RELIABILITY REPORT FOR

MAX44284

WAFER LEVEL DEVICES

July 29, 2014

**MAXIM INTEGRATED**

160 RIO ROBLES

SAN JOSE, CA 95134

| **Approved by** |
| --- |
| Eric Wright |
| Quality Assurance |
| Reliability Engineering |

## Conclusion

The MAX44284 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

A. General

The MAX44284 is a high-side, current-sense amplifier that operates with a 1.7V to 5.5V single supply and is optimized for very low power operation with only 21µA of quiescent current. The MAX44284 offers precision accuracy specifications of 2µV VOS and gain error of 0.05%. The device features an input common-mode voltage range from -0.1V to +36V. This current-sense amplifier has a voltage output and is offered in four different gain versions. The MAX44284 is offered in small 6-bump, 0.4mm-pitch WLP (1.3mm x 0.9mm) and 6-pin SOT23 packages and is specified for operation over the -40°C to +125°C automotive temperature range.

## II. Manufacturing Information

| | |
|---|---|
| A. Description/Function: | 36V, Input Common-Mode, High-Precision, Low-Power Current-Sense Amplifier |
| B. Process: | S18 |
| C. Number of Device Transistors: | 5291 |
| D. Fabrication Location: | USA |
| E. Assembly Location: | USA |
| F. Date of Initial Production: | December 20, 2013 |

## III. Packaging Information

| | | |
|---|---|---|
| A. Package Type: | 6-bump WLP 2x3 | 6-lead SOT23 |
| B. Lead Frame: | N/A | Copper |
| C. Lead Finish: | N/A | 100% matte Tin |
| D. Die Attach: | None | Conductive |
| E. Bondwire: | N/A (N/A mil dia.) | Au (1 mil dia.) |
| F. Mold Material: | None | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-5238 | #05-9000-5239 |
| H. Flammability Rating: | Class UL94-V0 | Class UL94-V0 |
| I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C | Level 1 | Level 1 |
| J. Single Layer Theta Ja: | N/A°C/W | N/A°C/W |
| K. Single Layer Theta Jc: | N/A°C/W | 80°C/W |
| L. Multi Layer Theta Ja: | 95°C/W | 230°C/W |
| M. Multi Layer Theta Jc: | °C/W | 76°C/W |

## IV. Die Information

| | |
|---|---|
| A. Dimensions: | 34.6457 X 50.3937 mils |
| B. Passivation: | $Si_3N_4/SiO_2$ (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. Bondpad Dimensions: | |
| H. Isolation Dielectric: | $SiO_2$ |
| I. Die Separation Method: | Wafer Saw |

## V. Quality Assurance Information

| | |
|---|---|
| A. Quality Assurance Contacts: | Don Lipps (Manager, Reliability Engineering)<br>Bryan Preeshl (Vice President of QA) |
| B. Outgoing Inspection Level: | 0.1% for all electrical parameters guaranteed by the Datasheet.<br>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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ($\lambda$) is calculated as follows:

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

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

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

$\lambda = 13.9$ 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 0.05 @ 25°C and 0.93 @ 55°C (0.8 eV, 60% UCL)

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

The OY88-1 die type has been found to have all pins able to withstand a transient pulse of:

| | |
|---|---|
| ESD-HBM: | +/- 2500V per JEDEC JESD22-A114 |
| ESD-CDM: | +/- 750V per JEDEC JESD22-C101 |

Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

**Table 1**

Reliability Evaluation Test Results

**MAX44284**

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|---|---|---|---|---|---|
| **Static Life Test** (Note 1) | | | | | |
| | Ta = 135°C<br>Biased<br>Time = 192 hrs. | DC Parameters<br>& functionality | 79 | 0 | SAOK9Q002A, D/C 1342 |

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