



RELIABILITY REPORT  
FOR  
MAX86140ENP+T  
WAFER LEVEL DEVICES

December 22, 2017

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

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## Conclusion

The MAX86140ENP+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 MAX86140/MAX86141 are ultra-low-power, completely integrated, optical data acquisition systems. On the transmitter side, the MAX86140/MAX86141 have three programmable high-current LED drivers that can be configured to drive up to six LEDs. With two MAX86140/MAX86141 devices working in master-slave mode, the LED drivers can drive up to twelve LEDs. On the receiver side, MAX86140 consists of a single optical readout channels, while the MAX86141 has two optical readout channels that can operate simultaneously. The devices have low-noise signal conditioning analog front-end (AFE) including 19-bit ADC, an industry-lead ambient light cancellation (ALC) circuit, and a picket fence detect and replace algorithm. Due to the low power consumption, compact size, easy/flexible-to-use and industry-lead ambient light rejection capability of MAX86140/MAX86141, the devices are ideal for a wide variety of optical-sensing applications, such as pulse oximetry and heart rate detection. The MAX86140/MAX86141 operate on a 1.8V main supply voltage and a 3.1~5.5V LED driver supply voltage. Both devices support a standard SPI compatible interface and fully autonomous operation. Each device has a large 128-word built-in FIFO. The MAX86140/MAX86141 is available in compact wafer-level package (WLP) (2.048 x 1.848mm) with 0.4mm ball pitch.

## II. Manufacturing Information

A. Description/Function:	Best-in-Class Optical Pulse Oximeter and Heart-Rate Sensor for Wearable Health
B. Process:	S18
C. Number of Device Transistors:	398012
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	June 8, 2017

## III. Packaging Information

A. Package Type:	20-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:	#05-100548
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:	55.49°C/W
M. Multi Layer Theta Jc:	N/A°C/W

## IV. Die Information

A. Dimensions:	81.8897X74.0157 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)  
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:

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

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

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

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

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 OS58 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

**MAX86140ENP+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	

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