



RELIABILITY REPORT  
FOR  
MAX188ACAP+  
PLASTIC ENCAPSULATED DEVICES

February 2, 2010

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
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## Conclusion

The MAX188ACAP+ 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 MAX186/MAX188 are 12-bit data-acquisition systems that combine an 8-channel multiplexer, high-bandwidth track/hold, and serial interface together with high conversion speed and ultra-low power consumption. The devices operate with a single +5V supply or dual  $\pm 5V$  supplies. The analog inputs are software configurable for unipolar/bipolar and single-ended/differential operation. The 4-wire serial interface directly connects to SPI<sup>®</sup>, QSPI<sup>®</sup>, and MICROWIRE<sup>®</sup> devices without external logic. A serial strobe output allows direct connection to TMS320 family digital signal processors. The MAX186/MAX188 use either the internal clock or an external serial-interface clock to perform successive-approximation A/D conversions. The serial interface can operate beyond 4MHz when the internal clock is used. The MAX186 has an internal 4.096V reference while the MAX188 requires an external reference. Both parts have a reference-buffer amplifier that simplifies gain trim. The MAX186/MAX188 provide a hard-wired active-low SHDN pin and two software-selectable power-down modes. Accessing the serial interface automatically powers up the devices, and the quick turn-on time allows the MAX186/MAX188 to be shut down between every conversion. Using this technique of powering down between conversions, supply current can be cut to under 10 $\mu$ A at reduced sampling rates. The MAX186/MAX188 are available in 20-pin DIP and SO packages, and in a shrink small-outline package (SSOP), that occupies 30% less area than an 8-pin DIP. For applications that call for a parallel interface, see the MAX180/MAX181 data sheet. For anti-aliasing filters, consult the MAX274/MAX275 data sheet.

## II. Manufacturing Information

A. Description/Function:	Low-Power, 8-Channel, Serial 12-Bit ADCs
B. Process:	S3
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia, Philippines
F. Date of Initial Production:	Pre 1997

## III. Packaging Information

A. Package Type:	20-pin SSOP
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:	#05-0101-0372
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:	125°C/W
K. Single Layer Theta Jc:	33°C/W

## IV. Die Information

A. Dimensions:	117 X 151 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (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 <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Ken Wendel (Director, 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 2193 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 1.08 \times 10^{-9}$$

$\lambda = 1.08$  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. 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 AD62-2 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1000 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

**MAX188ACAP+**

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	2193	1
<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