

RELIABILITY REPORT  
FOR  
**MAX5100xEUP**  
PLASTIC ENCAPSULATED DEVICES

March 10, 2004

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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## Conclusion

The MAX5100 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 MAX5100 parallel-input, voltage-output, quad 8-bit digital-to-analog converter (DAC) operates from a single +2.7V to +5.5V supply and comes in a space-saving 20-pin TSSOP package. Internal precision buffers swing Rail-to-Rail®, and the reference input range includes both ground and the positive rail. All four DACs share a common reference input.

The MAX5100 provides double-buffered logic inputs: four 8-bit buffer registers followed by four 8-bit DAC registers. This keeps the DAC outputs from changing during the write operation. An asynchronous control pin, LDAC-bar, allows for simultaneous updating of the DAC registers.

The MAX5100 features a shutdown mode that reduces current to 1nA, as well as a power-on reset mode that resets all registers to code 00 hex on power-up.

#### B. Absolute Maximum Ratings (Note 1)

<u>Item</u>	<u>Rating</u>
VDD to GND	-0.3V to +6V
D <sub>-</sub> , A0, WR, SHDN to GND	-0.3V to +6V
REF to GND	-0.3V to (VDD + 0.3V)
OUT <sub>-</sub> to GND	-0.3V to VDD
Maximum Current into Any Pin	±50mA
Operating Temperature Range	-40°C to +85°C
Maximum Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10sec)	+300°C
Continuous Power Dissipation (TA = +70°C)	
20-Pin TSSOP	559mW
Derates above +70°C	
20-Pin TSSOP	7.0W/°C

## II. Manufacturing Information

- A. Description/Function: +2.7V to +5.5V, Low-Power, Dual, Parallel 8-Bit DAC with Rail-to-Rail Voltage Outputs
- B. Process: S12 (Standard 1.2 micron silicon gate CMOS)
- C. Number of Device Transistors: 6848
- D. Fabrication Location: Oregon or California, USA
- E. Assembly Location: Malaysia or Philippines
- F. Date of Initial Production: October, 1999

## III. Packaging Information

- A. Package Type: **20-Pin TSSOP**
- B. Lead Frame: Copper
- C. Lead Finish: Solder Plate
- D. Die Attach: Silver-filled Epoxy
- E. Bondwire: Gold (1.0 mil dia.)
- F. Mold Material: Epoxy with silica filler
- G. Assembly Diagram: # 05- 0401-0513
- H. Flammability Rating: Class UL94-V0
- I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112: Level 1

## IV. Die Information

- A. Dimensions: 86 x 113 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:  $\text{SiO}_2$
- 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°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

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

Temperature Acceleration factor assuming an activation energy of 0.8eV

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

$$\lambda = 6.79 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5464) 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 DA80 die type has been found to have all pins able to withstand a transient pulse of  $\pm 1000\text{V}$ , per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of  $\pm 250\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX5100xEUP**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>PACKAGE</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		160	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	TSSOP	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
<b>Mechanical Stress</b> (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.

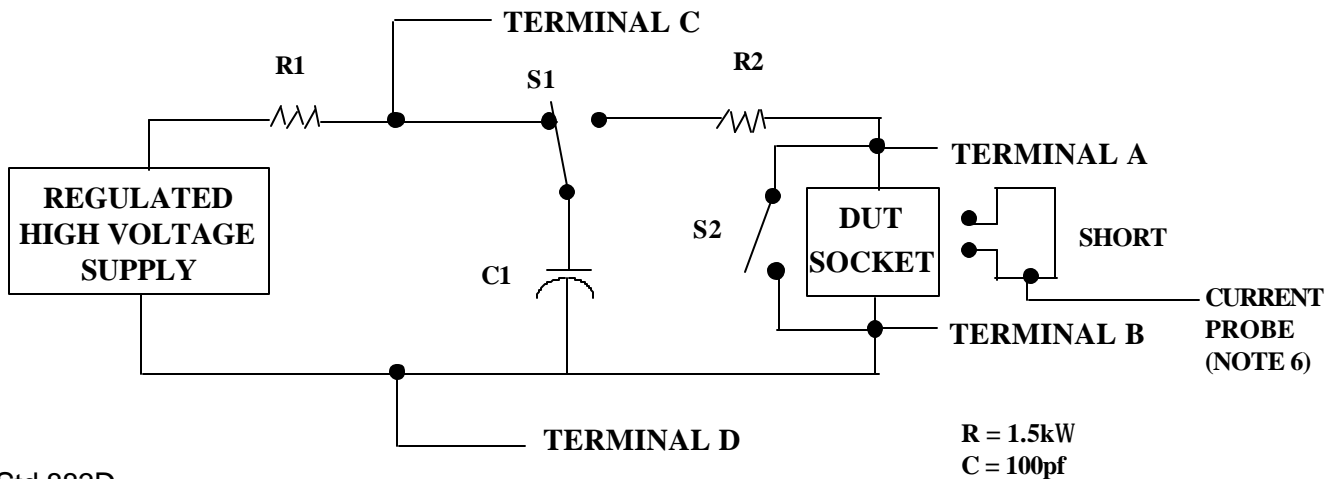
2/ No connects are not to be tested.

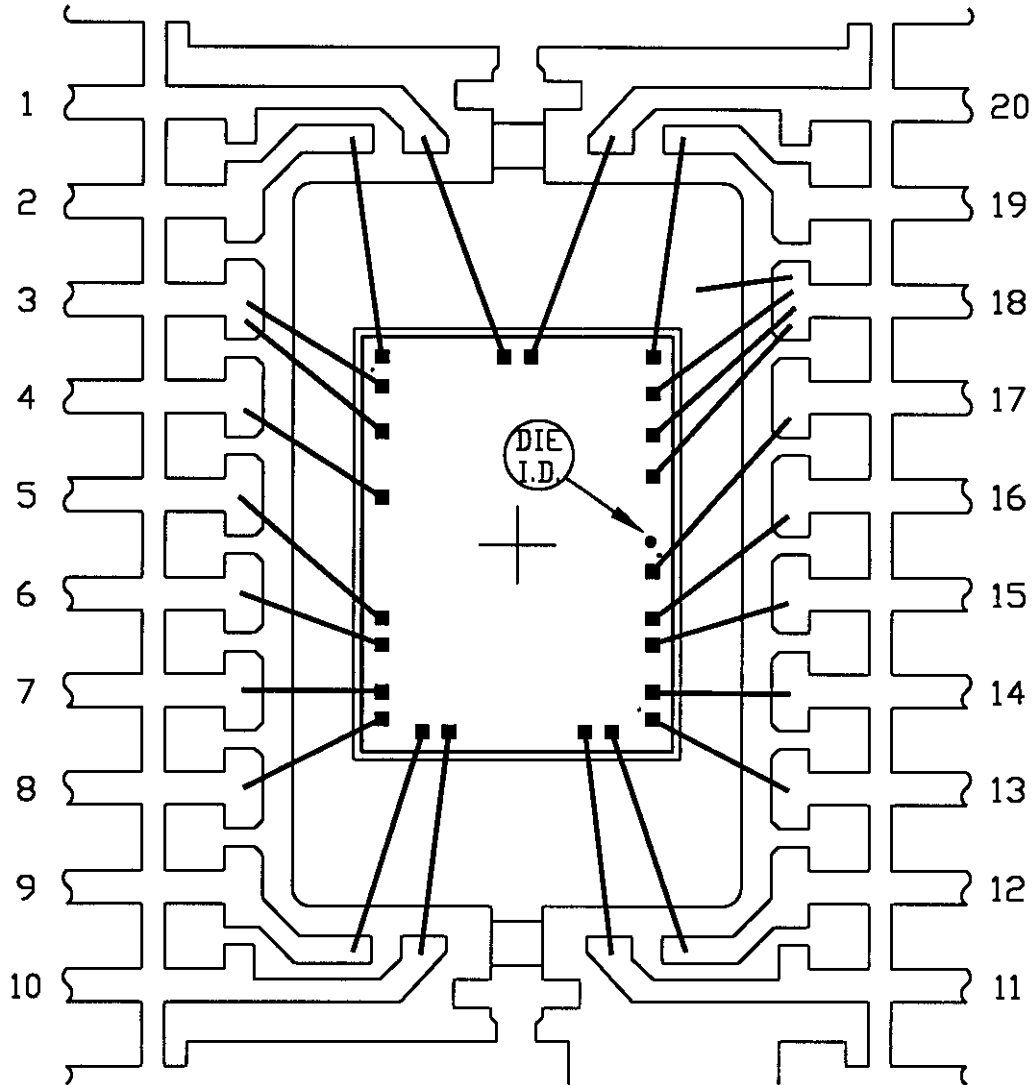
3/ Repeat pin combination I for each named Power supply and for ground

(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.

- 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.
- 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.
- 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: U20-2

APPROVALS

DATE



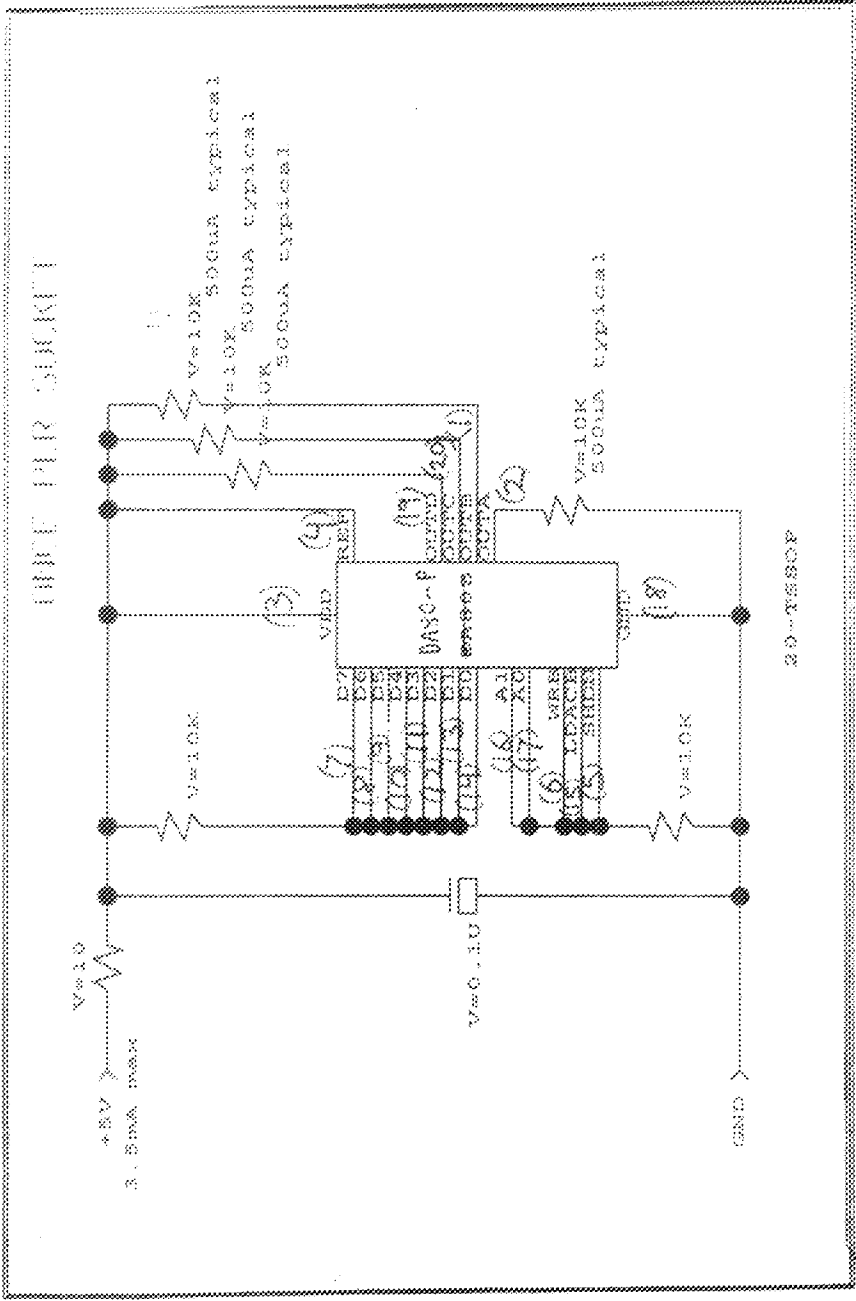
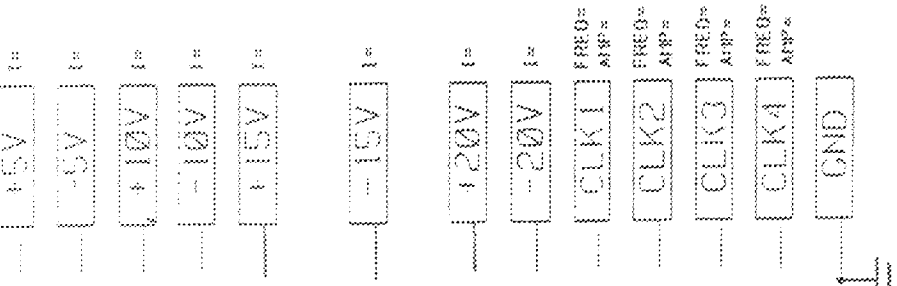
CAV./PAD SIZE:  
118X189

PKG.  
DESIGN

BUILDSHEET NUMBER:  
05-0401-0513

REV.:  
A

ONCE PER BOARD



20-TSSOP  
 - STEADY STATE LIFE TEST IS PER MIL-STD-883C H1001 H1002 H1003  
 - BURN-IN IS PER MIL-STD-883C H1015, E085, B

NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 155C CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL (X) HR/990

SPEC. 06-5464 REV. A

DATE: 6/10/99

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE: MAX 5100