

RELIABILITY REPORT  
FOR  
MAX197BCWI+  
PLASTIC ENCAPSULATED DEVICES

December 16, 2010

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX197BCWI+ 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 MAX197 multi-range, 12-bit data-acquisition system (DAS) requires only a single +5V supply for operation, yet accepts signals at its analog inputs that may span both above the power-supply rail and below ground. This system provides 8 analog input channels that are independently software programmable for a variety of ranges:  $\pm 10V$ ,  $\pm 5V$ ,  $0V$  to  $+10V$ , or  $0V$  to  $+5V$ . This increases effective dynamic range to 14 bits, and provides the user flexibility to interface 4mA-to-20mA,  $\pm 12V$ , and  $\pm 15V$  powered sensors to a single +5V system. In addition, the converter is overvoltage tolerant to  $\pm 16.5V$ ; a fault condition on any channel does **not** affect the conversion result of the selected channel. Other features include a 5MHz bandwidth track/hold, a 100ksps throughput rate, software-selectable internal or external clock and acquisition, 8+4 parallel interface, and an internal 4.096V or an external reference. A hardware active-low SHDN pin and two programmable power-down modes (STBYPD, FULLPD) are provided for low-current shutdown between conversions. In STBYPD mode, the reference buffer remains active, eliminating start-up delays. The MAX197 employs a standard microprocessor ( $\mu P$ ) interface. A three-state data I/O port is configured to operate with 8-bit data buses, and data-access and bus-release timing specifications are compatible with most popular  $\mu P$ s. All logic inputs and outputs are TTL/CMOS compatible. The MAX197 is available in 28-pin DIP, wide SO, SSOP, and ceramic SB packages. For a different combination of ranges ( $\pm 4V$ ,  $\pm 2V$ ,  $0V$  to  $4V$ ,  $0V$  to  $2V$ ), refer to the MAX199 data sheet. For 12-bit bus interface, refer to the MAX196 and MAX198 data sheets.

## II. Manufacturing Information

A. Description/Function:	Multi-Range ( $\pm 10V$ , $\pm 5V$ , $+10V$ , $+5V$ ), Single $+5V$ , 12-Bit DAS with 8+4 Bus Interface
B. Process:	S3
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia
F. Date of Initial Production:	Pre 1997

## III. Packaging Information

A. Package Type:	28-pin SOIC (W)
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-0101-0425
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:	80°C/W
K. Single Layer Theta Jc:	18°C/W
L. Multi Layer Theta Ja:	58°C/W
M. Multi Layer Theta Jc:	18°C/W

## IV. Die Information

A. Dimensions:	145 X 233 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:	3.0 microns (as drawn)
F. Minimum Metal Spacing:	3.0 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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 282 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 3.9 \times 10^{-9}$$

$$\lambda = 3.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 S3 Process results in a FIT Rate of 0.04 @ 25C and 0.69 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (ESD lot NGPBDA286B D/C 0207, Latchup lot NGPBDA286B D/C 0201)

The AD73-1 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

**MAX197BCWI+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C	DC Parameters & functionality	77	0	XGPCAA007A, D/C 9529
	Biased		80	0	XGPAAA009A, D/C 9532
	Time = 192 hrs.		45	0	XGPDAB001A, D/C 9504
			80	0	NGPDC2274A, D/C 0138

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