RELIABILITY REPORT

FOR

MAX12900ATJ+T

PLASTIC ENCAPSULATED DEVICES

January 11, 2018

MAXIM INTEGRATED

160 RIO ROBLES

SAN JOSE, CA 95134

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Conclusion

The MAX12900ATJ+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 MAX12900 is an ultra-low-power, highly integrated 20mA sensor transmitter. The MAX12900 integrates ten building blocks in a small package: a wide input supply voltage LDO, two conditioner circuits for pulse-width-modulated (PWM) inputs, two low-power, low-drift, general-purpose operational amplifiers (op amp) one wide bandwidth, zero-offset drift operational amplifier; two diagnostic comparators, a power-up sequencer with power good output to allow for a smooth power-up, and a low-drift voltage reference. The MAX12900 converts PWM data from a microcontroller into current over a 20mA loop with two, three, or four-wire configurations. The equivalent to an ultra-low-power, high-resolution, digital-to-analog converter is realized with the combination of two-PWM signals received from a microcontroller, the two conditioner circuits, and an active filter built with the integrated low-power op amp. The outputs of the two conditioner circuits provide a stable PWM amplitude over voltage supply and temperature variation. The wide bandwidth amplifier, in combination with a discrete transistor, converts a voltage input into a current output and allows HART and Foundation Fieldbus H1 signal modulation. The zero-offset operational amplifier and the low-drift voltage reference provide negligible error over wide temperature. The low-power operational amplifier and comparators provide building blocks for enhanced diagnostic features. Supply rail monitoring, output current readback, open circuit and failure detection are a few examples of diagnostic features. All these features, as well as ultralow- power and high accuracy make the MAX12900 ideal for loop-powered smart sensor transmitters for industrial application. The MAX12900 is available in 5mm x 5mm 32-pin TQFN package and operates over a wide industrial temperature range of -40°C to +125°C.

II. Manufacturing Information

A. Description/Function:	Ultra-Low-Power for 20mA Sensor Transmitter
B. Process:	S18
C. Fabrication Location:	USA
D. Assembly Location:	Thailand
E. Date of Initial Production:	September 26, 2017

III. Packaging Information

A. Package Type:	32-pin TQFN
B. Lead Frame:	Copper
C. Lead Finish:	NiPdAu
D. Die Attach:	Ab8600
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-100509
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:	53.7°C/W
K. Single Layer Theta Jc:	2°C/W
L. Multi Layer Theta Ja:	40.2°C/W
M. Multi Layer Theta Jc:	2°C/W

IV. Die Information

A. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
B. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
C. Minimum Metal Width:	0.23 microns (as drawn)
D. Minimum Metal Spacing:	0.23 microns (as drawn)
E. Isolation Dielectric:	SiO_2
F. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

A. Quality Assurance Contacts:	Eric Wright (Reliability Engineering) Brian Standley (Manager, Reliability) 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 (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{500 \times 4340 \times 240 \times 2}$$ (Chi square value for MTTF upper limit)

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

$\lambda = 1.76 \times 10^{-9}$

$\lambda = 1.76$ 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 @ 25C and 0.93 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing

The RV39-0 die type has been found to have all pins able to withstand an HBM transient pulse of +/-2000V 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

MAX12900ATJ+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)					
	Ta = 135C Biased Time = 500 hrs.	DC Parameters & functionality	240	0	

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