

RELIABILITY REPORT
FOR
MAX549AxxA
PLASTIC ENCAPSULATED DEVICES

May 13, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Conclusion

The MAX549A 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 Information |Attachments |

I. Device Description

A. General

The MAX549A serial 8Bit voltage-output digital-to-analog converter (DAC) operates from a single +2.5V to +5.5V supply. Its ± 1 LSB TUE specification is guaranteed over temperature. Operating current (supply current plus reference current) is typically 75 μ A per DAC with $V_{DD} = 2.5V$. In shutdown, the DAC is disconnected from the reference, reducing current drain to less than 1 μ A. The MAX549A allows each DAC to be shut down independently.

The 10MHz, 3-wire serial interface is compatible with SPITM/ QSPITM and MicrowireTM interface standards. Double-buffered inputs provide flexibility when updating the DAC; the input and DAC registers can be updated individually or simultaneously.

The MAX549A is a dual DAC with an external reference input. This device's low power consumption and small package size makes it ideal for portable and battery-powered applications.

B. Absolute Maximum Ratings

| <u>Item</u> | <u>Rating</u> |
|---|------------------------------|
| V_{DD} , SCLK, DIN, /CS, /LDAC, OUT_ to GND | -0.3V to +6V |
| REF to GND | -0.3V to ($V_{DD} + 0.3V$) |
| Maximum Current (any pin) | $\pm 50mA$ |
| Storage Temp. | -65°C to +150°C |
| Lead Temp. (10 sec.) | +300°C |
| Continuous Power Dissipation (TA = +70°C) | |
| 8-Lead DIP | 727mW |
| 8-Lead uMAX | 330mW |
| Derates above +70°C | |
| 8-Lead DIP | 9.09mW/°C |
| 8-Lead uMAX | 4.10mW/°C |

II. Manufacturing Information

| | |
|----------------------------------|---|
| A. Description/Function: | +2.5V to +5.5V Low-Power, Dual, 8-Bit Voltage-Output DAC in a μ MAX Package |
| B. Process: | SG1.2 (Standard 1.2 micron silicon gate CMOS) |
| C. Number of Device Transistors: | 1562 |
| D. Fabrication Location: | Oregon or California, USA |
| E. Assembly Location: | Malaysia, Philippines or Thailand |
| F. Date of Initial Production: | March, 1997 |

III. Packaging Information

| | | |
|---|---------------------------|---------------------------|
| A. Package Type: | 8 Lead DIP | 8-Lead uMAX |
| 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 # 05-0401-0469 | Buildsheet # 05-0401-0470 |
| 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: | 64 x 54 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: | 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 (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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 240 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

↓
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 4.52 \times 10^{-9}$$

$$\lambda = 4.52 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5177) 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 DA62-1 die type has been found to have all pins able to withstand a transient pulse of $\pm 2500\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 250\text{mA}$ and/or $\pm 20\text{V}$.

Table 1
 Reliability Evaluation Test Results
MAX549AxxA

| 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 | | 77 | 0 |
| Moisture Testing (Note 2) | | | | | |
| Pressure Pot | Ta = 121°C P = 15 psi. RH= 100% Time = 96hrs. | DC Parameters & functionality | DIP NSO | 260 1476 | 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 | | 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.

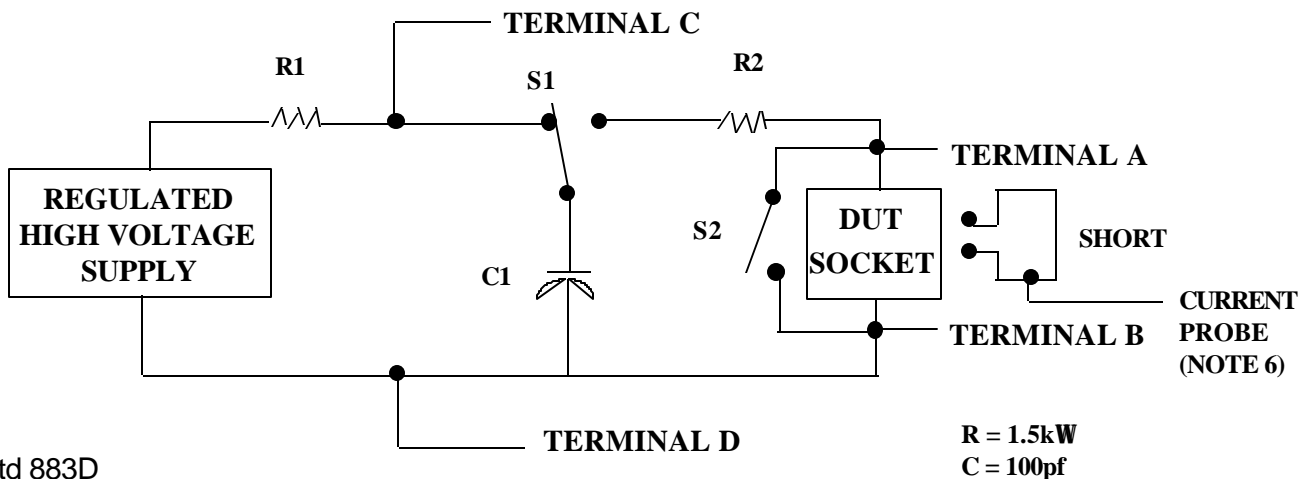
2/ No connects are not to be tested.

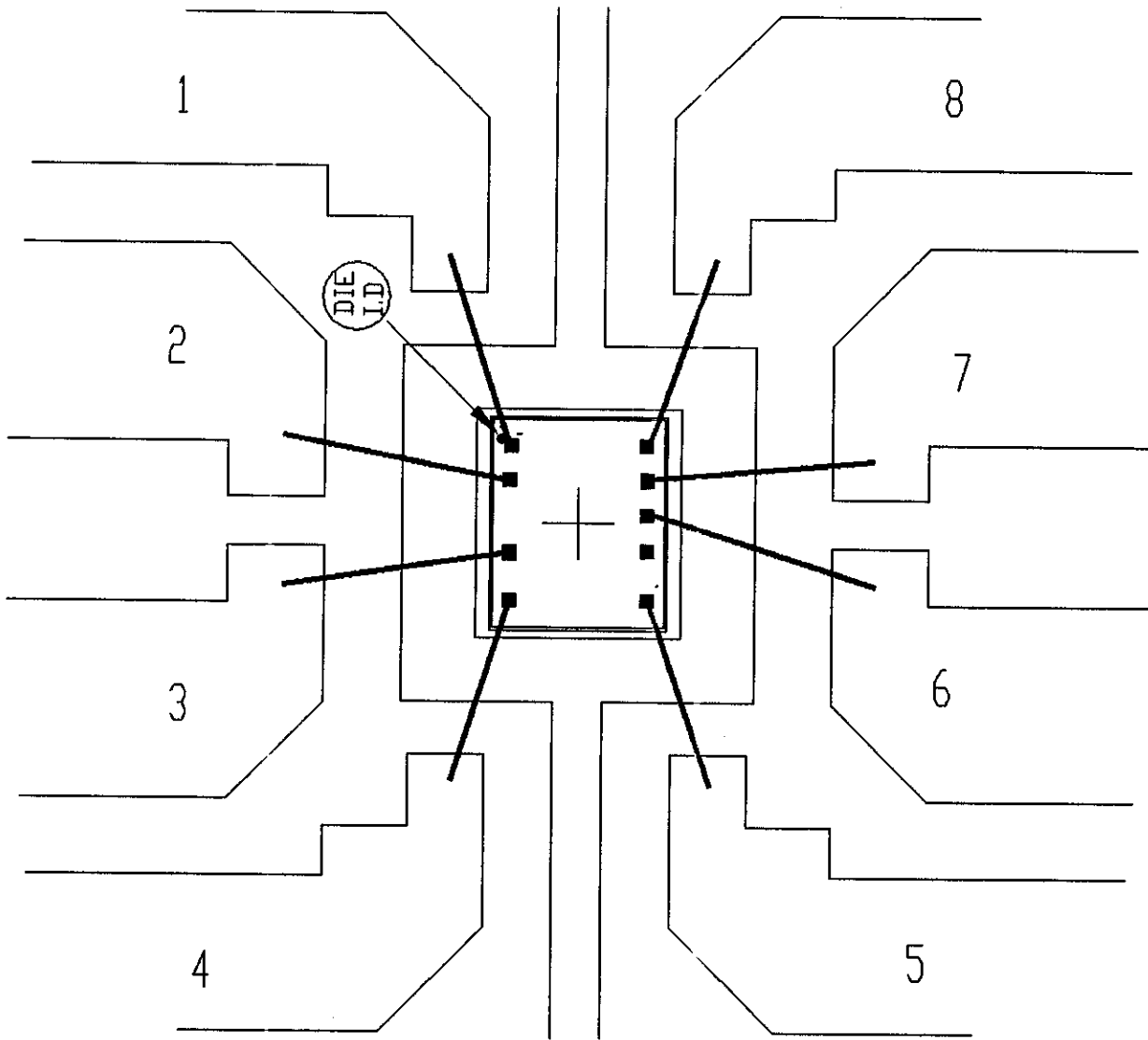
3/ Repeat pin combination I for each named Power supply and for ground

(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.





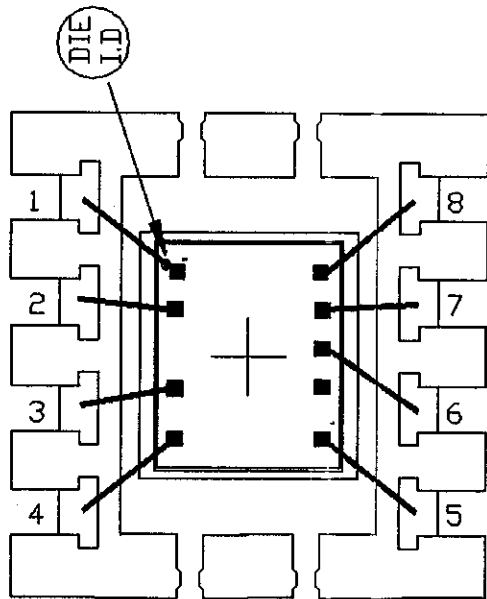
PKG.CODE: P8-1
 CAV./PAD SIZE: 100 X 100

PKG.
 DESIGN

APPROVALS

DATE

MAXIM
 BUILDSHEET NUMBER: 05-0401-0469
 REV: A



PKG. CODE: U8-1

APPROVALS

DATE



CAV./PAD SIZE:
68X94

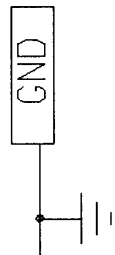
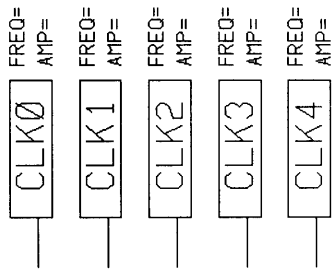
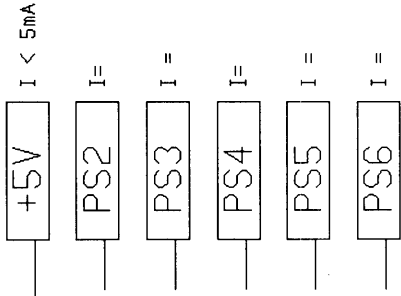
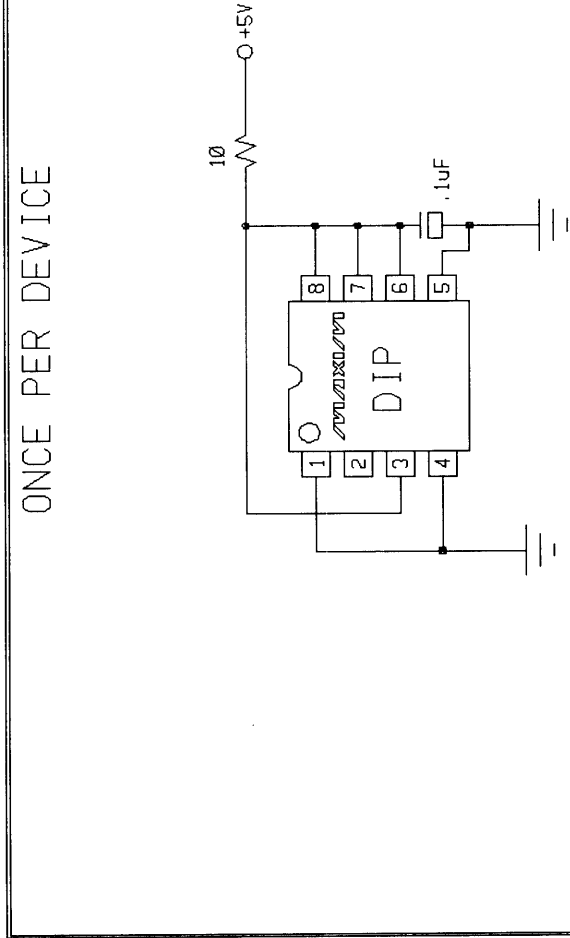
PKG.
DESIGN

BUILDSHEET NUMBER:
05-0401-0470

REV.:
A

ONCE PER BOARD

ONCE PER DEVICE



--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 CXJ COMMERCIAL
 CXJ HR/883

| | |
|---------------------------|-------------------------|
| SPEC. NO. 06-5177 REV : A | MAXIM BURN-IN SCHEMATIC |
| DATE : 2/2/96 | DEVICE TYPE(S) : |
| DRAWN BY : | MAX548/549/550 |