RELIABILITY REPORT

FOR

MAX5173AEEE+T

PLASTIC ENCAPSULATED DEVICES

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MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

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Conclusion

The MAX5173AEEE+T 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 MAX5171/MAX5173 low-power, serial, voltage-output, 14-bit digital-to-analog converters (DACs) feature a precision output amplifier in a space-saving 16-pin QSOP package. The MAX5171 operates from a +5V single supply, and the MAX5173 operates from a +3V single supply. The output amplifier's inverting input is available to allow specific gain configurations, remote sensing, and high output current capability. This makes the MAX5171/ MAX5173 ideal for a wide range of applications, including industrial process control. Both devices draw only 260µA of supply current, which reduces to 1µA in shutdown mode. In addition, the programmable power-up reset feature allows for a user-selectable output voltage of either 0 or midscale. The 3-wire serial interface is compatible with SPI(tm), QSPI(tm), and MICROWIRE(tm) standards. An input register followed by a DAC register provides a double-buffered input, allowing the input and DAC registers to be updated independently or simultaneously with a 16-bit serial word. Additional features include software and hardware shutdown, shutdown lockout, a hardware clear pin, and a reference input capable of accepting DC and offset AC signals. These devices provide a programmable digital output pin for added functionality and a serial-data output pin for daisy-chaining. All logic inputs are TTL/CMOS-compatible and are internally buffered with Schmitt triggers to allow direct interfacing to optocouplers. The MAX5171/MAX5173 incorporate a proprietary on-chip circuit that keeps the output voltage virtually "glitch free," limiting the glitches to a few millivolts during power-up. Both devices are available in 16-pin QSOP packages and are specified for the extended (-40°C to +85°C) temperature range. The MAX5171/MAX5173 are pin-compatible upgrades to the 12-bit MAX5175/MAX5177. For 100% pin-compatible DACs with an internal reference, see the 13-bit MAX5132/MAX5133 and the 12-bit MAX5122/MAX5123 data sheets.

II. Manufacturing Information

A. Description/Function:	Low-Power, Serial, 14-Bit DACs with Force-Sense Voltage-Output
B. Process:	S12
C. Number of Device Transistors:	2451
D. Fabrication Location:	USA
E. Assembly Location:	Philippines, Thailand
F. Date of Initial Production:	April 23, 1999

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:	#05-7001-0353
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:	105°C/W
M. Multi Layer Theta Jc:	37°C/W

IV. Die Information

A. Dimensions:	120X86 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:	1.2 microns (as drawn)
F. Minimum Metal Spacing:	1.2 microns (as drawn)
G. Isolation Dielectric:	SiO_2
H. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Eric Wright (Reliability Engineering) Brian Standley (Manager, Reliability) 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 (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4340 \times 160 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 6.87 \times 10^{-9}$

$\lambda = 6.87$ 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 S12 Process results in a FIT Rate of 0.17 @ 25C and 3.00 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The DA73-1 die type has been found to have all pins able to withstand an 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 and overvoltage per JEDEC JESD78.

Table 1

Reliability Evaluation Test Results

MAX5173AEEE+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	160	0	

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