RELIABILITY REPORT

FOR

MAX1249xxxE

PLASTIC ENCAPSULATED DEVICES

May 30, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX1249 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

A. General

The MAX1249 10-bit data-acquisition system combines a 4-channel multiplexer, high-bandwidth track/hold, and serial interface with high conversion speed and low power consumption. It operates from a single +2.7V to +5.25V supply, and it's analog inputs are software configurable for unipolar/bipolar and single-ended/differential operation.

The 4-wire serial interface connects directly to SPI™/ QSPI™ and MICROWIRE™ devices without external logic. A serial strobe output allows direct connection to TMS320-family digital signal processors. The MAX1249 uses either the internal clock or an external serial-interface clock to perform successive-approximation analog-to-digital conversions.

The MAX1249 requires an external reference and has a reference-buffer amplifier with a ±1.5% voltage adjustment range.

This device provides a hard-wired SHDN-bar pin and a software-selectable power-down, and can be programmed to automatically shut down at the end of a conversion. Accessing the serial interface automatically powers up the MAX1249, and the quick turn-on time allows it to be shut down between all conversions. This technique can cut supply current to under 60µA at reduced sampling rates.

The MAX1249 is available in a 16-pin DIP and a very small QSOP that occupies the same board area as an 8-pin SO.

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B. Absolute Maximum Ratings (Note 1)

Item	Rating
VDD to AGND, DGND	-0.3V to +6V
AGND to DGND	-0.3V to +0.3V
CH0–CH3, COM to AGND, DGND	-0.3V to (VDD + 0.3V)
VREF to AGND	-0.3V to (VDD + 0.3V)
Digital Inputs to DGND	-0.3V to +6V
Digital Outputs to DGND	-0.3V to (VDD + 0.3V)
Digital Output Sink Current	25mA
Operating Temperature Ranges	
MAX1249_C_E	0°C to +70°C
MAX1249_E_E	-40°C to +85°C
Storage Temperature Range	-60°C to +150°C
Lead Temperature (soldering, 10sec)	+300°C
Continuous Power Dissipation (TA = +70°C)	
16-Pin PDIP	842mW
16-Pin QSOP	667mW
Derates above +70°C	
16-Pin Narrow SO	10.53W/°C
16-Pin Narrow QSOP	8.30W/°C

II. Manufacturing Information

A. Description/Function:	+2.7V to +5.25V, Low-Power, 4-Channel, Serial 10-Bit ADC
B. Process:	S12 (Standard 1.2 micron silicon gate CMOS)
C. Number of Device Transistors:	2554
D. Fabrication Location:	Oregon or California, USA
E. Assembly Location:	Malaysia, Thailand or Philippines
F. Date of Initial Production:	March, 1997

III. Packaging Information

A. Package Type:	**16-Pin PDIP**	**16-Pin QSOP**
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- 2101-0011	# 05- 2101-0012
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1	Level 1

IV. Die Information

A. Dimensions:	85 x 106 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:	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 (Manager, Rel Operations)
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°Cbiased (static) life test are shown in **Table 1** Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 160 \times 2}$$ (Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 6.79 \times 10^{-9}$

$\lambda = 6.79$ 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. # 06-5207) 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 AC18 die type has been found to have all pins able to withstand a transient pulse of ±1500V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±200mA.

Table 1
Reliability Evaluation Test Results

MAX1249xxxE

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		160	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	PDIP 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

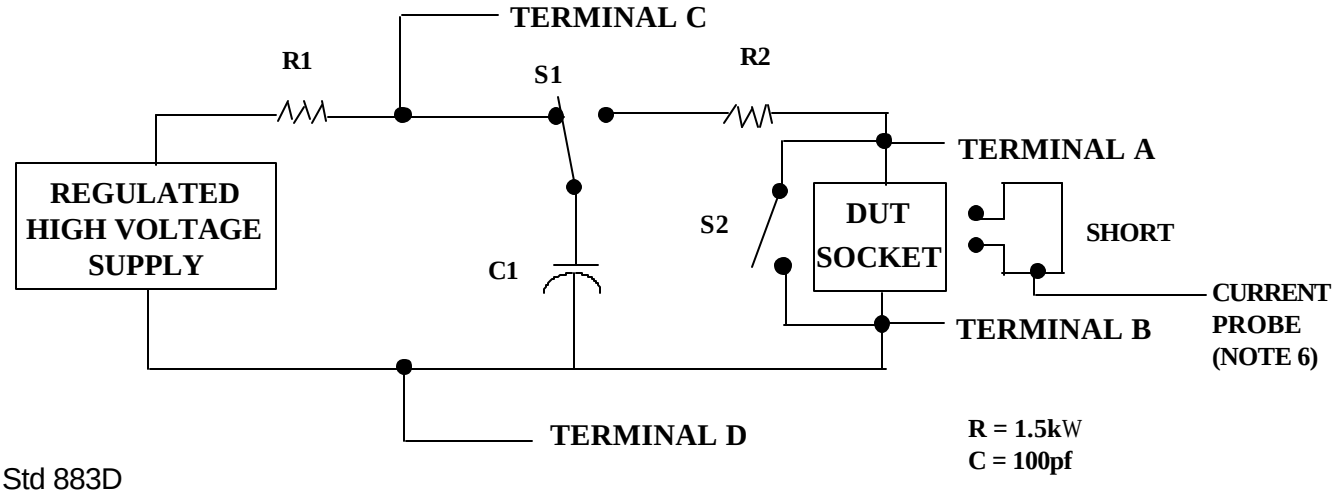
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

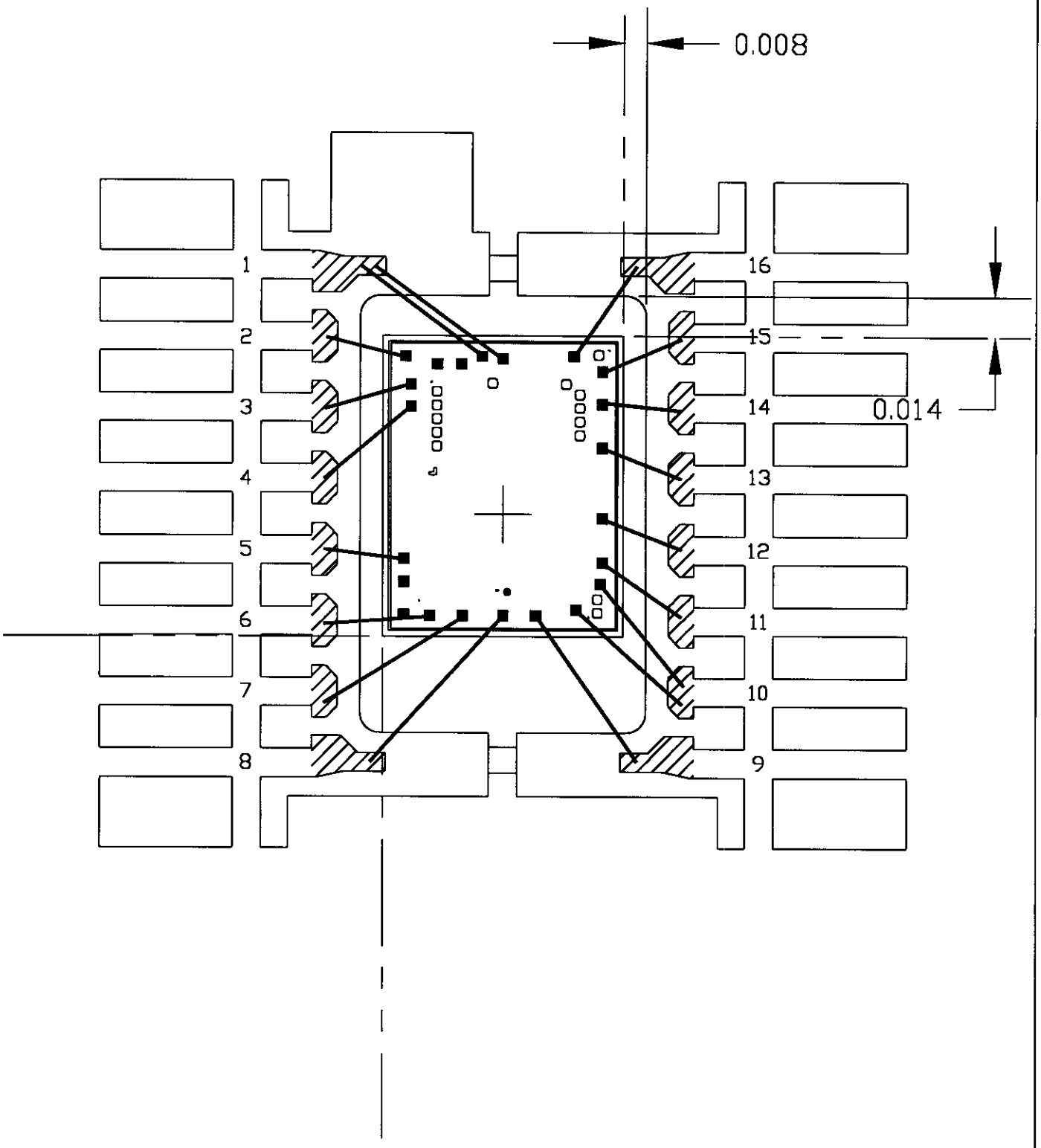
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

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.

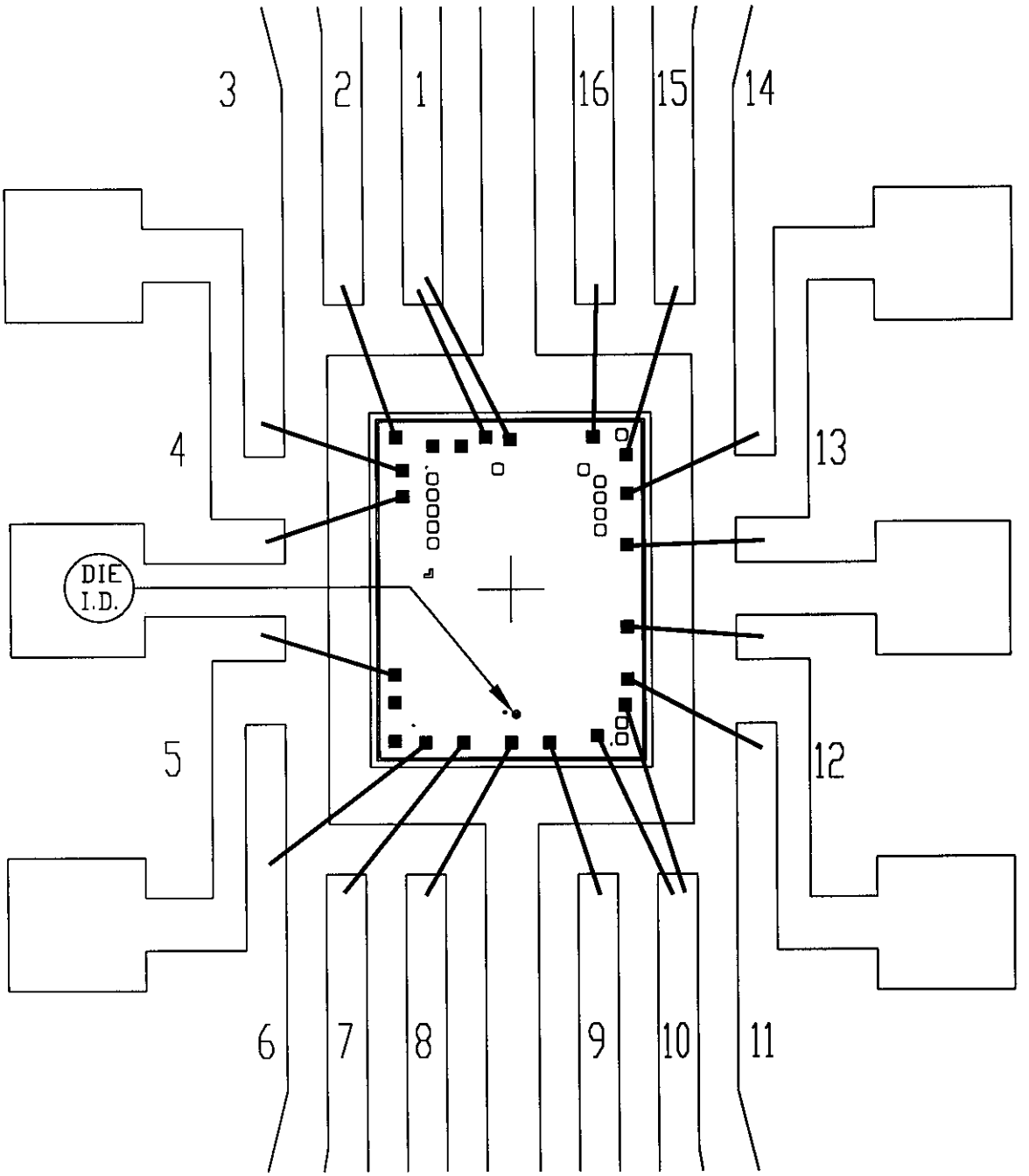
c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



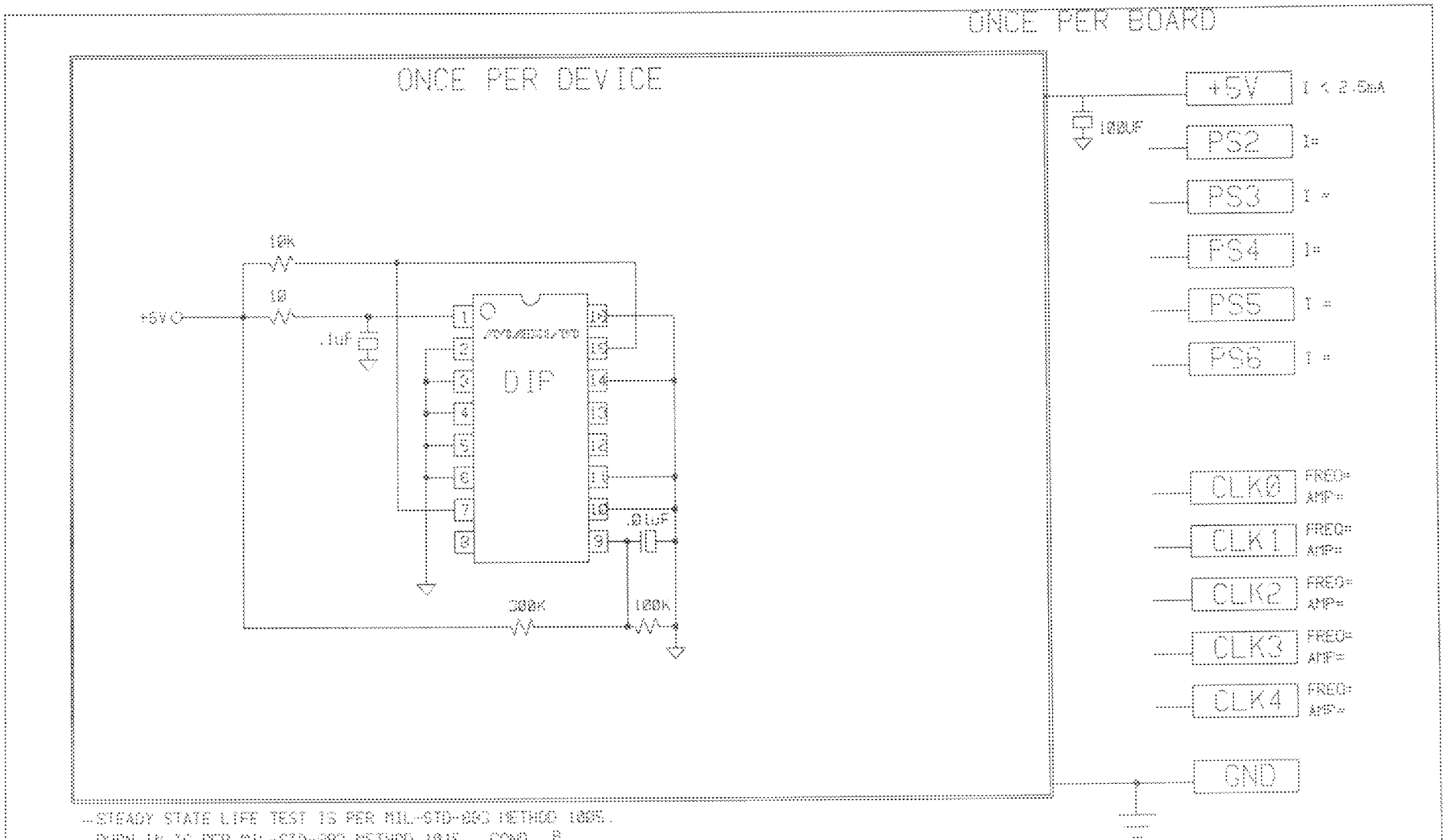
Mil Std 883D
Method 3015.7
Notice 8



PKG.CODE: E16-5		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 101x154	PKG. DESIGN		BUILDSHEET NUMBER: 05-2101-0012	REV.: B



PKG.CODE: P16-1		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 110 X 140	PKG. DESIGN			BUILDSHEET NUMBER: 05-2101-0011 / REV.: A



--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: 240 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR EXT COMMERCIAL
   EXT HR/883

SPEC. NO. 06-5207 REV: A

DATE: 5/07/96

DRAWN BY:

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

MAX1247/1249