

RELIABILITY REPORT  
FOR  
MAX1301BEUP+  
PLASTIC ENCAPSULATED DEVICES

June 2, 2014

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
Sokhom Chum
Quality Assurance
Reliability Engineer

## Conclusion

The MAX1301BEUP+ 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.

## Table of Contents

<b>I. ....Device Description</b>	<b>IV. ....Die Information</b>
<b>II. ....Manufacturing Information</b>	<b>V. ....Quality Assurance Information</b>
<b>III. ....Packaging Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX1300/MAX1301 multirange, low-power, 16-bit, successive-approximation, analog-to-digital converters (ADCs) operate from a single +5V supply and achieve throughput rates up to 115ksps. A separate digital supply allows digital interfacing with 2.7V to 5.25V systems using the SPI-/QSPI (tm)-/MICROWIRE®-compatible serial interface. Partial power-down mode reduces the supply current to 1.3mA (typ). Full power-down mode reduces the power-supply current to 1µA (typ). The MAX1300 provides eight (single-ended) or four (true differential) analog input channels. The MAX1301 provides four (single-ended) or two (true differential) analog input channels. Each analog input channel is independently software programmable for seven single-ended input ranges  $[0 \text{ to } (3 \times V_{REF})/2, (-3 \times V_{REF})/2 \text{ to } 0, 0 \text{ to } 3 \times V_{REF}, -3 \times V_{REF} \text{ to } 0, (\pm 3 \times V_{REF})/4, (\pm 3 \times V_{REF})/2, \pm 3 \times V_{REF}]$  and three differential input ranges  $[(\pm 3 \times V_{REF})/2, \pm 3 \times V_{REF}, \pm 6 \times V_{REF}]$ . An on-chip +4.096V reference offers a small convenient ADC solution. The MAX1300/MAX1301 also accept an external reference voltage between 3.800V and 4.136V. The MAX1300 is available in a 24-pin TSSOP package and the MAX1301 is available in a 20-pin TSSOP package. Each device is specified for operation from -40°C to +85°C.

## II. Manufacturing Information

A. Description/Function:	8- and 4-Channel, $\pm 3 \times V_{REF}$ Multirange Inputs, Serial 16-Bit ADCs
B. Process:	C6Y
C. Number of Device Transistors:	29149
D. Fabrication Location:	Japan
E. Assembly Location:	Philippines, Thailand
F. Date of Initial Production:	October 21, 2006

## III. Packaging Information

A. Package Type:	20-pin TSSOP
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:	#05-9000-0557
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:	91°C/W
K. Single Layer Theta Jc:	20°C/W
L. Multi Layer Theta Ja:	73.8°C/W
M. Multi Layer Theta Jc:	20°C/W

## IV. Die Information

A. Dimensions:	108X179 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (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:	
H. Isolation Dielectric:	SiO <sub>2</sub>
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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 22.9 \times 10^{-9}$$

$$\lambda = 22.9 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 C6Y Process results in a FIT Rate of 0.17 @ 25C and 2.89 @ 55C (0.8 eV, 60% UCL).

### B. E.S.D. and Latch-Up Testing (EGE0GQ003E D/C 1029)

The AC57 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 +/-250mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX1301BEUP+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0	SGE0DQ003B, D/C 0442

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