

RELIABILITY REPORT
FOR
MAX211ExxI
PLASTIC ENCAPSULATED DEVICES

January 24, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



Jim Pedicord
Quality Assurance
Reliability Lab Manager

Reviewed by



Bryan J. Preeshl
Quality Assurance
Executive Director

Conclusion

The MAX211E 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	V.Quality Assurance Information
II.Manufacturing Information	VI.Reliability Evaluation
III.Packaging Information	
IV.Die InformationAttachments

I. Device Description

A. General

The MAX211E line driver/receiver is designed for RS-232 and V.28 communication in harsh environments. Each transmitter output and receiver input is protected against $\pm 15\text{kV}$ electrostatic discharge (ESD) shocks, without latchup. This device has four drivers and five receivers. The drivers and receivers meet all EIA/TIA-232E and CCITT V.28 specifications at data rates up to 120kbps, when loaded in accordance with the EIA/TIA-232E specification.

The MAX211E operates with four $0.1\mu\text{F}$ capacitors, reducing cost and board space.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
V _{CC}	-0.3V to +6V
V ₊	(V _{CC} - 0.3V) to +14V
V ₋	-14V to +0.3V
Input Voltages	
T _{IN}	-0.3V to (V ₊ +0.3V)
R _{IN}	$\pm 30\text{V}$
Output Voltages	
T _{OUT}	(V ₋ -0.3V) to (V ₊ +0.3V)
R _{OUT}	-0.3V to (V _{CC} + 0.3V)
Short-Circuit Duration, T _{OUT}	Continuous
Storage Temp.	-65°C to +165°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	762mW
Derates above +70°C	9.52mW/°C

II. Manufacturing Information

A. Description/Function:	±15kV ESD-Protected, +5V RS-232 Transceiver
B. Process:	M5 (5 micron metal gate CMOS)
C. Number of Device Transistors:	542
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Philippines, Malaysia, or Korea
F. Date of Initial Production:	September, 1993

III. Packaging Information

A. Package Type:	28 Lead SSOP	28 Lead WSO
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:	Buildsheet # 05-1901-0031	Buildsheet # 05-1901-0030
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	

IV. Die Information

A. Dimensions:	138 x 174 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	5 microns (as drawn)
F. Minimum Metal Spacing:	5 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 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 726 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

↳ Thermal acceleration factor assuming a 0.8eV activation energy

$$\lambda = 1.49 \times 10^{-9} \quad \lambda = 1.49 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-0034) 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 RS25-1 die type has been found to have all pins able to withstand a transient pulse of $\pm 1500\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Additionally, the MAX211E has achieved $\pm 15\text{kV}$ ESD protection using both methods 3015 and IEC 801-2 (air-gap discharge) on the I/O pins. 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

MAX211ExxI

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		726	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	TSSOP WSO	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		77	0

Note 1: Life Test Data may represent plastic D.I.P. qualification lots for the Shrink Small Outline package.

Note 2: Generic Process/Package 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.

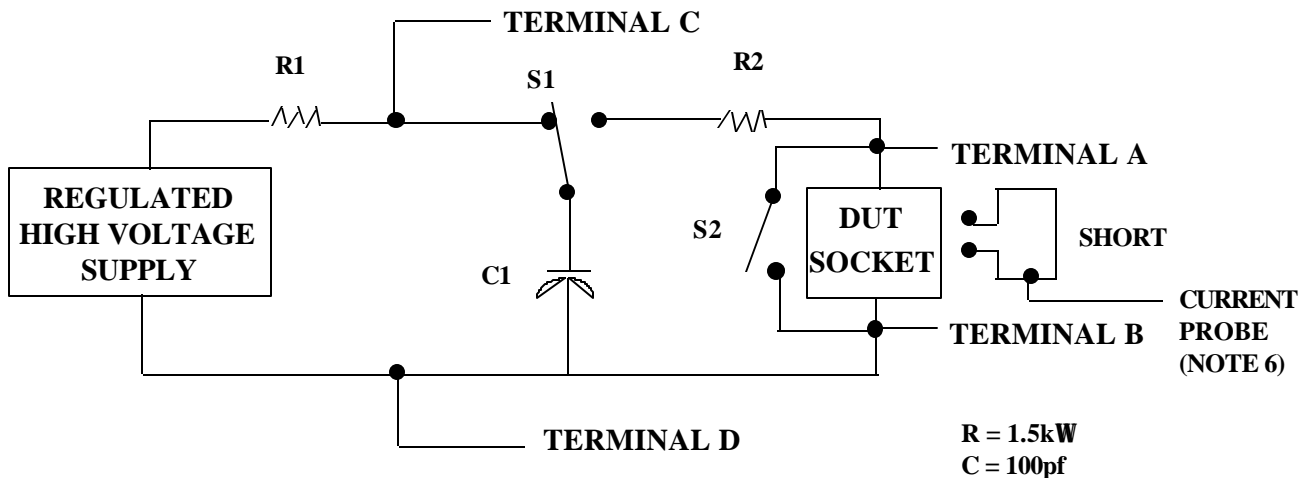
3/ Repeat pin combination I for each named Power supply and for ground

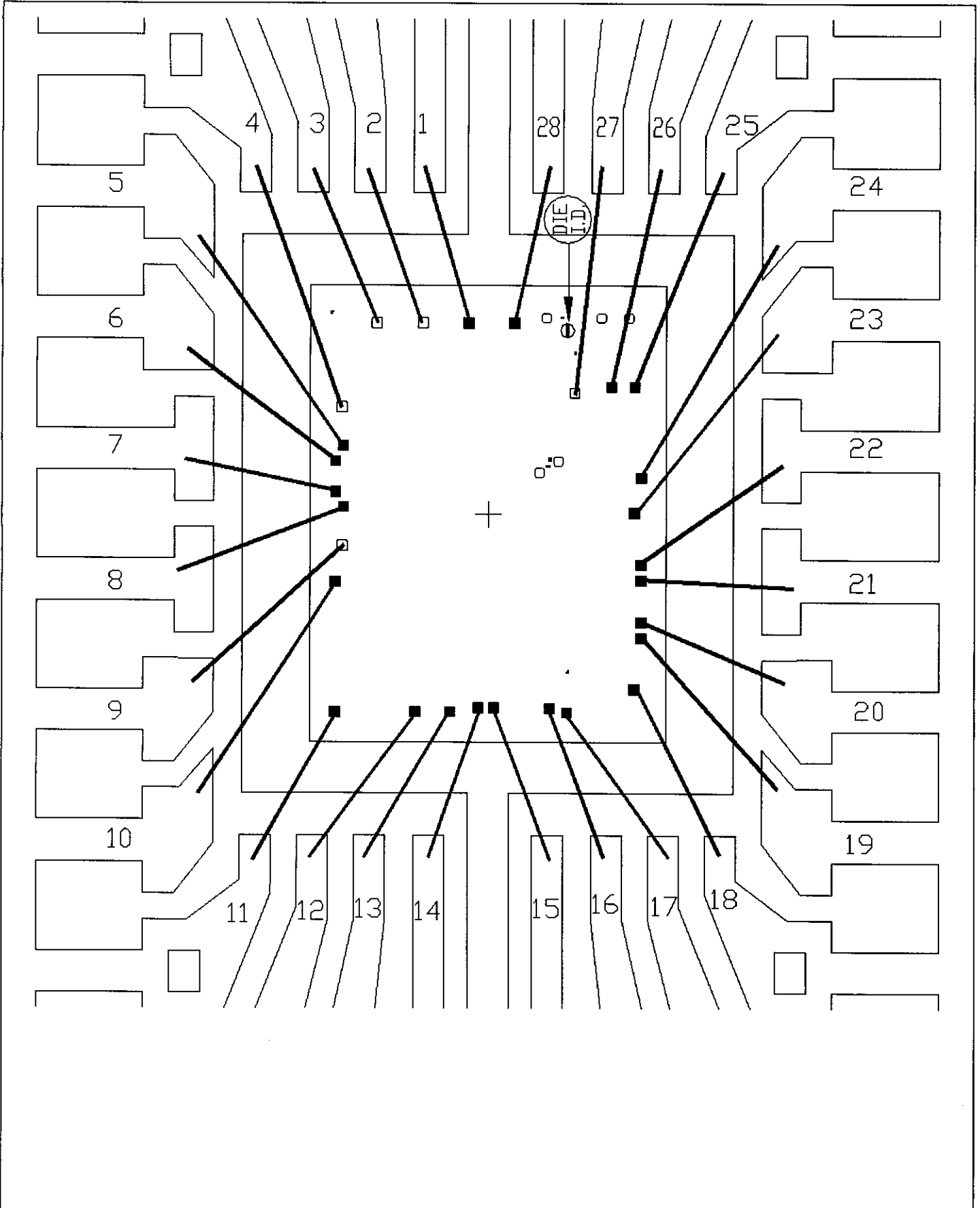
(e.g., where V_{PS1} is V_{DD} , V_{CC} , V_{SS} , V_{BB} , GND, $+V_S$, $-V_S$, V_{REF} , etc).

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.





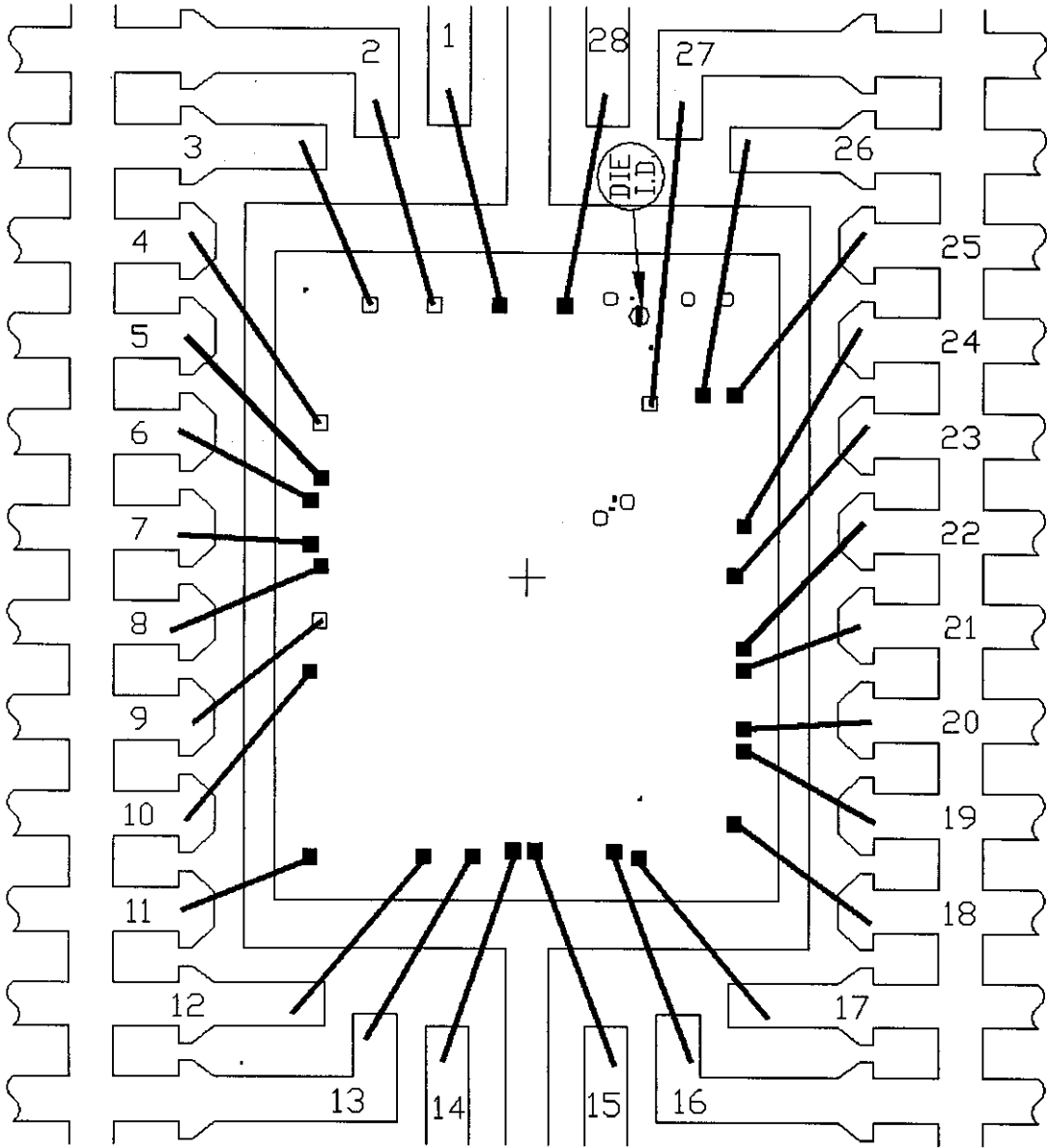
PKG.CODE: W28-2
 CAV./PAD SIZE: 190 X 214

PKG.
 DESIGN

APPROVALS

DATE

MAXIM
 BUILDSHEET NUMBER: 05-1901-0030
 REV.: B



PKG.CODE: A28-1

CAV./PAD SIZE:
154X200

APPROVALS

DATE

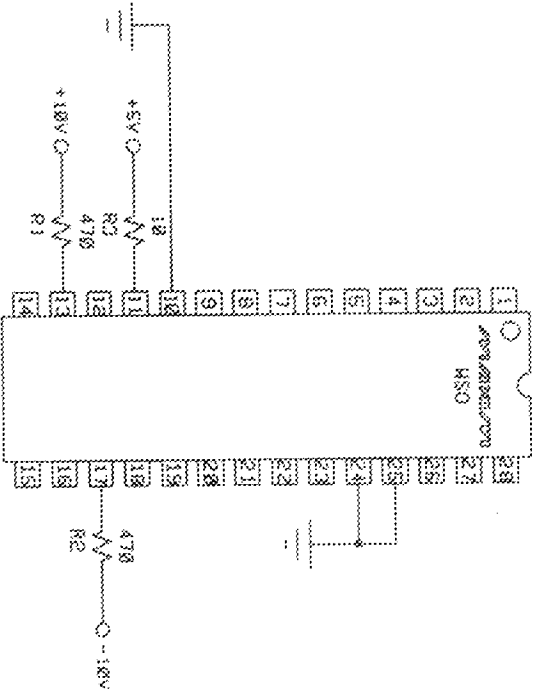


PKG.
DESIGN

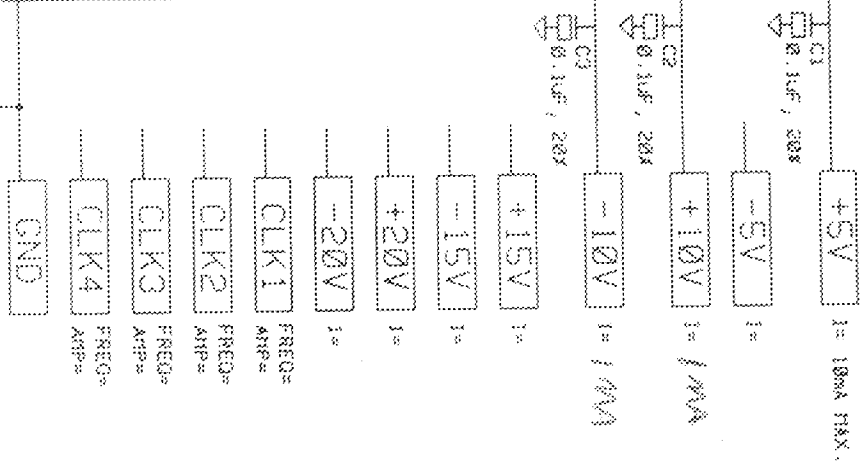
BUILDSHEET NUMBER:
05-1901-0031

REV.:
B

ONCE PER SOCKET



ONCE PER BOARD



... STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1886.
 ... BURN-IN IS PER MIL-STD-883 METHOD 1015. COND. B

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 159C CONTINUOUS
4. APPROVED FOR OJ COMMERCIAL (VJ) HR/88C

SPEC. NO. 06-0034 REV. A
 DATE: 6/23/92
 DRAWN BY:

MAXIM BURN-IN SCHEMATIC
 DEVICE TYPE:
 MAX ZHI/ZII