

RELIABILITY REPORT
FOR
MAX110xxxx
PLASTIC ENCAPSULATED DEVICES

September 19, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Conclusion

The **MAX110** 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 MAX110 analog-to-digital converter (ADC) uses an internal auto-calibration technique to achieve 14-bit resolution plus overrange, with no external components. Operating supply current is only 550 μ A and reduces to 4 μ A in power-down mode, making this ADC ideal for high-resolution battery-powered or remote-sensing applications. A fast serial interface simplifies signal routing and opto-isolation, saves micro-controller pins, and offers compatibility with SPI™, QSPI™, and Microwire™. The MAX110 operates with \pm 5V supplies, and converts differential analog signals in the -3V to +3V range. Internal calibration allows for both offset and gain-error correction under microprocessor (μ P) control.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
V_{DD} to GND	+6V
V_{SS} to GND	+0.3V to -6V
AGND to DGND	-0.3V to +0.3V
V_{IN1+} , V_{IN1-}	($V_{DD} + 0.3V$) to ($V_{SS} - 0.3V$)
V_{IN2+} , V_{IN2-}	($V_{DD} + 0.3V$) to ($V_{SS} - 0.3V$)
V_{REF+} , V_{REF-}	($V_{DD} + 0.3V$) to ($V_{SS} - 0.3V$)
Digital Inputs and Outputs	($V_{DD} + 0.3V$) to -0.3V
Storage Temp.	-65°C to +160°C
Lead Temp. (10 sec.)	+300°C
Continuous Power Dissipation ($T_A = +70^\circ\text{C}$)	
16-Lead DIP	842mW
16-Lead WSO	762mW
20-Lead SSOP	640mW
Derates above +70°C	
16-Lead DIP	10.53mW/°C
16-Lead WSO	9.52mW/°C
20-Lead SSOP	8.00mW/°C

II. Manufacturing Information

A. Description/Function:	Low-Cost, 2-Channel, ± 14 -Bit Serial ADC
B. Process:	S3 (Standard 3 micron silicon gate CMOS)
C. Number of Device Transistors:	5849
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Philippines, Malaysia, or Thailand
F. Date of Initial Production:	December, 1994

III. Packaging Information

A. Package Type:	16 Lead DIP	16 Lead WSO	20 Lead SSOP
B. Lead Frame:	Copper	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate	Solder Plate
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.3 mil dia.)	Gold (1.3 mil dia.)	Gold (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-0101-0380	# 05-0101-0381	# 05-0101-0391
H. Flammability Rating:	Class UL94-V0	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	Level 1	Level 1

IV. Die Information

A. Dimensions:	121 x 168 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:	3 microns (as drawn)
F. Minimum Metal Spacing:	3 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 500 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 2.17 \times 10^{-9}$$

$$\lambda = 2.17 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-0130) shows the static Burn-In circuit. 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 AD67 die type has been found to have all pins able to withstand a transient pulse of $\pm 800\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 100\text{mA}$ and/or $\pm 20\text{V}$.

Table 1
Reliability Evaluation Test Results

MAX110xxxx

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		500	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	DIP	77	0
			WSO	77	0
			SSOP	77	
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 D.I.P. 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.

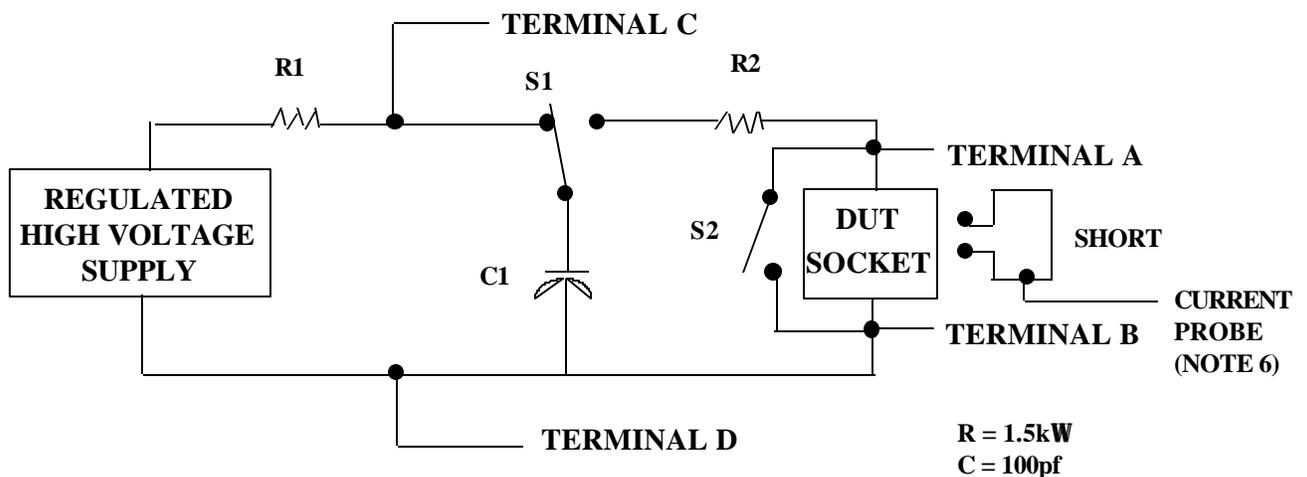
2/ No connects are not to be tested.

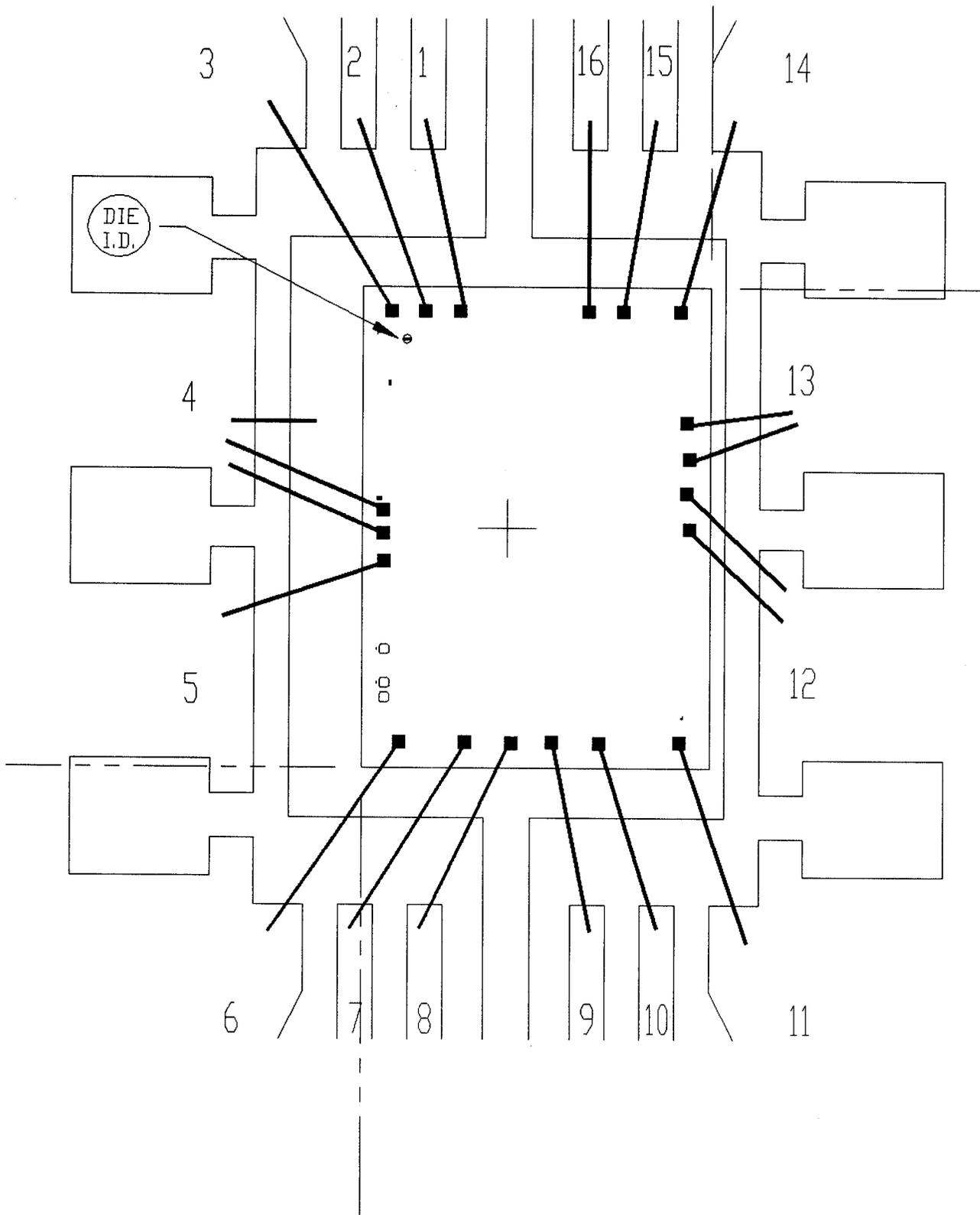
3/ Repeat pin combination I for each named Power supply and for ground

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

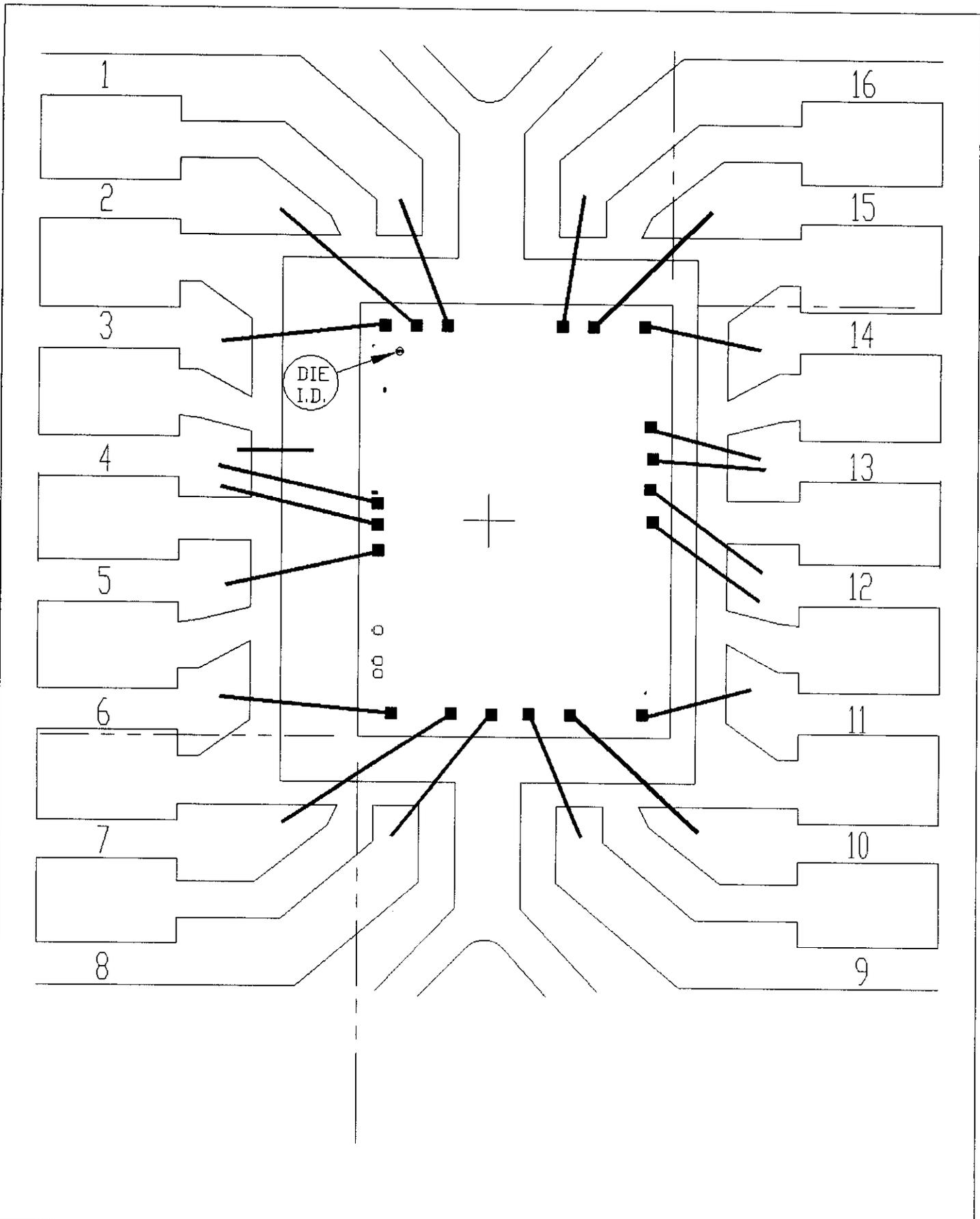
3.4 Pin combinations to be tested.

- 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: P16-3		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 150 X 200	PKG. DESIGN			BUILDSHEET NUMBER: 05-0101-0380
				REV: A

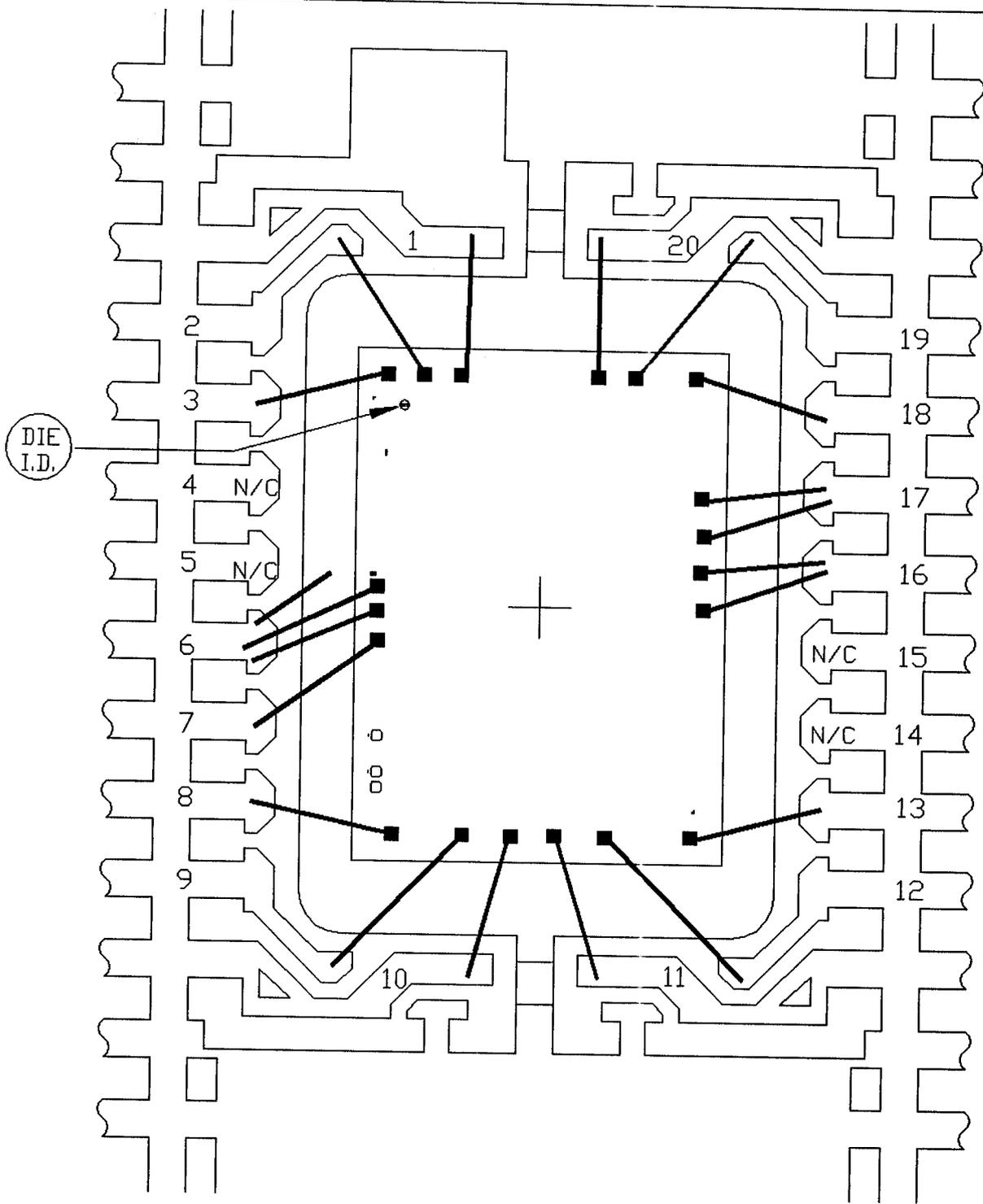


PKG.CODE: W16-3
 CAV./PAD SIZE: 160 X 200

APPROVALS
 PKG. DESIGN

DATE

MAXIM
 BUILDSHEET NUMBER: 05-0101-0381
 REV: A



NOTE: OFFSET DIE AT DIE ATTACH TO MAKE ROOM FOR DOWN BOND ON PIN 6.

PKG.CODE: A20-2

CAV./PAD SIZE:
154X213

APPROVALS

DATE

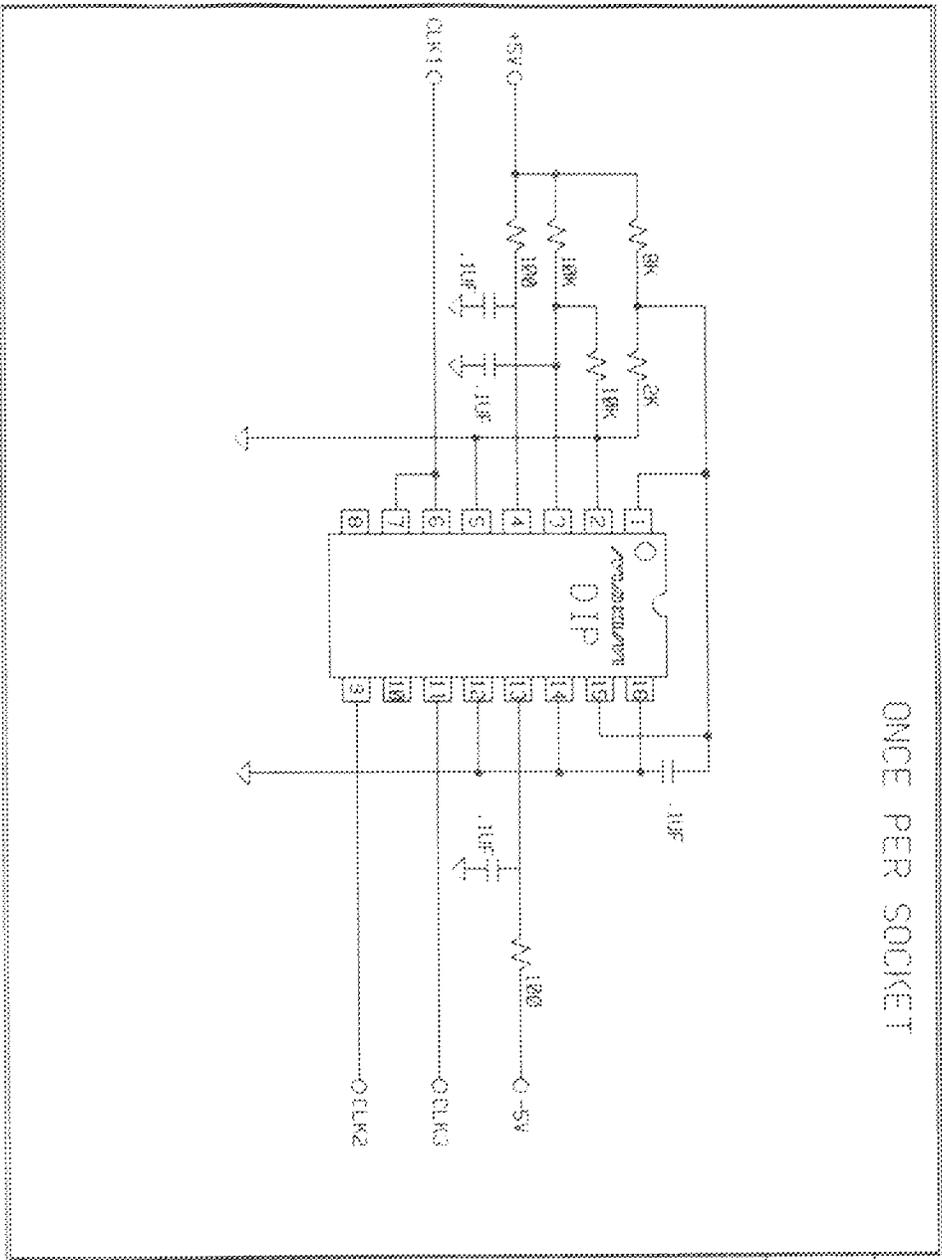
MAXIM

BUILDSHEET NUMBER:
05-0101-0391

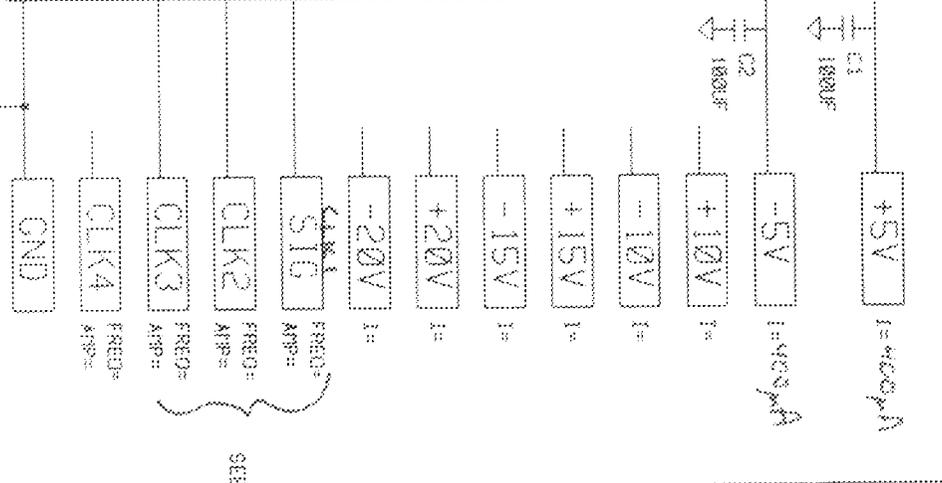
REV.:
A

PKG.
DESIGN

ONCE PER SOCKET



ONCE PER BOARD



NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 100 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL (Y) MIL/SECS

- STAGY STATE LIFE TEST IS PER MIL-STD-883 METHOD J885
 -- BURN-IN IS PER MIL-STD-883 METHOD B115. COND. 7 2

SPEC. NO. 06-0130 REV. A
 DATE: 5/4/93
 DRAWN BY: C. JONES

MAXIMUM BURN-IN SCHEMATIC
 DEVICE TYPE:
 MAX110

SEE ATTACHED