

RELIABILITY REPORT  
FOR  
MAX5816ATB+T  
PLASTIC ENCAPSULATED DEVICES

February 15, 2012

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX5816ATB+T 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.

## Table of Contents

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

### I. Device Description

#### A. General

The MAX5816 4-channel, low-power, 12-bit, voltage-output digital-to-analog converter (DAC) includes output buffers and an internal reference that is selectable to be 2.048V, 2.500V, or 4.096V. The MAX5816 accepts a wide supply voltage range of 2.7V to 5.5V with extremely low power (3mW) consumption to accommodate most low-voltage applications. A precision external reference input allows rail-to-rail operation and presents a 100k $\Omega$  (typ) load to an external reference.

The MAX5816 has an I<sup>2</sup>C-compatible, 2-wire interface that operates at clock rates up to 400kHz. The DAC output is buffered and has a low supply current of less than 250 $\mu$ A per channel and a low offset error of  $\pm$ 0.5mV (typ). On power-up, the MAX5816 resets the DAC outputs to zero, providing additional safety for applications that drive valves or other transducers which need to be off on power-up. The internal reference is initially powered down to allow use of an external reference. The MAX5816 allows simultaneous output updates using software LOAD commands. Multiple devices can simultaneously be updated using software load command in combination with the broadcast ID.

The MAX5816 is available in a 10-pin TDFN package and is specified over the -40°C to +125°C temperature range.

## II. Manufacturing Information

A. Description/Function:	Ultra-Small, Quad-Channel, 12-Bit Buffered Output DAC with Internal Reference and I <sup>2</sup> C Interface
B. Process:	S18
C. Number of Device Transistors:	43769
D. Fabrication Location:	USA
E. Assembly Location:	China and Thailand
F. Date of Initial Production:	December 21, 2011

## III. Packaging Information

A. Package Type:	10-pin TDFN 3x3
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:	#05-9000-4234
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:	54°C/W
K. Single Layer Theta Jc:	9°C/W
L. Multi Layer Theta Ja:	41°C/W
M. Multi Layer Theta Jc:	9°C/W

## IV. Die Information

A. Dimensions:	60.2362X80.3149 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:	Metal1 = 0.23 / Metal2-3 = 0.28 / Metal 4 = 2.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.23 / Metal2-3 = 0.28 / Metal 4 = 3.0 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)  
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.7 \times 10^{-9}$$

$$\lambda = 13.7 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 S18 Process results in a FIT Rate of 0.06 @ 25C and 1.04 @ 55C (0.8 eV, 60% UCL)

### B. E.S.D. and Latch-Up Testing (lot SABB2Q001B, D/C 1139)

The DB47 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

**MAX5816ATB+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	80	0	SABB2Q001B, D/C 1139

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