

RELIABILITY REPORT  
FOR  
MAX5428EUA+  
PLASTIC ENCAPSULATED DEVICES

February 26, 2015

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
Sokhom Chum
Quality Assurance
Reliability Engineer

## Conclusion

The MAX5428EUA+ successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

## Table of Contents

<b>I. ....Device Description</b>	<b>IV. ....Die Information</b>
<b>II. ....Manufacturing Information</b>	<b>V. ....Quality Assurance Information</b>
<b>III. ....Packaging Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX5427/MAX5428/MAX5429 linear-taper digital potentiometers function as mechanical potentiometers, but replace the mechanics with a simple 2-wire digital interface. These digital potentiometers are unique in that they have an optional one-time programmable feature that either sets the wiper's power-on reset (POR) position to a user-defined value, or the wiper can be set and the interface disabled to prevent further adjustment. The MAX5427 has an end-to-end resistance of 100k , the MAX5428 a resistance of 50k , and the MAX5429 a resistance of 10k . All these devices have 32 wiper positions, operate from a single 2.7V to 5.5V supply, and use less than 1.5 $\mu$ A (max) static supply current. The MAX5427/MAX5428/MAX5429 are available in 8-pin thin QFN and  $\mu$ MAX® packages. Each device is guaranteed over the extended temperature range of -40°C to +85°C.

## II. Manufacturing Information

A. Description/Function:	32-Tap, One-Time Programmable, Linear-Taper Digital Potentiometers
B. Process:	C6Y
C. Number of Device Transistors:	1956
D. Fabrication Location:	Japan
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	April 27, 2002

## III. Packaging Information

A. Package Type:	8-pin uMAX
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:	#05-3401-0025
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:	221°C/W
K. Single Layer Theta Jc:	41.9°C/W
L. Multi Layer Theta Ja:	206.3°C/W
M. Multi Layer Theta Jc:	41.9°C/W

## IV. Die Information

A. Dimensions:	45X54 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	0.6 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Don Lipps (Manager, Reliability Engineering)  
Bryan Preeshl (Vice President 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 44 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 25 \times 10^{-9}$$

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

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the C6Y Process results in a FIT Rate of 0.17 @ 25C and 2.89 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (ESD lot EE01EQ002A D/C 1003, Latch-Up lot SE01CQ003A D/C0538)

The DP12-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX5428EUA+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	44	0	IE01AQ001B, D/C 0206

Note 1: Life Test Data may represent plastic DIP qualification lots.