

RELIABILITY REPORT  
FOR  
MAX86160EFN+T  
PLASTIC ENCAPSULATED DEVICES

December 15, 2016

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

<b>Approved by</b>
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## Conclusion

The MAX86160EFN+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 MAX86160 is an integrated heart rate monitor sensor module designed for the demanding requirements of mobile, wearable, and hearable devices. It includes internal LEDs, photo-detector, and low-noise electronics with high-dynamic-range ambient light rejection. This integrated product is a complete system solution, and comes with plug-and-play software and robust algorithms to give meaningful outputs to the user with minimal additional design effort. The MAX86160 sensor module takes care of the most challenging parts of the design for fast time-to-market in mobile and wearable devices. The MAX86160 operates on a 1.8V supply voltage, with a separate 3.3V/5.0V power supply for the internal LEDs. Communication to and from the module occurs entirely through a standard I<sup>2</sup>C-compatible interface. The module can be shut down through software with near zero standby current, allowing the power rails to remain powered at all times.

**II. Manufacturing Information**

A. Description/Function:	Integrated Heart-Rate Sensor for In-Ear Applications
B. Process:	S18
C. Number of Device Transistors:	254561
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	August 18, 2016

**III. Packaging Information**

A. Package Type:	18-pin Optically Enhanced SiP
B. Lead Frame:	Substrate
C. Bondwire:	Au (1 mil dia.)
D. Mold Material:	Epoxy with silica filler
E. Assembly Diagram:	#05-100468
F. Flammability Rating:	Class UL94-V0
G. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	
H. Single Layer Theta Ja:	N/A°C/W
I. Single Layer Theta Jc:	N/A°C/W
J. Multi Layer Theta Ja:	174°C/W
K. Multi Layer Theta Jc:	150°C/W

**IV. Die Information**

A. Dimensions:	78.7401X114.1732 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:	0.23 microns (as drawn)
F. Minimum Metal Spacing:	0.23 microns (as drawn)
G. Isolation Dielectric:	SiO <sub>2</sub>
H. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

A. Quality Assurance Contacts:	Eric Wright (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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 230 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 4.78 \times 10^{-9}$$

$$\lambda = 4.78 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 OS46-1 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

**MAX86160EFN+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135C	DC Parameters & functionality	230	0	
	Biased Time = 192 hrs.				

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