



RELIABILITY REPORT  
FOR  
MAX11616EEE+  
PLASTIC ENCAPSULATED DEVICES

March 12, 2012

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX11616EEE+ 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 MAX11612-MAX11617 low-power, 12-bit, multichannel analog-to-digital converters (ADCs) feature internal track/hold (T/H), voltage reference, clock, and an I<sup>2</sup>C-compatible 2-wire serial interface. These devices operate from a single supply of 2.7V to 3.6V (MAX11613/MAX11615/MAX11617) or 4.5V to 5.5V (MAX11612/MAX11614/MAX11616) and require only 670μA at the maximum sampling rate of 94.4ksps. Supply current falls below 230μA for sampling rates under 46ksps. AutoShutdown(tm) powers down the devices between conversions, reducing supply current to less than 1μA at low throughput rates. The MAX11612/MAX11613 have 4 analog input channels each, the MAX11614/MAX11615 have 8 analog input channels each, while the MAX11616/MAX11617 have 12 analog input channels each. The fully differential analog inputs are software configurable for unipolar or bipolar, and single-ended or differential operation. The full-scale analog input range is determined by the internal reference or by an externally applied reference voltage ranging from 1V to VDD. The MAX11613/MAX11615/MAX11617 feature a 2.048V internal reference and the MAX11612/MAX11614/MAX11616 feature a 4.096V internal reference. The MAX11612/MAX11613 are available in an 8-pin μMAX® package and the MAX11613 is available in an ultra-small, 1.9mm x 2.2mm, 12-bump wafer-level package (WLP). The MAX11614-MAX11617 are available in a 16-pin QSOP package. The MAX11612-MAX11617 are guaranteed over the extended temperature range (-40°C to +85°C). For pin-compatible 10-bit parts, refer to the MAX11606-MAX11611 data sheet. For pin-compatible 8-bit parts, refer to the MAX11600-MAX11605 data sheet.

## II. Manufacturing Information

A. Description/Function:	Low-Power, 4-/8-/12-Channel, I <sup>2</sup> C, 12-Bit ADCs in Ultra-Small Packages
B. Process:	C6
C. Number of Device Transistors:	
D. Fabrication Location:	Japan
E. Assembly Location:	Malaysia, Philippines, Thailand
F. Date of Initial Production:	July 25, 2009

## III. Packaging Information

A. Package Type:	0.150 16L 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:	#05-9000-3644 / A
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	120°C/W
K. Single Layer Theta Jc:	37°C/W
L. Multi Layer Theta Ja:	103.7°C/W
M. Multi Layer Theta Jc:	37°C/W

## IV. Die Information

A. Dimensions:	86 X 80 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:	0.6 microns (as drawn)
F. Minimum Metal Spacing:	0.6 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- |                                   |  |
|-----------------------------------|--|
| A. Quality Assurance Contacts:    | Richard Aburano (Manager, Reliability Engineering)<br>Don Lipps (Manager, Reliability Engineering)<br>Bryan Preeshl (Vice President 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 biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 196 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 5.6 \times 10^{-9}$$

$$\lambda = 5.6 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 C6 Process results in a FIT Rate of 0.43 @ 25C and 7.50 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot E3N01A012 D/C 0921)

The AC30-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX11616EEE+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C	DC Parameters	48	0	E3N5FA009A, D/C 0922
	Biased	& functionality	48	0	E3N3HA004A, D/C 0850
	Time = 192 hrs.		50	0	I3N1FA015A, D/C 0513
			50	0	S3N2EQ001C, D/C 0517

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