

RELIABILITY REPORT  
FOR  
**MAX691xxE**  
PLASTIC ENCAPSULATED DEVICES

January 21, 2004

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Reviewed by



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Executive Director

## Conclusion

The MAX691 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 MAX691 supervisory circuit reduces the complexity and number of components required for power supply monitoring and battery control functions in microprocessor ( $\mu$ P) systems. These include  $\mu$ P reset and backup-battery switchover, watchdog timer, CMOS RAM write protection, and power-failure warning. The MAX691 significantly improves system reliability and accuracy compared to that obtainable with separate ICs or discrete components.

This part provides seven functions:

- 1) A Reset output during power-up, power-down, and brownout conditions.
- 2) Battery-backup switching for CMOS RAM, CMOS microprocessor, or other low-power logic.
- 3) A Reset pulse if the optional watchdog timer has not been toggled within a specified time.
- 4) A 1.3V threshold detector for power-fail warning or low battery detection, or to monitor a power supply other than +5V.
- 5) Write protection of CMOS RAM or EEPROM.
- 6) Adjustable reset and watchdog timeout periods.
- 7) Separate outputs for indicating a watchdog timeout, backup-battery switchover, and low  $V_{CC}$ .

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Terminal Voltage (with respect to GND)	
VCC	-0.3V to 6.0V
VBATT	-0.3V to 6.0V
All Other Inputs (Note 1)	-0.3V to (VOUT + 0.5V)
Input Current	
VCC	200mA
VBATT	50mA
GND	20mA
Output Current	
VOUT	Short-Circuit Protected
All Other Outputs	20mA
Rate-of-Rise, VCC, VBATT	100V/ $\mu$ s
Storage Temp.	-65°C to +160°C
Lead Temp. (10 sec.)	+300°C
Continuous Power Dissipation (TA =+70°C)	
16-Pin PDIP	842mW
16-Pin WSO	762mW
Derates above +70°C	
16-Pin PDIP	10.53mW/°C
16-Pin WSO	9.52mW/°C

**Note 1:** The input voltage limits on PFI and WDI may be exceeded provided the input current is limited to less than 10mA.

## II. Manufacturing Information

A. Description/Function:	Microprocessor Supervisory Circuit
B. Process:	M6 [(SMG) - 6 micron metal gate CMOS]
C. Number of Device Transistors:	540
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Philippines or Malaysia
F. Date of Initial Production:	September, 1991

## III. Packaging Information

A. Package Type:	16-Lead WSO	16-Lead PDIP
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.3 mil dia.)	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-0701-0427	# 05-0701-0251
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	Level 1

## IV. Die Information

A. Dimensions:	86 x 122 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	6 microns (as drawn)
F. Minimum Metal Spacing:	6 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 (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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 800 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Thermal acceleration factor assuming a 0.8eV activation energy

$$\lambda = 1.36 \times 10^{-9} \quad \lambda = 1.36 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 the 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 lots exceeding this level. The following Burn-In Schematic (Spec. # 06-4527) 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 PS77 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  $\pm 100\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX691xxE**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test (Note 1)</b>					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		800	0
<b>Moisture Testing (Note 2)</b>					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	PDIP	77	0
			WSO	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
<b>Mechanical Stress (Note 2)</b>					
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.

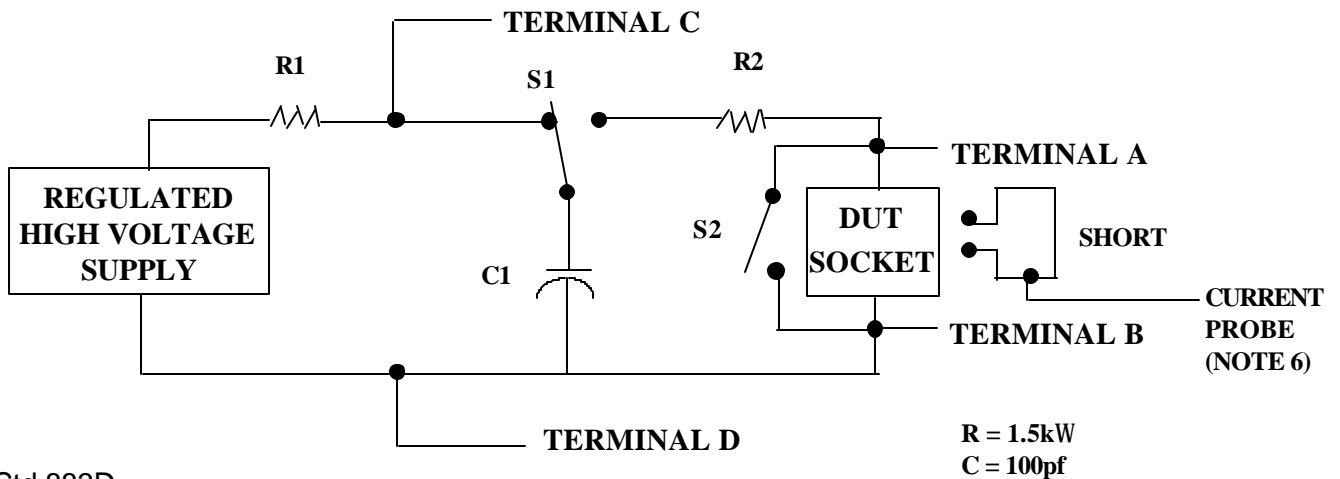
2/ No connects are not to be tested.

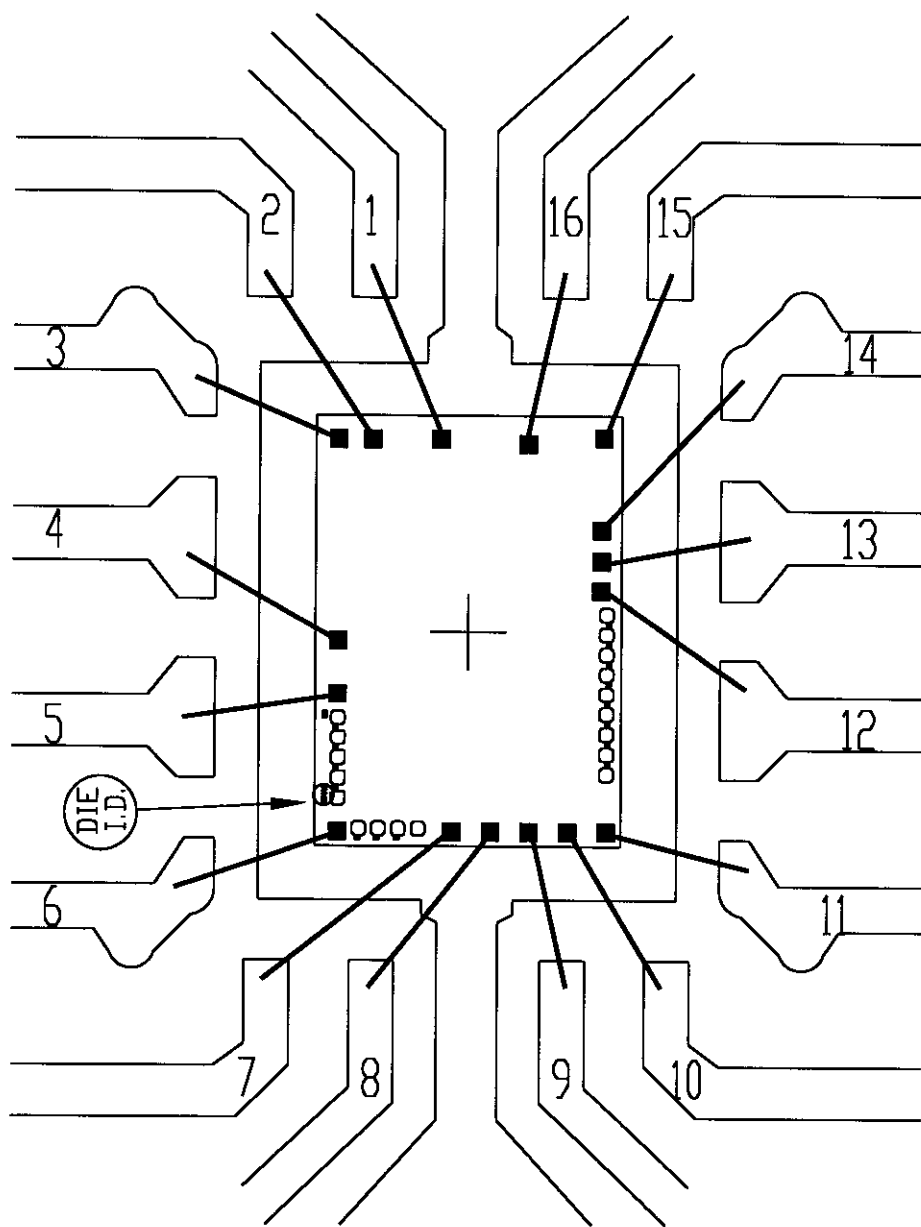
3/ Repeat pin combination I for each named Power supply and for ground

(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.





PKG.CODE: W16-1

CAV./PAD SIZE:  
110 X 140

PKG.  
DESIGN

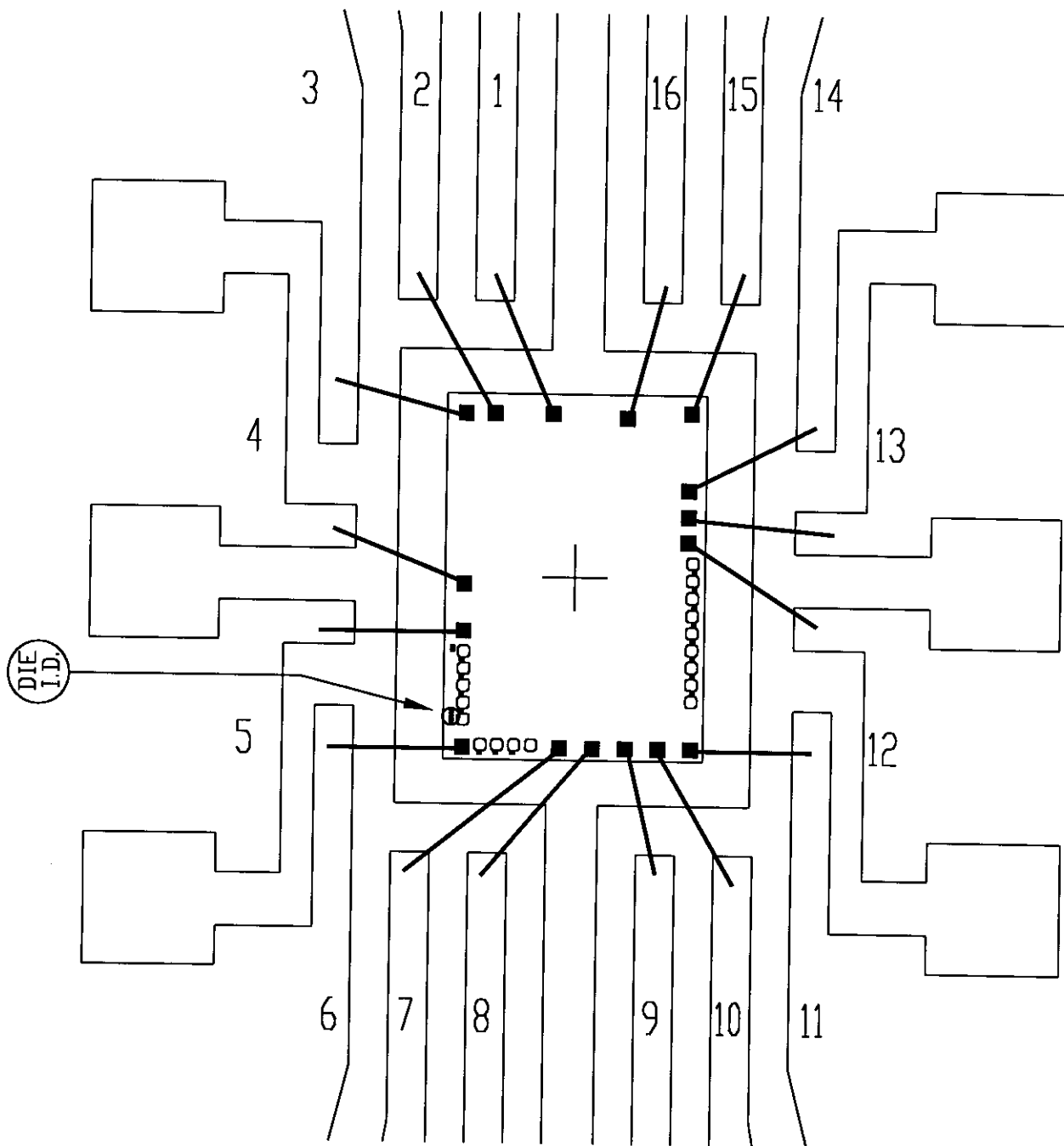
APPROVALS

DATE

**MAXIM**

BUILDSHEET NUMBER:  
05-0701-0427

REV.:  
B



PKG.CODE: P16-1

CAV./PAD SIZE:  
110 X 140

PKG.  
DESIGN

APPROVALS

DATE

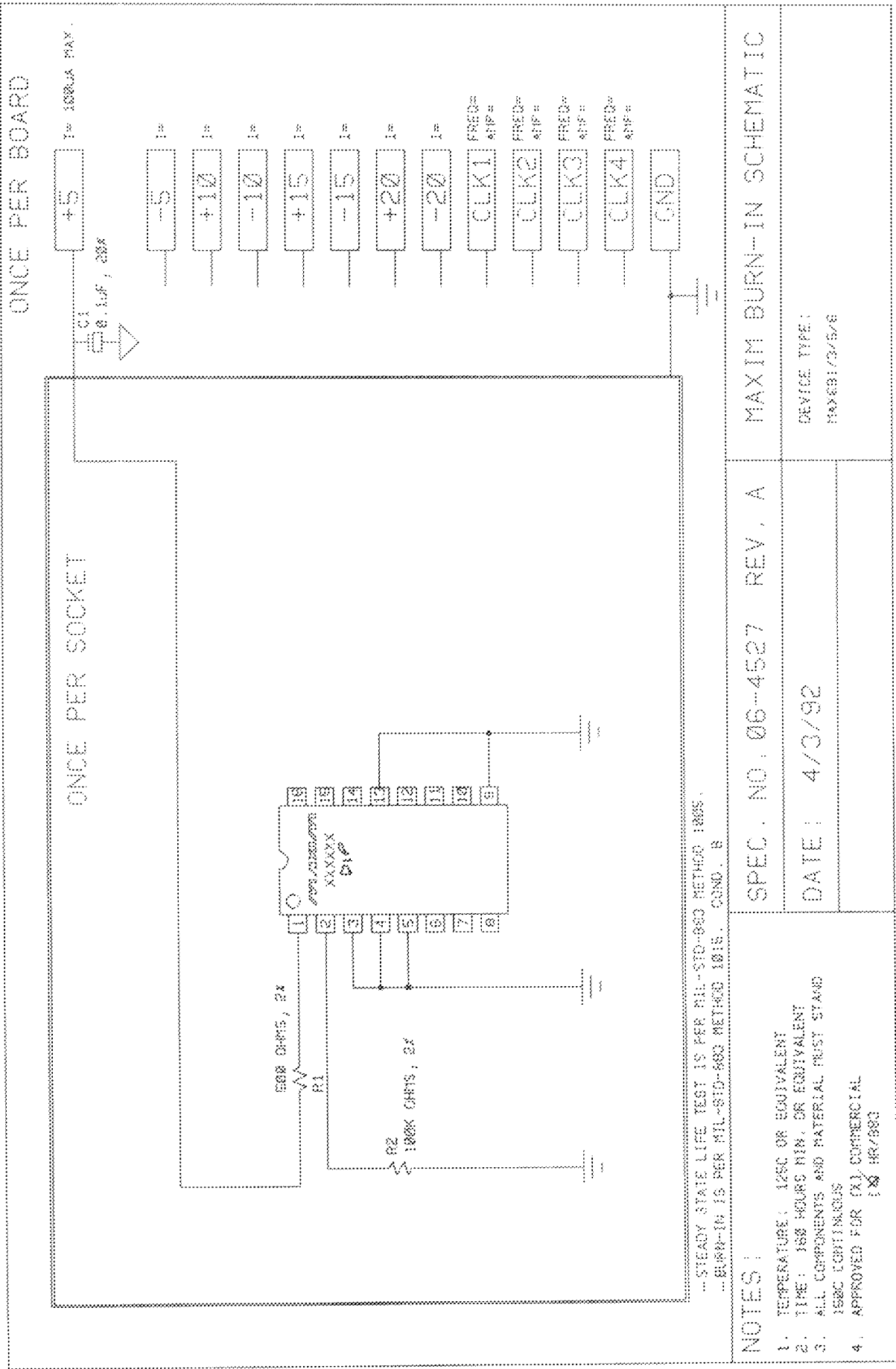
**MAXIM**

BUILDSHEET NUMBER:

05-0701-0251

REV.:

D



ONCE PER BOARD

ONCE PER SOCKET

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

SPEC. NO. 06-4527 REV. A MAXIM BURN-IN SCHEMATIC

DATE: 4/3/92

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C FOR 10 MIN.
4. APPROVED FOR (X) COMMERCIAL 100 HR/500

DEVICE TYPE:  
 MAX9313/5/8