

RELIABILITY REPORT
FOR
MAX86176ENX+
MAX86176ENX+T

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MAXIM INTEGRATED

160 RIO ROBLES
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Conclusion

The MAX86176 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 MAX86176 is a complete photoplethysmogram (PPG) and electrocardiogram (ECG) analog front-end (AFE) solution for wearable applications. The MAX30005 is a complete AFE solution for ECG only. Both AFEs offer high performance for fitness and clinical applications with ultra-low power for long battery life.

Both MAX86176 and MAX30005 feature an ECG channel, EMI filtering, internal-lead biasing, AC and DC lead-off detection, right-leg drive, ultra-low power DC lead-on detection during standby mode, and extensive calibration voltages for built in self-test. In addition, the MAX86176 has a PPG data acquisition system supporting up to 6 LEDs and 4 photodiode inputs, which is fully synchronized with the ECG signal path. The MAX86176/MAX30005 can operate with either internal or external clock. The MAX86176/ MAX30005 are designed to meet IEC 60601-2-47 Ambulatory ECG Systems monitoring compliance for even the most challenging dry electrode applications.

The MAX86176/MAX30005 are available in a 6x6 36-bump wafer-level packages (WLP), operating over the -40°C to +85°C temperature range.

II. Manufacturing Information

A. Description/Function:	Ultra-Low-Power, Optical PPG and Single-Lead ECG AFE
B. Process:	S18
C. Device Count:	408028
D. Fabrication Location:	USA
E. Assembly Location:	Taiwan
F. Date of Initial Production:	October 13, 2020

III. Packaging Information

A. Package Type:	THIN WLP
B. Lead Frame:	N/A
C. Lead Finish:	SAC125Ni
D. Die Attach:	N/A
E. Bondwire:	N/A
F. Mold Material:	N/A
G. Assembly Diagram:	05-101438
H. Flammability Rating:	UL-94 (V-0 Rating)
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	N/A
K. Single Layer Theta Jc:	N/A
L. Multi Layer Theta Ja:	45.72 °C/W
M. Multi Layer Theta Jc:	N/A

IV. Die Information

A. Dimensions:	107.874X108.6614 mils
B. Passivation:	SiN/ SiO2

V. Quality Assurance Information

A. Quality Assurance Contacts:	Ryan Wall (Manager, Reliability) Michael Cairnes (Executive Director, Reliability) Bryan Preeshl (SVP 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 125C biased (static) life test are shown in Table 1. Using these results, the Failure Rate λ is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 2454 \times 80 \times 2} \text{ (Chi square value for MTTF upper limit)}$$

(where 2454 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 24.3 \times 10^{-9}$$

$$\lambda = 24.3 \text{ FITs (60\% confidence level @25°C)}$$

Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <https://www.maximintegrated.com/en/support/qa-reliability/reliability/reliability-monitor-program.html>.

S18 cumulative process Fit

$$\lambda = 0.02 \text{ FITs (60\% confidence level @25°C)}$$

$$\lambda = 0.24 \text{ FITs (60\% confidence level @55°C)}$$

B. ESD and Latch-Up Testing

The MAX86176 has been found to have all pins able to withstand an HBM transient pulse of ± 2500 V per JEDEC / ESDA JS-001. Latch-Up testing has shown that this device withstands ± 250 mA current injection and supply overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results
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TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 125°C Biased Time = 192 hrs.	DC parameters & functionality	80	0	

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