RELIABILITY REPORT

FOR

MAX5115EEP+

PLASTIC ENCAPSULATED DEVICES

September 22, 2009

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

| **Approved by** |
| --- |
| Ken Wendel |
| Quality Assurance |
| Director, Reliability Engineering |

**Conclusion**

The MAX5115EEP+ 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.

**Table of Contents**



**I. Device Description**

A. General

The MAX5115/MAX5116 quad, 8-bit, digital-to-analog converters (DACs) feature nonvolatile registers. These nonvolatile registers store the DAC operating modes and output states, allowing the DACs to initialize to specified configurations at power-up. Precision on-chip output buffers swing rail-to-rail, and provide 8µs settling time. The I²C-compatible, 2-wire serial interface allows for a maximum clock frequency of 400kHz. The MAX5115 has independent high and low reference inputs allowing maximum output voltage range flexibility. The MAX5116 has single high and low reference inputs for all DACs to minimize trace count and save board space. The reference rails accept voltage inputs that range from ground to the positive supply rail. The devices operate from a single +2.7V to +5.25V supply and consume 200µA per DAC. A software-controlled power-down mode decreases supply current to less than 25µA. A software-controlled mute mode sets each DAC, or both DACs simultaneously, to their respective REFL_ voltages. The MAX5116 also includes an asynchronous active-low MUTE input, that drives all DAC outputs simultaneously to their respective REFL_ voltages. The MAX5115 is available in a 20-pin QSOP, and the MAX5116 is available in a 16-pin QSOP package. Both devices are specified for operation over the extended (-40°C to +85°C) temperature range.

## II. Manufacturing Information

| | |
|---|---|
| A. Description/Function: | Nonvolatile, Quad, 8-Bit DACs with 2-Wire Serial Interface |
| B. Process: | E35 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | Texas |
| E. Assembly Location: | Philippines |
| F. Date of Initial Production: | January 22, 2005 |

## III. Packaging Information

| | |
|---|---|
| A. Package Type: | 20-pin QSOP |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive Epoxy |
| E. Bondwire: | Gold (1 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-0918 |
| 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: | 34°C/W |
| L. Multi Layer Theta Ja: | 89°C/W |
| M. Multi Layer Theta Jc: | 30°C/W |

## IV. Die Information

| | |
|---|---|
| A. Dimensions: | 76 X 139 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: | 0.35µm |
| F. Minimum Metal Spacing: | 0.35µm |
| G. Bondpad Dimensions: | 5 mil. Sq. |
| H. Isolation Dielectric: | $SiO_2$ |
| I. Die Separation Method: | Wafer Saw |

## V. Quality Assurance Information

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|---|---|
| A. Quality Assurance Contacts: | Ken Wendel (Director, Reliability Engineering)<br>Bryan Preeshl (Managing Director of QA) |
| B. Outgoing Inspection Level: | 0.1% for all electrical parameters guaranteed by the Datasheet.<br>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 125°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 48 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 22.4 \times 10^{-9}$

$\lambda = 22.4$ 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 E35 Process results in a FIT Rate of 0.68 @ 25C and 11.68 @ 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 DB18 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 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

**MAX5115EEP+**

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES |
|---|---|---|---|---|
| **Static Life Test** (Note 1) | | | | |
| | Ta = 125°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | 48 | 0 |
| **Moisture Testing** (Note 2) | | | | |
| HAST | Ta = 130°C<br>RH = 85%<br>Biased<br>Time = 96hrs. | DC Parameters<br>& functionality | 77 | 0 |
| **Mechanical Stress** (Note 2) | | | | |
| Temperature Cycle | -65°C/150°C<br>1000 Cycles<br>Method 1010 | DC Parameters<br>& functionality | 77 | 0 |

Note 1: Life Test Data may represent plastic DIP qualification lots.
Note 2: Generic Package/Process data