

RELIABILITY REPORT  
FOR  
MAX5437EUD+  
PLASTIC ENCAPSULATED DEVICES

February 19, 2010

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX5437EUD+ 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 MAX5436-MAX5439 are 128-tap high-voltage ( $\pm 5V$  to  $\pm 15V$ ) digital potentiometers in packages that are half the size of comparable devices in 8-pin SO. They perform the same function as mechanical potentiometers, but replace the mechanics with a simple digital interface. The digital logic is powered by a separate single +2.7V to +5.25V supply voltage (VCC). The resistor string uses its own analog supplies (VDD and VSS) that require  $V_{DD} - V_{SS}$  to be greater than 9V and less than 31.5V. This allows for greater flexibility in voltage ranges that can be used with these devices. Examples of analog supply ranges include not only dual voltages of  $\pm 5V$  to  $\pm 15V$ , but single-supply voltages, such as +10V, +15V, +30V, -30V, and more, as long as the ranges of  $V_{DD} - V_{SS}$  and  $V_{CC} - V_{SS}$  are met. The MAX5437/MAX5439 include an on-chip, high-voltage, uncommitted amplifier, providing additional reductions in board space and cost. Other features include low 35ppm/ $^{\circ}C$  end-to-end and 5ppm/ $^{\circ}C$  ratio-metric resistor temperature coefficients, a 3-wire SPI(tm)/QSPI(tm)/MICROWIRE(tm)-compatible serial interface, and a power-on reset to midscale. The MAX5436/MAX5438 are available in 10-pin  $\mu$ MAX<sup>®</sup> packages. The MAX5437/MAX5439 are available in 14-pin TSSOP package. Each device is guaranteed over the extended temperature range of -40 $^{\circ}C$  to +85 $^{\circ}C$ .

## II. Manufacturing Information

A. Description/Function:	±15V, 128-Tap, Low-Drift Digital Potentiometers
B. Process:	HV3
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	October 25, 2002

## III. Packaging Information

A. Package Type:	14-pin TSSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-0175
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:	110°C/W
K. Single Layer Theta Jc:	30°C/W
L. Multi Layer Theta Ja:	100.4°C/W
M. Multi Layer Theta Jc:	30°C/W

## IV. Die Information

A. Dimensions:	75 X 88 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:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 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:	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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 23.9 \times 10^{-9}$$
$$\lambda = 23.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 HV3 Process results in a FIT Rate of 0.10 @ 25C and 1.77 @ 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 DP14 die type has been found to have all pins able to withstand a HBM transient pulse of +/-600 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX5437EUD+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	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)				
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