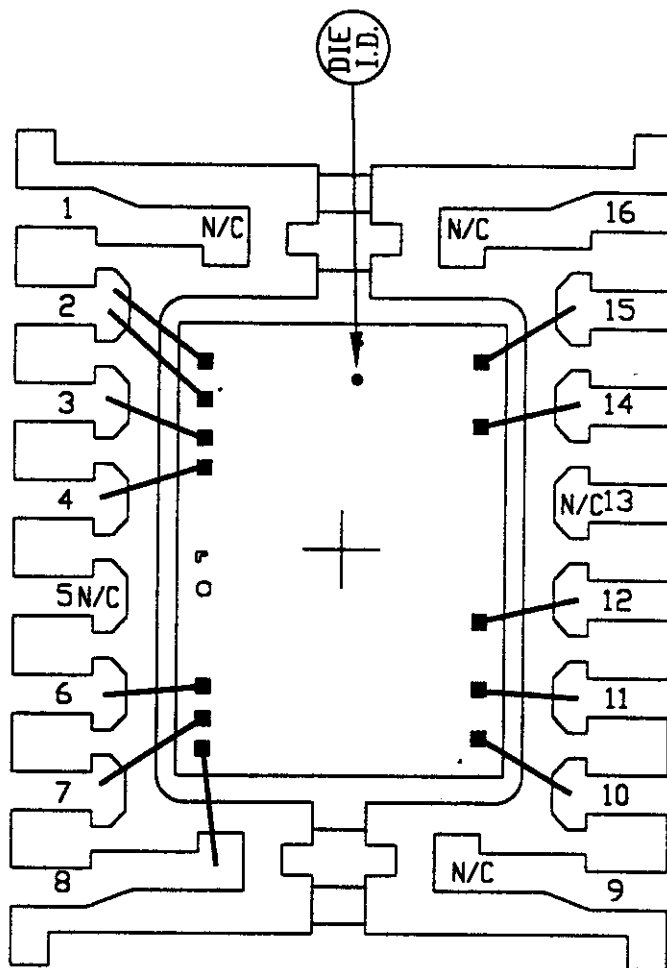
3/ Repeat pin combination I for each named Power supply and for ground

(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.

- 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.

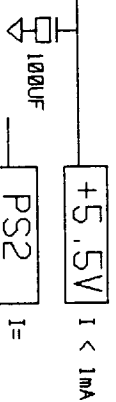
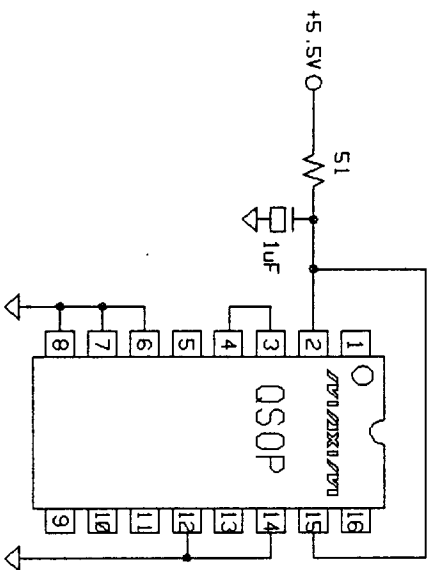




PKG.CODE: E16-1		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 96X130	PKG. DESIGN			BUILDSHEET NUMBER: 05-2301-0004	REV.: A

ONCE PER BOARD

ONCE PER DEVICE



PS2 I =

PS3 I =

PS4 I =

PS5 I =

PS6 I =

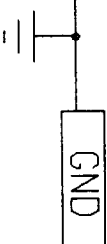
CLK0 FREQ= AMP=

CLK1 FREQ= AMP=

CLK2 FREQ= AMP=

CLK3 FREQ= AMP=

CLK4 FREQ= AMP=



—STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1005.
—BURN-IN IS PER MIL-STD-883 METHOD 1015. COND. B

NOTES:

1. TEMPERATURE : 125C OR EQUIVALENT
2. TIME : 160 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR [X] COMMERCIAL [X] HR/883

SPEC. NO. 06-5267 REV: D

MAXIM BURN-IN SCHEMATIC

DATE: 4/21/98

DEVICE TYPE(S):

DRAWN BY:

MAX1617/1618