

RELIABILITY REPORT  
FOR  
**MAX4023ExE**  
PLASTIC ENCAPSULATED DEVICES

January 21, 2004

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Reviewed by



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Executive Director

## Conclusion

The MAX4023 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 MAX4023 is a voltage feedback, multiplexer-amplifier combining low-glitch switching and excellent video specifications with fixed or settable gain. The MAX4023/ is a triple 2:1 multiplexers with adjustable gain amplifiers optimized for unity-gain stability. The device has 25ns channel switching time and low 10mV<sub>P-P</sub> switching transients, making it ideal for high-speed video-switching applications. This device operates from a single +4.5V to +11V supply or from dual supplies of ±2.25V to ±5.5V, and features an input common-mode voltage range that extends to the negative supply rail. A low-power disable mode places the output in a high-impedance state.

The MAX4023 has -3dB bandwidths of 260MHz and up to 330V/μs slew rates with a settable gain to equalize long cable runs. The MAX4023 internal amplifiers maintain an open-loop output impedance of only 18Ω over the full output voltage range, and minimize the gain error and bandwidth changes under loads typical of most Rail-to-Rail® amplifiers. This device is ideal for broadcast video applications with differential gain and phase errors of 0.07% and 0.07°, respectively.

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage (VCC to VEE)	12V
IN_A, IN_B, FB_	(VEE - 0.3V) to (VCC + 0.3V)
REF, EN, A/B	(VEE - 0.3V) to (VCC + 0.3V)
Current Into IN_A, IN_B, FB_	±20mA
Short-Circuit Duration (OUT_ to GND or VEE)	Continuous
Short-Circuit Duration (OUT_ to VCC)	(Note 1)
Operating Temperature Range	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Continuous Power Dissipation (TA = +70°C)	
16-Pin QSOP	667mW
16-Pin NSO	696mW
Derates above +70°C	
16-Pin QSOP	8.3mW/°C
16-Pin NSO	8.7mW/°C

**Note 1:** Do not short OUT\_ to VCC.

## II. Manufacturing Information

A. Description/Function:	Triple, 2:1 Video Multiplexer-Amplifiers with Settable Gain
B. Process:	CB2 (Complementary Bipolar Process)
C. Number of Device Transistors:	655
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Philippines, Malaysia, Korea or Thailand
F. Date of Initial Production:	January, 2003

## III. Packaging Information

A. Package Type:	<b>16-Lead Small Outline</b>	<b>16-Lead QSSOP</b>
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1.0 mil dia.)	Gold (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-9000-0056	# 05-9000-0057
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:	79 x 111 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	2 microns (as drawn)
F. Minimum Metal Spacing:	2 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

 Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 24.13 \times 10^{-9}$$

$$\lambda = 24.13 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. Attached Burn-In Schematic (Spec. # 06-6045) shows the static Burn-In circuit. Maxim performs failure analysis on any lot that exceeds this reliability control level. 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 VA19-2 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  $\pm 250\text{mA}$ .

**Table 1**  
Reliability Evaluation Test Results

**MAX4023ExE**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		45	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SO	77	0
			QSOP	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.

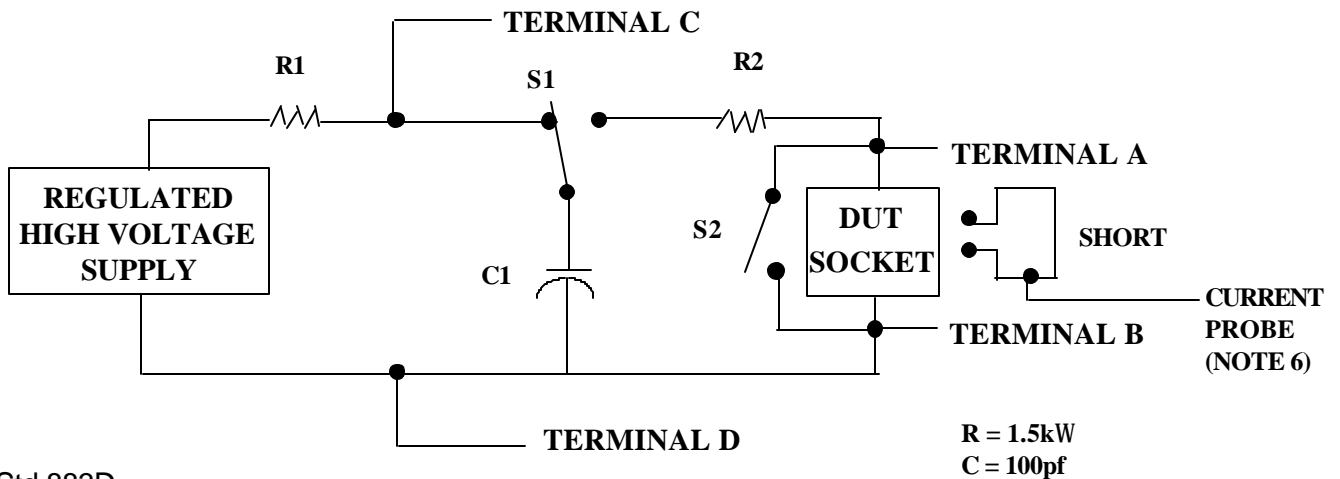
2/ No connects are not to be tested.

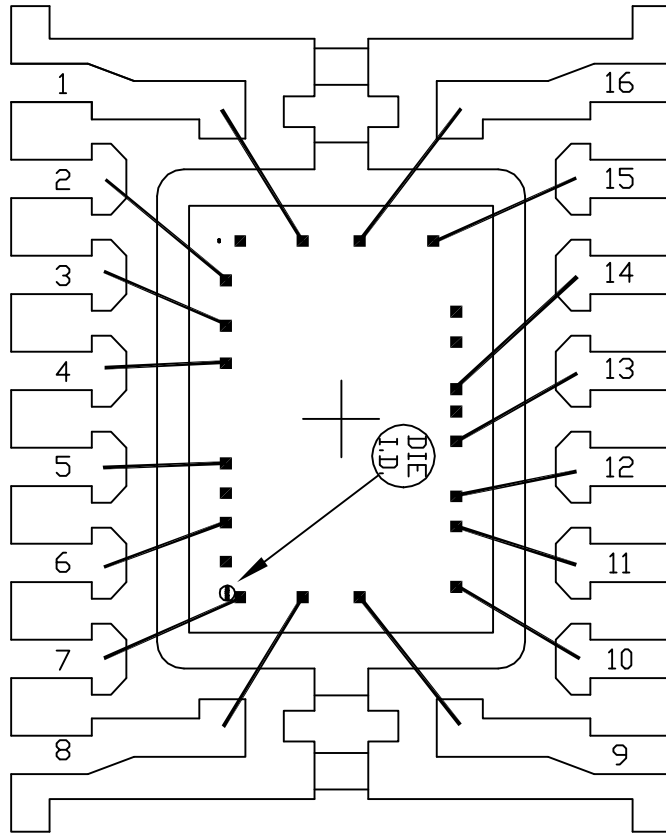
3/ Repeat pin combination I for each named Power supply and for ground

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

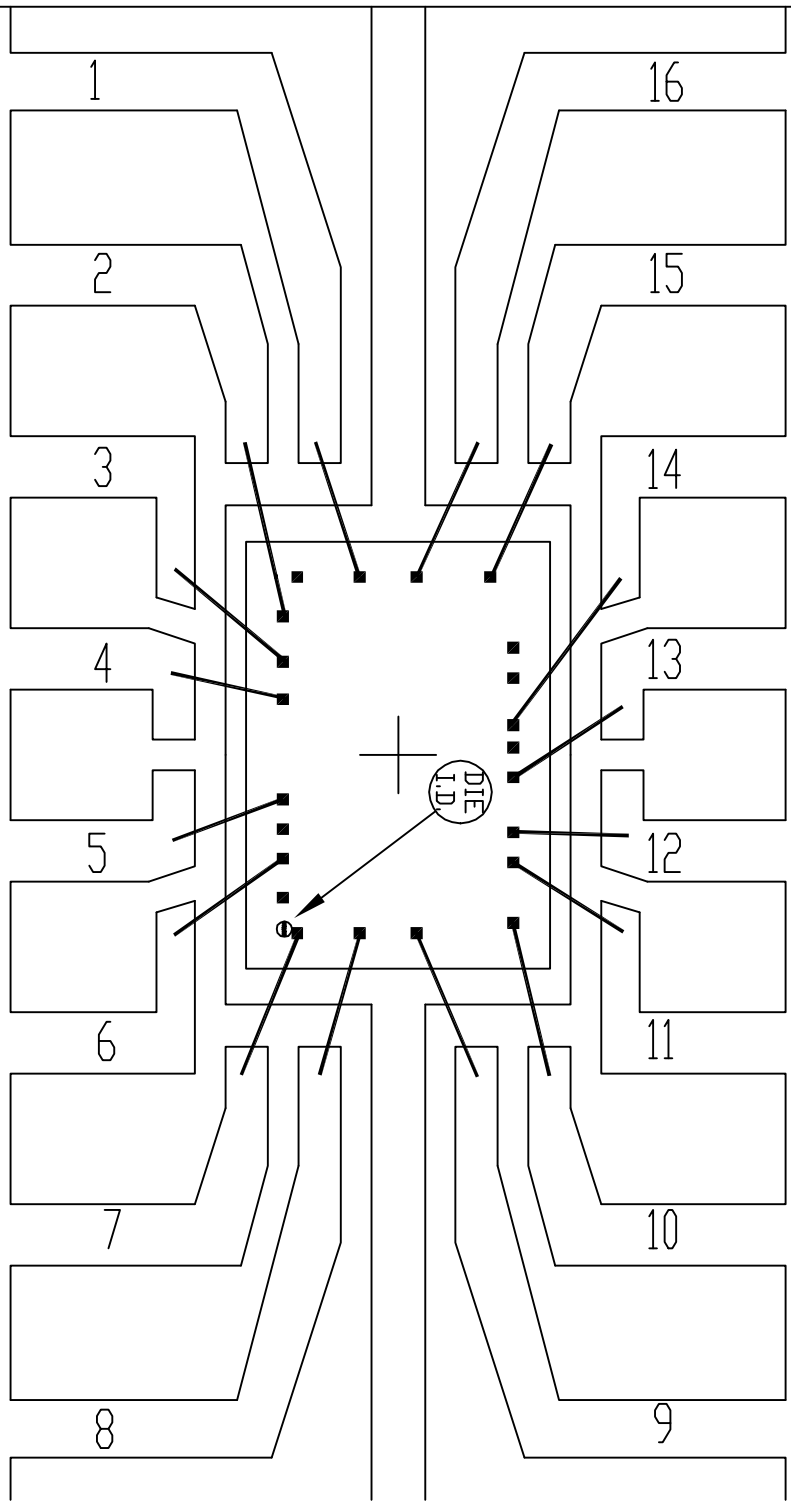
### 3.4 Pin combinations to be tested.

- 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: E16-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 96X130	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0057	REV: A

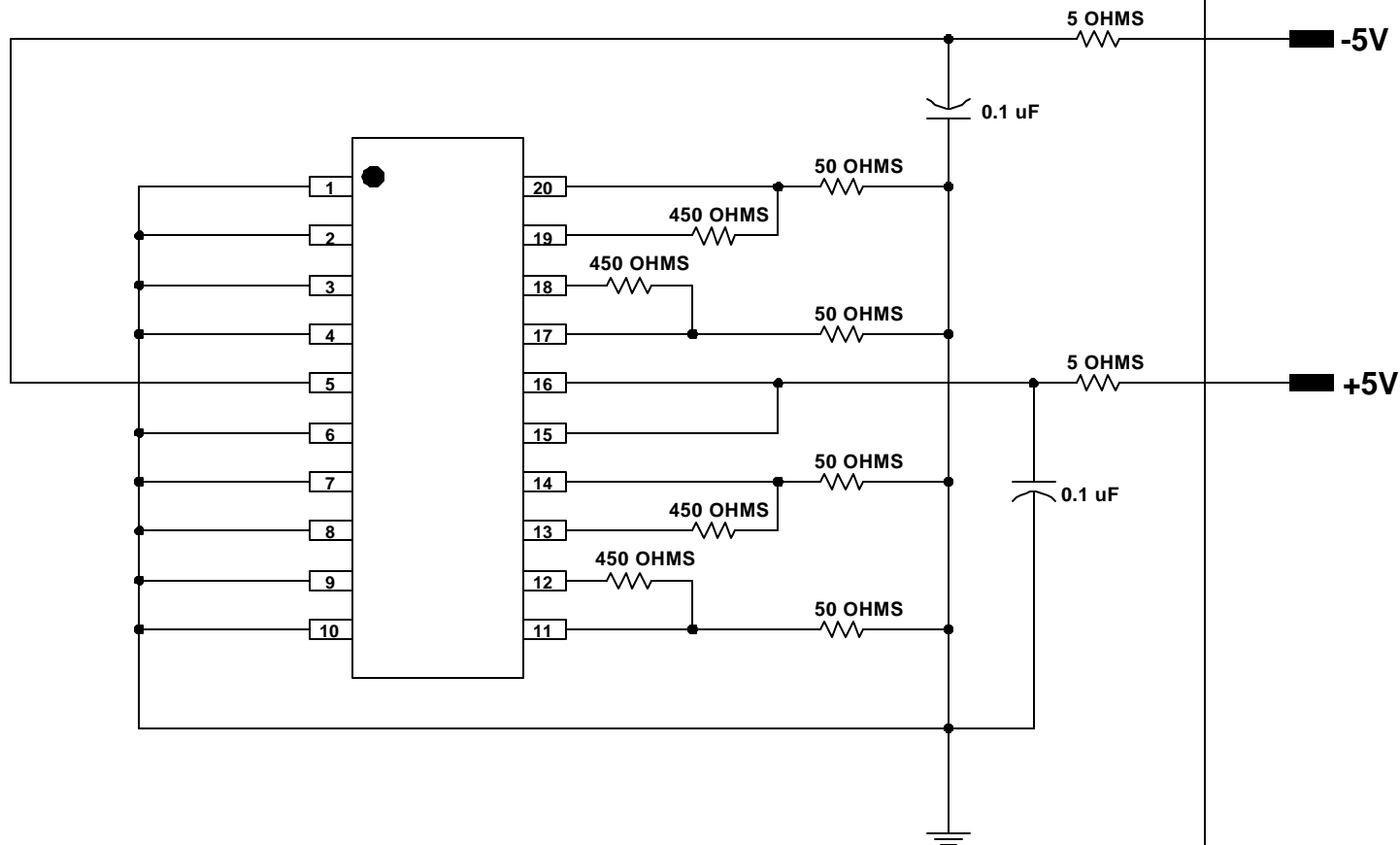


PKG. CODE: S16-2		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 90 X 130	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0056	REV: A



ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX 4025 (VA19Z)  
 PACKAGE: 20-TSSOP  
 MAX. EXPECTED CURRENT = 36mA (+/-5V).

DRAWN BY : TEK TAN  
 NOTES: