



RELIABILITY REPORT
FOR
MAX30001CTI+T
PLASTIC ENCAPSULATED DEVICES

December 20, 2017

MAXIM INTEGRATED

160 RIO ROBLES
SAN JOSE, CA 95134

 Eric Wright Reliability Engineer	 Brian Standley Manager, Reliability
--	--

Conclusion

The MAX30001CTI+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.

Table of Contents

I.Device Description	IV..... Die Information
II.Manufacturing Information	V..... Quality Assurance Information
III.Packaging Information	VI..... Reliability Evaluation
.....Attachments	

I. Device Description

A. General

The MAX30001 is a complete, biopotential and bioimpedance (BioZ), analog front-end (AFE) solution for wearable applications. It offers high performance for clinical and fitness applications, with ultra-low power for long battery life. The MAX30001 is a single biopotential channel providing electrocardiogram (ECG) waveforms, heart rate and pacemaker edge detection, and a single bioimpedance channel capable of measuring respiration. The biopotential and bioimpedance channels have ESD protection, EMI filtering, internal lead biasing, DC leads-off detection, ultra-low-power, leads-on detection during standby mode, and extensive calibration voltages for built-in self-test. Soft power-up sequencing ensures no large transients are injected into the electrodes. Both channels also have high input impedance, low noise, high CMRR, programmable gain, various low-pass and high-pass filter options, and a high-resolution analog-to-digital converter. The biopotential channel is DC coupled, can handle large electrode voltage offsets, and has a fast recovery mode to quickly recover from overdrive conditions, such as defibrillation and electro-surgery. The bioimpedance channel includes integrated programmable current drive, works with common electrodes, and has the flexibility for 2 or 4 electrode measurements. It also has AC lead off detection. The MAX30001 is available in a 28-pin TQFN and 30-bump wafer-level package (WLP), operating over the 0°C to +70°C commercial temperature range.

II. Manufacturing Information

A. Description/Function:	Ultra-Low-Power, Single-Channel Integrated Biopotential (ECG, R-to-R, and Pace Detection) and Bioimpedance (BioZ) AFE
B. Process:	TS18
C. Number of Device Transistors:	547431
D. Fabrication Location:	Taiwan
E. Assembly Location:	Taiwan, China, Thailand
F. Date of Initial Production:	September 19, 2017

III. Packaging Information

A. Package Type:	28-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Bondwire:	Au (1.3 mil dia.)
E. Mold Material:	Epoxy with silica filler
F. Assembly Diagram:	#05-100164
G. Flammability Rating:	Class UL94-V0
H. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
I. Single Layer Theta Ja:	47°C/W
J. Single Layer Theta Jc:	1.7°C/W
K. Multi Layer Theta Ja:	29°C/W
L. Multi Layer Theta Jc:	1.7°C/W

IV. Die Information

A. Dimensions:	109.1496X116.4724 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (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 ₂
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 (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 79 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.9 \times 10^{-9}$$

$$\lambda = 13.9 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 TS18 Process results in a FIT Rate of 0.24 @ 25C and 4.14 @ 55C (0.8 eV, 60% UCL)

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

The OT02-0 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

MAX30001CTI+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	79	0	

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