



RELIABILITY REPORT  
FOR  
MAX5496ETE+  
PLASTIC ENCAPSULATED DEVICES

January 5, 2010

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

<b>Approved by</b>
Ken Wendel
Quality Assurance
Director, Reliability Engineering

## Conclusion

The MAX5496ETE+ 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 MAX5494-MAX5499 10-bit (1024-tap), dual, nonvolatile, linear-taper, programmable voltage-dividers and variable resistors perform the function of a mechanical potentiometer, but replace the mechanics with a 3-wire SPI(tm)-compatible serial interface. The MAX5494/MAX5495 are dual, 3-terminal, programmable voltage-dividers; the MAX5496/MAX5497 are dual, 2-terminal variable resistors; and the MAX5498/MAX5499 include one 2-terminal variable resistor and one 3-terminal programmable voltage-divider. The MAX5494-MAX5499 feature an internal, nonvolatile, electrically erasable programmable read-only memory (EEPROM) that stores the wiper position for initialization during power-up. The 3-wire SPI-compatible serial interface allows communication at data rates up to 7MHz. The MAX5494-MAX5499 are ideal for applications requiring digitally controlled potentiometers. End-to-end resistance values of 10k and 50k are available with a 35ppm/°C end-to-end temperature coefficient. The ratiometric temperature coefficient is 5ppm/°C for each channel, making these devices ideal for applications requiring low-temperature-coefficient programmable voltage-dividers such as low-drift, programmable-gain amplifiers. The MAX5494-MAX5499 operate with either a single power supply (+2.7V to +5.25V) or dual power supplies (±2.5V). The devices consume 400µA (max) of supply current when writing data to the nonvolatile memory and 1.5µA (max) of standby supply current. The devices are available in space-saving (5mm x 5mm x 0.8mm), 16-pin TQFN package and are specified over the extended (-40°C to +85°C) temperature range.

**II. Manufacturing Information**

A. Description/Function:	10-Bit, Dual, Nonvolatile, Linear-Taper Digital Potentiometers
B. Process:	E35
C. Number of Device Transistors:	
D. Fabrication Location:	Texas
E. Assembly Location:	China, Thailand
F. Date of Initial Production:	April 22, 2005

**III. Packaging Information**

A. Package Type:	16-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-1661
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	48°C/W
K. Single Layer Theta Jc:	1.7°C/W
L. Multi Layer Theta Ja:	30°C/W
M. Multi Layer Theta Jc:	1.7°C/W

**IV. Die Information**

A. Dimensions:	108 X 111 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.35µm
F. Minimum Metal Spacing:	0.35µm
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:	Ken Wendel (Director, Reliability Engineering) Bryan Preeshl (Managing 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 125°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 22.4 \times 10^{-9}$$

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the E35 Process results in a FIT Rate of 0.68 @ 25C and 11.68 @ 55C (0.8 eV, 60% UCL)

### B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

### C. E.S.D. and Latch-Up Testing

The DP25-2 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000 V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX5496ETE+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)				
	Ta = 125°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	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