

RELIABILITY REPORT  
FOR  
MAX1312ECM+  
PLASTIC ENCAPSULATED DEVICES

May 3, 2010

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX1312ECM+ 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 MAX1304-MAX1306/MAX1308-MAX1310/MAX1312-MAX1314 12-bit, analog-to-digital converters (ADCs) offer eight, four, or two independent input channels. Independent track-and-hold (T/H) circuitry provides simultaneous sampling for each channel. The MAX1304/MAX1305/MAX1306 provide a 0 to +5V input range with  $\pm 6V$  fault-tolerant inputs. The MAX1308/MAX1309/MAX1310 provide a  $\pm 5V$  input range with  $\pm 16.5V$  fault-tolerant inputs. The MAX1312/MAX1313/MAX1314 have a  $\pm 10V$  input range with  $\pm 16.5V$  fault-tolerant inputs. These ADCs convert two channels in  $0.9\mu s$ , and up to eight channels in  $1.98\mu s$ , with an 8-channel throughput of 456ksps per channel. Other features include a 20MHz T/H input bandwidth, internal clock, internal (+2.5V) or external (+2.0V to +3.0V) reference, and power-saving modes. A 20MHz, 12-bit, bidirectional parallel data bus provides the conversion results and accepts digital inputs that activate each channel individually. All devices operate from a +4.75V to +5.25V analog supply and a +2.7V to +5.25V digital supply and consume 57mA total supply current when fully operational. Each device is available in a 48-pin 7mm x 7mm TQFP package and operates over the extended  $-40^{\circ}C$  to  $+85^{\circ}C$  temperature range.

**II. Manufacturing Information**

A. Description/Function:	8-/4-/2-Channel, 12-Bit, Simultaneous-Sampling ADCs with $\pm 10V$ , $\pm 5V$ , and 0 to $+5V$ Analog Input Ranges
B. Process:	C6Y
C. Number of Device Transistors:	34044
D. Fabrication Location:	Japan
E. Assembly Location:	Malaysia
F. Date of Initial Production:	January 24, 2004

**III. Packaging Information**

A. Package Type:	48-pin LQFP
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:	#05-9000-2375
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:	n/a
K. Single Layer Theta Jc:	n/a
L. Multi Layer Theta Ja:	44°C/W
M. Multi Layer Theta Jc:	10°C/W

**IV. Die Information**

A. Dimensions:	192 X 210 mils
B. Passivation:	$Si_3N_4/SiO_2$ (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 (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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 142 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 7.7 \times 10^{-9}$$

$\lambda = 7.7$  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. 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 AC44-2 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

**MAX1312ECM+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)				
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	142	0
<b>Moisture Testing</b> (Note 2)				
HAST	Ta = 130°C RH = 85% Biased Time = 96hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (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