

RELIABILITY REPORT FOR  
MAX20303  
WAFER LEVEL DEVICES

February 10, 2018

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

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## Conclusion

The MAX20303 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 MAX20303 is a highly integrated and programmable power management solution designed for ultra-low-power wearable applications. It is optimized for size and efficiency to enhance the value of the end product by extending battery life and shrinking the overall solution size. A flexible set of power-optimized voltage regulators, including multiple bucks, boost, buck-boost, and linear regulators, provides a high level of integration and the ability to create a fully optimized power architecture. The quiescent current of each regulator is specifically suited for 1 $\mu$ A (typ) to extend battery life in always-on applications. The MAX20303 includes a complete battery management solution with battery seal, charger, power path, and fuel gauge. Both thermal management and input protection are built into the charger. The device also includes a factory programmable button controller with multiple inputs that are customizable to fit specific product UX requirements. Three integrated LED current sinks are included for indicator or backlighting functions, and an ERM/LRA driver with automatic resonance tracking is capable of providing sophisticated haptic feedback to the user. The device is configurable through an I<sup>2</sup>C interface that allows for programming various functions and reading device status, including the ability to read temperature and supply voltages with the integrated ADC. This device is available in a 56-bump, 0.5mm pitch 3.71mm x 4.21mm, wafer-level package (WLP) and operates over the -40°C to +85°C extended temperature range.

## II. Manufacturing Information

A. Description/Function:	Wearable Power Management Solution
B. Process:	S18
C. Number of Device Transistors:	723291
D. Fabrication Location:	USA, Taiwan
E. Assembly Location:	Taiwan, China
F. Date of Initial Production:	December 21, 2016

## III. Packaging Information

A. Package Type:	56-bump WLP
B. Lead Frame:	N/A
C. Lead Finish:	N/A
D. Die Attach:	None
E. Bondwire:	N/A (N/A mil dia.)
F. Mold Material:	None
G. Assembly Diagram:	#05-100364
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:	N/A°C/W
K. Single Layer Theta Jc:	N/A°C/W
L. Multi Layer Theta Ja:	33.35°C/W
M. Multi Layer Theta Jc:	N/A°C/W

## IV. Die Information

A. Dimensions:	165.748X146.063 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. Minimum Metal Width:	0.23 microns (as drawn)
E. Minimum Metal Spacing:	0.23 microns (as drawn)
F. Isolation Dielectric:	SiO <sub>2</sub>
G. 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 ( $\lambda$ ) 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)

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

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

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 0.40 @ 25C and 6.96 @ 55C (0.8 eV, 60% UCL)

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

The AL97 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 +/-250mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX20303**

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	48	0	

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