RELIABILITY REPORT

FOR

MAX11300GTL+T / MAX11300GCM+T

PLASTIC ENCAPSULATED DEVICES

January 26, 2015

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

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Conclusion

The MAX11300GTL+T / MAX11300GCM+T 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.

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I. Device Description

A. General

The MAX11300 integrates a PIXI(tm), 12-bit, multichannel, analog-to-digital converter (ADC) and a 12-bit, multichannel, buffered digital-to-analog converter (DAC) in a single integrated circuit (IC). This device offers 20 mixed-signal high-voltage, bipolar ports, which are configurable as an ADC analog input, a DAC analog output, a general-purpose input port (GPI), a general-purpose output port (GPO), or an analog switch terminal. One internal and two external temperature sensors track junction and environmental temperature, respectively. Adjacent pairs of ports are configurable as a logic-level translator for open-drain devices or an analog switch. Custom designs are easily created using the MAX11300 configuration GUI software. PIXI ports provide highly flexible hardware configuration for 12-bit mixed-signal applications. The MAX11300 is best suited for applications that demand a mixture of several analog and digital functions. Each port is individually configurable with up to four selectable voltage ranges within -10V to +10V. The MAX11300 allows for the averaging of 2, 4, 8, 16, 32, 64, or 128 ADC samples from each ADC-configured port to improve noise performance. A DAC-configured output port can drive up to 25mA. The GPIO ports can be programmed to user-defined logic levels, and a GPI coupled with a GPO forms a logic-level translator. Internal and external temperature measurements can monitor user-programmable conditions of minimum and maximum temperature limits, using the interrupt to notify the host if one or more conditions occur. The temperature measurement results are made available through the serial interface. The MAX11300 features an internal, low-noise 2.5V voltage reference and provides the option to use external voltage references with separate inputs for the DAC and ADC. The MAX11300 uses a 4-wire, 20MHz, SPI-compatible serial interface for communication with the host. The device operates from a 5V analog supply and a 1.8 V to 5.0V digital supply. The PIXI port driver voltage supply operates from a wide -12.5V to +12.5V. The MAX11300 is available in a 40-pin TQFN, 6mm x 6mm package or a 48-pin TQFP, 9mm x 9mm package specified over the -40°C to +105°C temperature range.

II. Manufacturing Information

A. Description/Function:	PIXI, 20-Port Programmable Mixed-Signal I/O with 12-Bit ADC, 12-Bit DAC, Analog Switches, and GPIO
B. Process:	S18
C. Number of Device Transistors:	363359
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan, Thailand
F. Date of Initial Production:	April 18, 2014

III. Packaging Information

A. Package Type:	40-pin TQFN 6x6	48-pin TQFP 7x7
B. Lead Frame:	Copper	Copper
C. Lead Finish:	100% matte Tin	100% matte Tin
D. Die Attach:	Non Conductive	Conductive
E. Bondwire:	Au (1.3 mil dia.)	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-5572	#05-9000-5573
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1	Level 3
J. Single Layer Theta Ja:	38°C/W	N/A°C/W
K. Single Layer Theta Jc:	1.0 °C/W	N/A°C/W
L. Multi Layer Theta Ja:	27°C/W	27.6°C/W
M. Multi Layer Theta Jc:	1.0°C/W	2°C/W

IV. Die Information

A. Dimensions:	150 X 150 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:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 microns (as drawn)
G. Bondpad Dimensions:	
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 (λ) is calculated as follows:

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

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

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

λ = 13.7 F.I.T. (60% confidence level @ 25°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 S18 Process results in a FIT Rate of 0.05 @ 25°C and 0.93 @ 55°C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot SAPS8Q002A D/C 1405)

The CO18-0 die type has been found to have all pins able to withstand an HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and overvoltage per JEDEC JESD78.

Table 1

Reliability Evaluation Test Results

MAX11300GTL+T / MAX11300GCM+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	80	0	SAZS7Q001B, D/C 1450

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