RELIABILITY REPORT

FOR

MAX149xxxP

PLASTIC ENCAPSULATED DEVICES

October 13 , 2004

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

Jim Pedicord
Quality Assurance
Manager, Reliability Operations

Conclusion

The MAX149 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 MAX149 10-bit data-acquisition system combines an 8-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 samples to 133ksps. This device'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 MAX149 uses either the internal clock or an external serial-interface clock to perform successive-approximation analog-to-digital conversions.

The MAX149 has an internal 2.5V reference. This part has a reference-buffer amplifier with a ±1.5% voltage-adjustment range.

This device provides a hard-wired /SHDN 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 MAX149, and the quick turn-on time allows them to be shut down between all conversions. This technique can cut supply current to under 60μA at reduced sampling rates.

B. Absolute Maximum Ratings

Item	Rating
V_{DD} to AGND, DGND	-0.3V to 6V
AGND to DGND	-0.3V to 0.3V
CH0-CH7, COM to AGND, DGND	-0.3V to (V_{DD} + 0.3V)
VREF, REFADJ, to AGND	-0.3V to (V_{DD} + 0.3V)
Digital Inputs to DGND	-0.3V to 6V
Digital Outputs to DGND	-0.3V to (V_{DD} + 0.3V)
Digital Output Sink Current	25mA
Storage Temp.	-60°C to +150°C
Lead Temp. (10 sec.)	+300°C
Continuous Power Dissipation (TA = +70°C)	
20-Pin SSOP	640mW
20-Pin PDIP	889mW
Derates above +70°C	
20-Pin SSOP	8.0mW/°C
20-Pin PDIP	11.11mW/°C

II. Manufacturing Information

A. Description/Function:	+2.7V, Low-Power, 8-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, USA
E. Assembly Location:	Philippines, Malaysia or Thailand
F. Date of Initial Production:	December, 1995

III. Packaging Information

A. Package Type:	**20-Lead SSOP**	**20-Lead PDIP**
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate or 100% Matte Tin	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:	# 05-2101-0010	# 05-2101-0008
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C:	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 (Manager Director of QA)

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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 80 \times 2}$$

(Chi square value for MTTF upper limit)

↳ Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 13.57 \times 10^{-9}$ $\lambda = 13.57$ 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. #06-5162) 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-1N**).

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 AC18-4 die type has been found to have all pins able to withstand a transient pulse of +/-1000V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX149xxxP

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		80	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SSOP PDIP	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 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

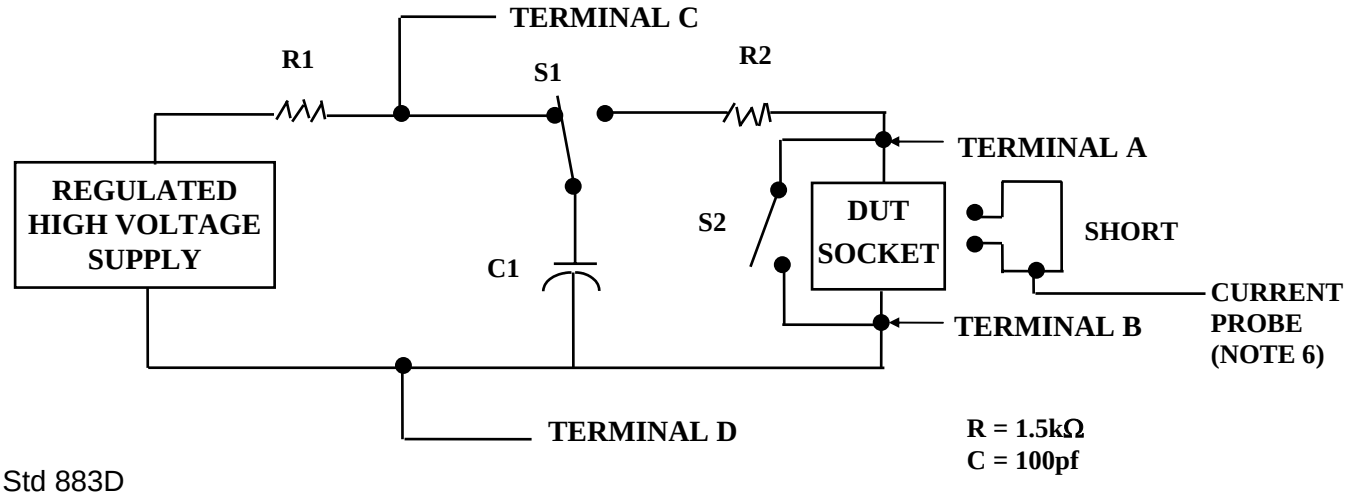
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

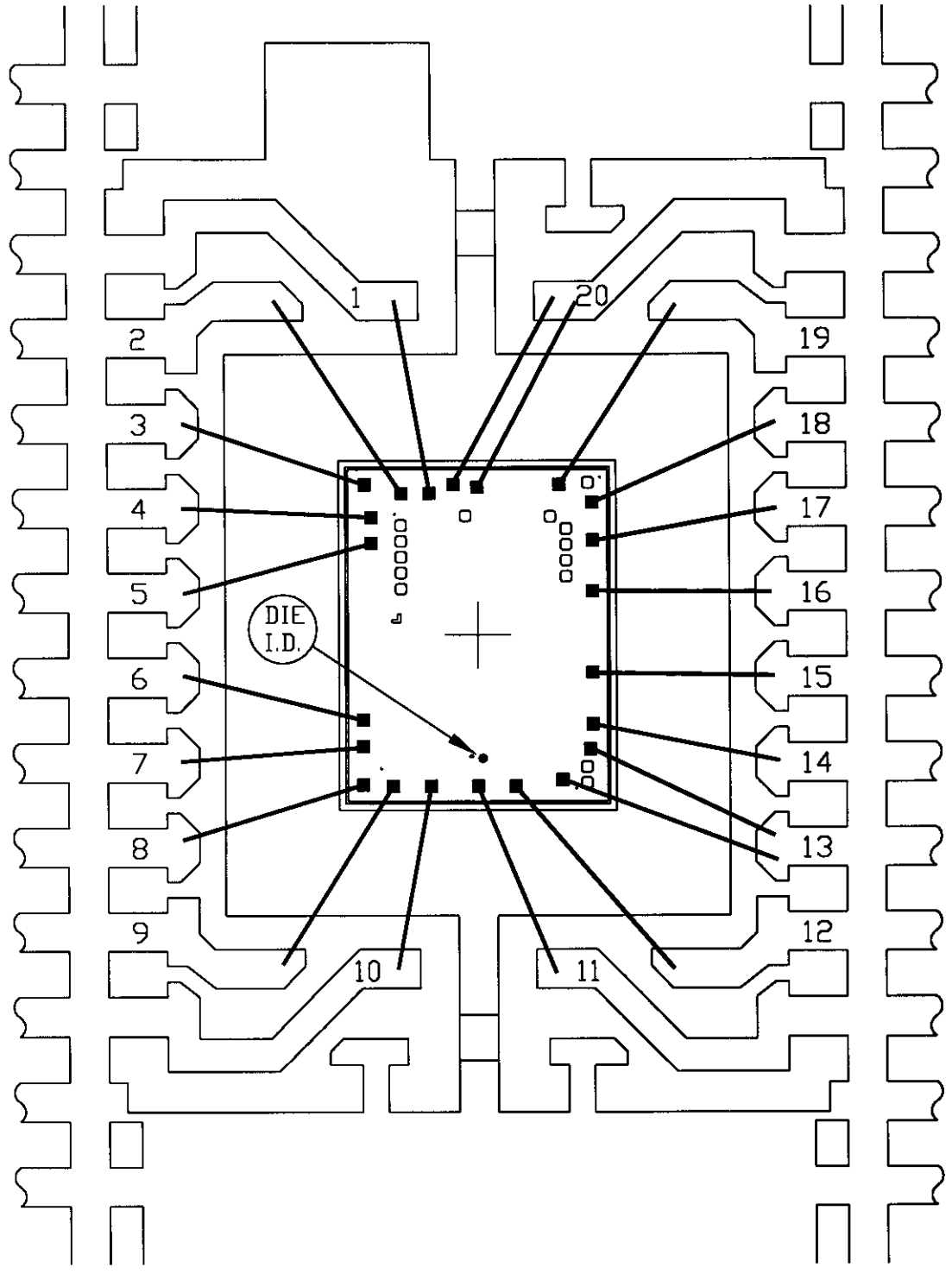
3.4 Pin combinations to be tested.

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.

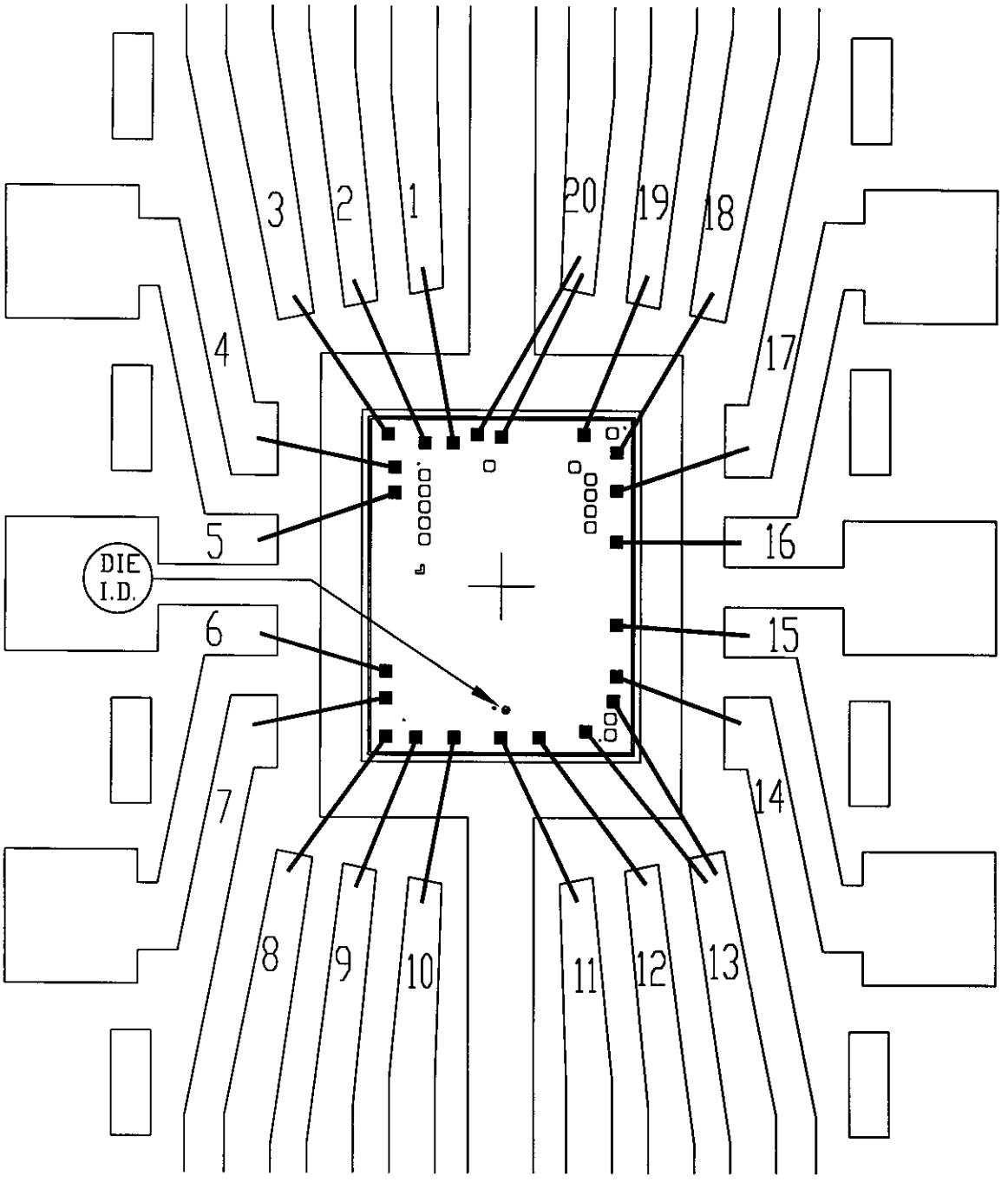
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall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





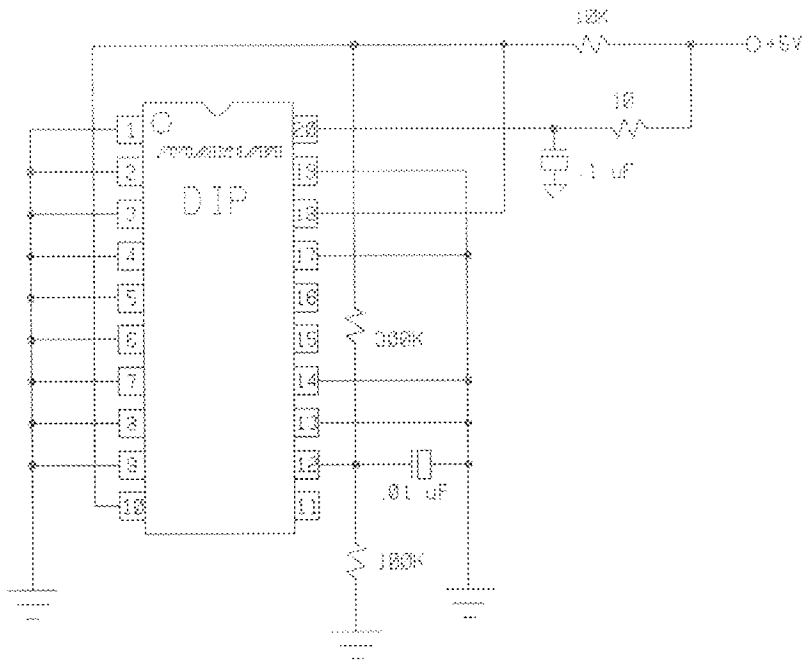
PKG.CODE: A20-1		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 154X169	PKG. DESIGN			BUILDSHEET NUMBER: 05-2101-0010 / REV.: A



PKG.CODE: P20-4		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 110 X 140	PKG. DESIGN			BUILDSHEET NUMBER: 05-2101-0008 / REV.: A

ONCE PER BOARD

ONCE PER DEVICE



+5V I < 2.5 mA
100UF
PS2 I=
PS3 I =
PS4 I=
PS5 I =
PS6 I =

CLK0 FREQ= AMP=
CLK1 FREQ= AMP=
CLK2 FREQ= AMP=
CLK3 FREQ= AMP=
CLK4 FREQ= AMP=

GND

- 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: 160 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR EX3 COMMERCIAL
   EX3 HR/96D

SPEC. NO. 06-5162 REV: D

DATE: 12/07/95

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE(S):

MAX146/147/148/149
MAX1246