RELIABILITY REPORT

FOR

MAX186xxxP

PLASTIC ENCAPSULATED DEVICES

February 14, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX186 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 MAX186 is a 12-bit data-acquisition system that combines an 8-channel multiplexer, high-bandwidth track/hold, and serial interface together with high conversion speed and ultra-low power consumption. The device operates with a single +5V supply or dual ±5V supplies. The analog inputs are software configurable for unipolar/bipolar and single-ended/differential operation.

The 4-wire serial interface directly connects to SPI™, QSPI™ and Microwire™ devices without external logic. A serial strobe output allows direct connection to TMS320 family digital signal processors. The MAX186 uses either the internal clock or an external serial-interface clock to perform successive-approximation A/D conversions. The serial interface can operate beyond 4mhz when the internal clock is used.

The MAX186 has an internal 4.096V reference and has a reference-buffer amplifier that simplifies gain trim.

The MAX186 provides a hard-wired /SHDN pin and two software-selectable power-down modes. Accessing the serial interface automatically powers up the devices, and the quick turn-on time allows the MAX186 to be shut down between every conversion. Using this technique of powering down between conversions, supply current can be cut to under 10µA at reduced sampling rates.

B. Absolute Maximum Ratings

Item	Rating
V_{DD} to AGND	-0.3V to +6V
V_{SS} to AGND	+03V to -6V
V_{DD} to V_{SS}	-0.3V to +12V
AGND to DGND	-0.3V to +0.3V
CH0-CH7 to AGND, DGND	(V_{SS} -0.3V) to (V_{DD} +0.3V)
CH0-CH7 Total Input Current	±20mA
VREF to AGND	-0.3V to (V_{DD} + 0.3V)
REFADJ to AGND	-0.3V to (V_{DD} + 0.3V)
Digital Inputs to DGND	-0.3V to (V_{DD} + 0.3V)
Digital Outputs to DGND	-0.3V to (V_{DD} + 0.3V)
Digital Output Sink Current	25mA
Storage Temp.	-65°C to +150°C
Lead Temp. (10 sec.)	+300°C
Continuous Power Dissipation (TA=+70°C)	
20-Pin SSOP	640mW
20-Pin WSO	800mW
Derates above +70°C	
20-Pin SSOP	8.0mW/°C
20-Pin WSO	10.00mW/°C

II. Manufacturing Information

A. Description/Function:	Low-Power, 8-Channel, Serial 12-Bit ADC
B. Process:	S3 (Standard 3 micron silicon gate CMOS)
C. Number of Device Transistors:	2278
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Philippines, Malaysia, or Korea
F. Date of Initial Production:	May, 1996

III. Packaging Information

A. Package Type:	**20-Lead WSO**	**20-Lead SSOP**
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:	# 05-0101-0371	# 05-0101-0372
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:	117 x 147 mils
B. Passivation:	Si_3N_4/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 (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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 790 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 1.37 \times 10^{-9}$

$\lambda = 1.37$ 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. # 06-0029) 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 AD62 die type has been found to have all pins able to withstand a transient pulse of ±800, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit).

Latch-Up testing has shown that this device withstands a current of ±100mA.

Table 1
Reliability Evaluation Test Results

MAX186xxxP

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		790	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SSOP SO	77 77	0 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 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

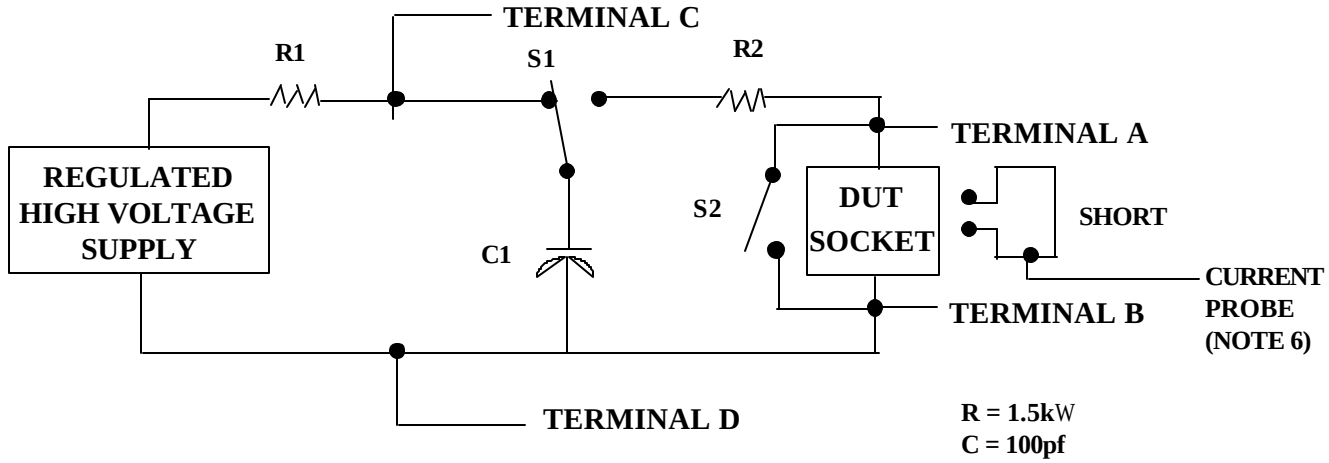
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

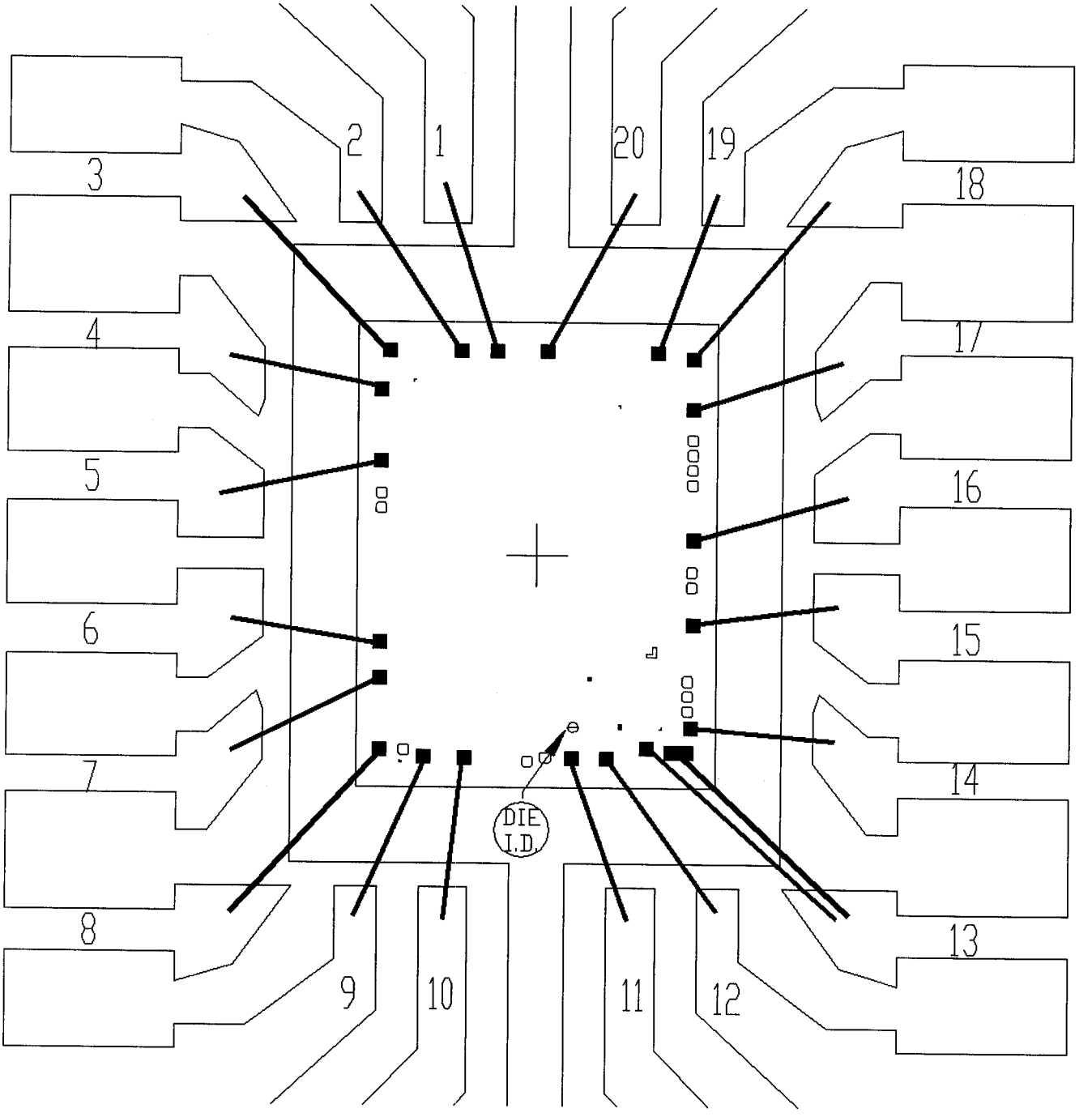
3.4 Pin combinations to be tested.

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.

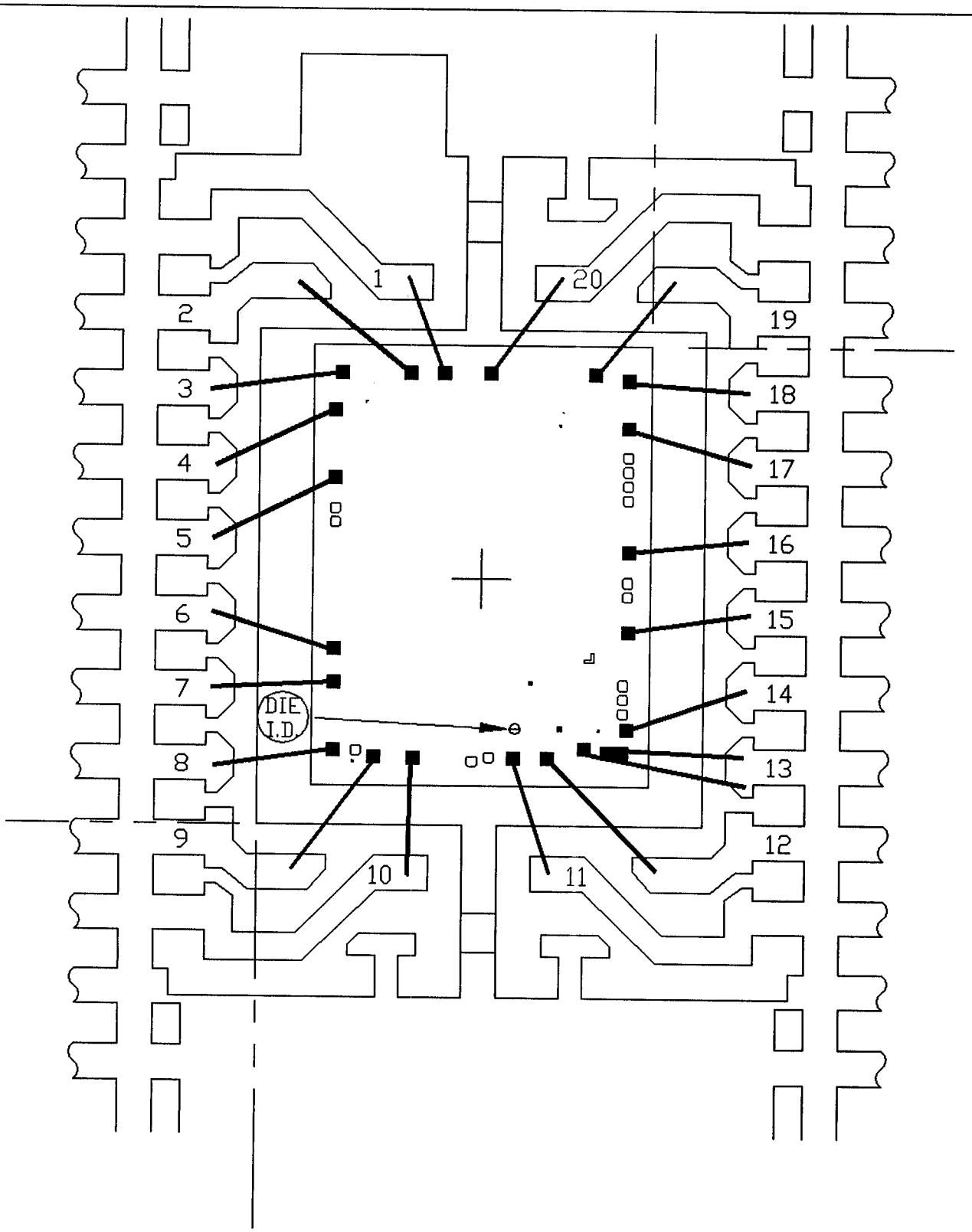
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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

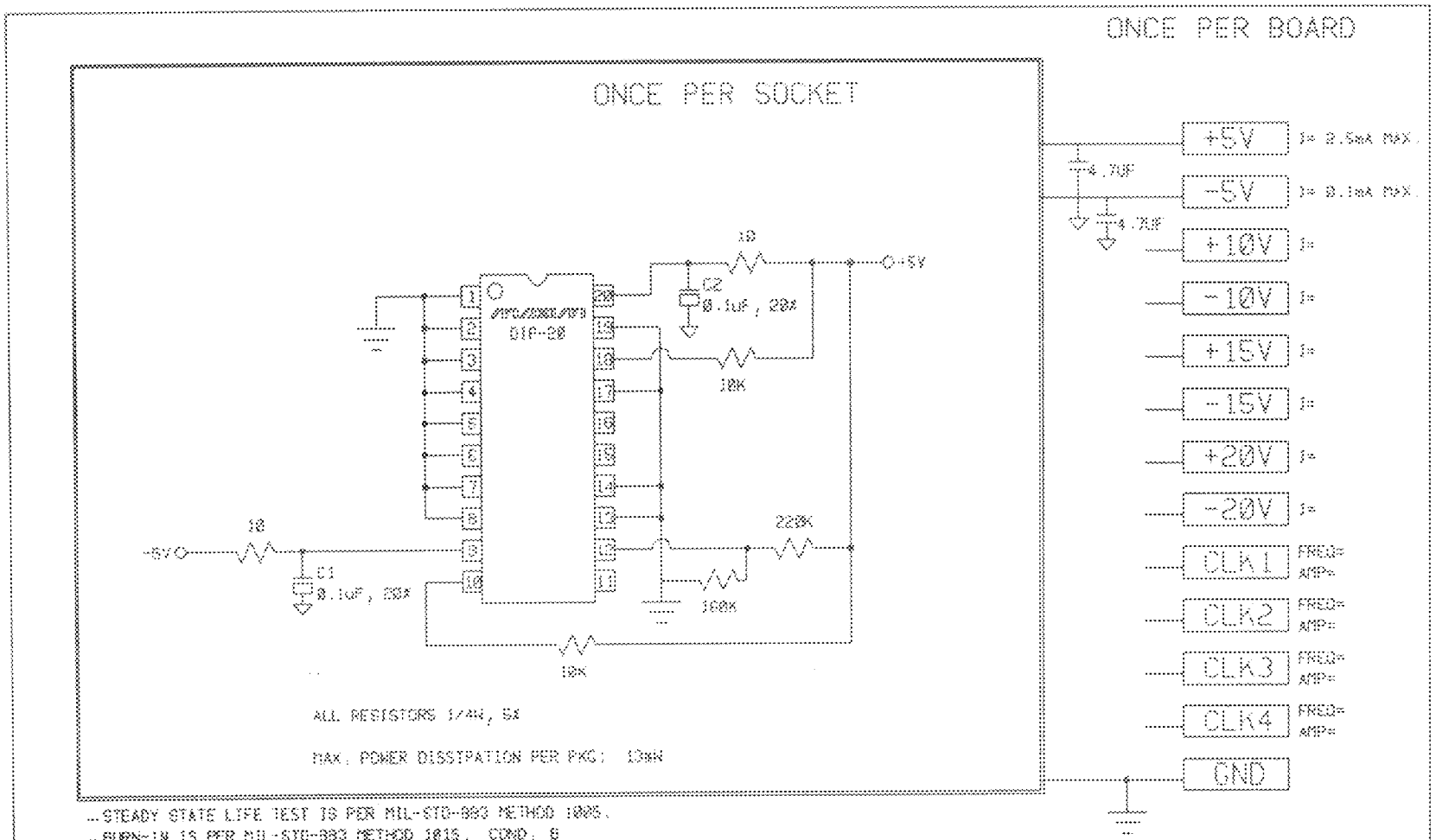




PKG.CODE: W20-3		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 160 X 200	PKG. DESIGN			BUILDSHEET NUMBER: 05-0101-0371 / REV.: B



PKG.CODE: A20-1		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 154X169	PKG. DESIGN			BUILDSHEET NUMBER: 05-0101-0372 / REV.: B



...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: 192 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL
   (X) MIL/883

SPEC. NO. 06-0029 REV. C

DATE: 2/7/94

DRAWN BY:

MAXIM BURN-IN SCHEMATIC

DEVICE(S):

MAX186/188/192