RELIABILITY REPORT

FOR

MAX5494ETE+

PLASTIC ENCAPSULATED DEVICES

December 15, 2014

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

Approved by
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Quality Assurance
Reliability Engineer

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Conclusion

The MAX5494ETE+ 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.

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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.

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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:	January 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:	108X111 mils
B. Passivation:	Si_3N_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:	0.35um
F. Minimum Metal Spacing:	0.35um
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO_2
I. Die Separation Method:	Wafer Saw

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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 125C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 2454 \times 48 \times 2}$$ (Chi square value for MTTF upper limit)

(where 2454 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$\lambda = 40.5 \times 10^{-9}$

λ = 40.5 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 E35 Process results in a FIT Rate of 0.4 @ 25C and 6.84 @ 55C (0.8 eV, 60% UCL).

B. E.S.D. and Latch-Up Testing (lot CXG0AQ002A, D/C 0452)

The DP25 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.

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Table 1
Reliability Evaluation Test Results

MAX5494ETE+

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 125°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	CXG5AQ001T, 0453

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

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