

RELIABILITY REPORT
FOR
MAX5450EUB+
PLASTIC ENCAPSULATED DEVICES

August 22, 2010

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
Don Lipps
Quality Assurance
Manager, Reliability Engineering

Conclusion

The MAX5450EUB+ 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 MAX5450-MAX5455 are a family of dual digital potentiometers that perform the same function as a mechanical potentiometer or variable resistor. The MAX5451/MAX5453/MAX5455 have two 3-terminal potentiometers and the MAX5450/MAX5452/MAX5454 have two 2-terminal variable resistors. The MAX5450-MAX5455 operate from a +2.7V to +5.5V single-supply voltage and use an ultra-low supply current of 0.1 μ A. These devices consist of two fixed resistors each with 256 digitally-controlled wiper contacts. The convenient power-on reset (POR) sets the wiper to midscale position at power-up and the easy-to-use up/down interface allows glitchless switching between resistor taps. Six inputs control the 14-pin MAX5451/MAX5453/MAX5455 potentiometers. Four inputs control the 10-pin MAX5450/MAX5452/MAX5454 variable resistors. The MAX5450-MAX5455 are ideal for applications requiring digitally-controlled resistors. Three resistance values are available: 10k , 50k , and 100k . An end-to-end resistor temperature coefficient of 35ppm/ $^{\circ}$ C and a ratiometric temperature coefficient of 5ppm/ $^{\circ}$ C make the MAX5450-MAX5455 excellent choices for adjustable gain circuit requiring low-temperature drift. The MAX5450-MAX5455 are available in 10-pin μ MAX[®] and 14-pin TSSOP packages. Each device is guaranteed over the extended-industrial temperature range (-40 $^{\circ}$ C to +85 $^{\circ}$ C).

II. Manufacturing Information

A. Description/Function:	Dual, 256-Tap, Up/Down Interface, Digital Potentiometers
B. Process:	C6
C. Number of Device Transistors:	9680
D. Fabrication Location:	California
E. Assembly Location:	Thailand
F. Date of Initial Production:	April 25, 2001

III. Packaging Information

A. Package Type:	10-pin uMAX
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Non-conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-3375
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:	180°C/W
K. Single Layer Theta Jc:	41.9°C/W
L. Multi Layer Theta Ja:	113.1°C/W
M. Multi Layer Theta Jc:	41.9°C/W

IV. Die Information

A. Dimensions:	76 X 89 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu 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:	5 mil. Sq.
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Don Lipps (Manager, 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 (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 130 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

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

$$\lambda = 8.5 \times 10^{-9}$$

$\lambda = 8.5 \text{ F.I.T. (60\% confidence level @ 25°C)}$

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 C6 Process results in a FIT Rate of 0.43 @ 25C and 7.50 @ 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 DP11 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

Table 1
Reliability Evaluation Test Results

MAX5450EUB+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	130	0
Moisture Testing (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	DC Parameters & functionality	77	0
Mechanical Stress (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