

RELIABILITY REPORT
FOR
MAX5408EEE+
PLASTIC ENCAPSULATED DEVICES

November 30, 2010

MAXIM INTEGRATED PRODUCTS

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Approved by
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Conclusion

The MAX5408EEE+ 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 MAX5408-MAX5411 dual, logarithmic taper digital potentiometers, with 32-tap points each, replace mechanical potentiometers in audio applications requiring digitally controlled resistors. The MAX5408/MAX5410 are dual potentiometers with one wiper per potentiometer. The MAX5409/MAX5411 are dual potentiometers with two wipers per potentiometer (see Functional Diagram). An SPI-compatible serial interface controls the wiper positions. The MAX5408- MAX5411 have a factory-set resistance of 10k per potentiometer. A zero-crossing detect feature minimizes the audible noise generated by wiper transitions. The MAX5408-MAX5411 have nominal temperature coefficients of 35ppm/°C end-to-end and 5ppm/°C ratiometric. The MAX5408-MAX5411 are available in 16-pin QSOP and 16-pin thin QFN packages and are specified over the extended temperature range (-40°C to +85°C).

II. Manufacturing Information

A. Description/Function:	Dual, Audio, Log Taper Digital Potentiometers
B. Process:	C6Y
C. Number of Device Transistors:	12762
D. Fabrication Location:	California
E. Assembly Location:	Thailand
F. Date of Initial Production:	April 28, 2001

III. Packaging Information

A. Package Type:	16-pin QSOP
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:	#05-3401-0009
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:	120°C/W
K. Single Layer Theta Jc:	37°C/W
L. Multi Layer Theta Ja:	103.7°C/W
M. Multi Layer Theta Jc:	37°C/W

IV. Die Information

A. Dimensions:	81 X 80 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (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:	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 (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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 238 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 4.6 \times 10^{-9}$$
$$\lambda = 4.6 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 C6Y Process results in a FIT Rate of 0.90 @ 25C and 15.55 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot I3R0GA015, DC 0533)

The DP04 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

MAX5408EEE+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135°C	DC Parameters	80	0	I3R0DQ001I, DC 0207
	Biased	& functionality	78	0	I3R0CZ001E, DC 0227
	Time = 192 hrs.		80	0	I3R0BZ001D, DC 0116

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