

RELIABILITY REPORT
FOR
MAX4165EUK+
(MAX4165-MAX4169)
PLASTIC ENCAPSULATED DEVICES

January 7, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

| |
|-----------------------------------|
| Approved by |
| Ken Wendel |
| Quality Assurance |
| Director, Reliability Engineering |

Conclusion

The MAX4165EUK+ successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

Table of Contents

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

I. Device Description

A. General

The MAX4165-MAX4169 family of operational amplifiers combines excellent DC accuracy with high output current drive, single-supply operation, and rail-to-rail inputs and outputs. These devices operate from a single +2.7V to +6.5V supply, or from dual $\pm 1.35\text{V}$ to $\pm 3.25\text{V}$ supplies. They typically draw 1.2mA supply current, and are guaranteed to deliver 80mA output current. The MAX4166/MAX4168 have a shutdown mode that reduces supply current to 38 μA per amplifier and places the outputs into a high-impedance state. The MAX4165-MAX4169's precision performance combined with high output current, wide input/output dynamic range, single-supply operation, and low power consumption makes them ideal for portable audio applications and other low-voltage, battery-powered systems. The MAX4165 is available in the space-saving 5-pin SOT23 package and the MAX4166 is available in a tiny 2mm x 2mm x 0.8mm μDFN package.

II. Manufacturing Information

| | |
|----------------------------------|--|
| A. Description/Function: | High-Output-Drive, Precision, Low-Power, Single-Supply, Rail-to-Rail I/O Op Amps with Shutdown |
| B. Process: | CB20 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | Oregon |
| E. Assembly Location: | Carsem Malaysia, ISPL Philippines, Hana Thailand, UTL Thailand, Unisem Malaysia |
| F. Date of Initial Production: | April 26, 1997 |

III. Packaging Information

| | |
|--|--------------------------|
| A. Package Type: | 5-pin SOT23 |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive Epoxy |
| E. Bondwire: | Gold (1 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-3001-0017 |
| 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: | 324.3°C/W |
| K. Single Layer Theta Jc: | 82°C/W |

IV. Die Information

| | |
|----------------------------|--|
| A. Dimensions: | 57 X 38 mils |
| B. Passivation: | Si ₃ N ₄ (Silicon nitride) |
| C. Interconnect: | Gold |
| D. Backside Metallization: | None |
| E. Minimum Metal Width: | 2 microns (as drawn) |
| F. Minimum Metal Spacing: | 2 microns (as drawn) |
| G. Bondpad Dimensions: | 5 mil. Sq. |
| H. Isolation Dielectric: | SiO ₂ |
| I. Die Separation Method: | Wafer Saw |

V. Quality Assurance Information

- A. Quality Assurance Contacts: Ken Wendel (Director, Reliability Engineering)
Bryan Preeshl (Managing Director 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 150°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

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

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

$$\lambda = 13.4 \times 10^{-9}$$

$\lambda = 13.4$ F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the CB20 Process results in a FIT Rate of 0.14 @ 25C and 2.14 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The OP16 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

Table 1
Reliability Evaluation Test Results

MAX4165EUK+

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES |
|---|--|----------------------------------|-------------|--------------------|
| Static Life Test (Note 1) | Ta = 150°C Biased Time = 192 hrs. | DC Parameters & functionality | 80 | 0 |
| Moisture Testing (Note 2) 85/85 | Ta = 85°C RH = 85% Biased Time = 1000hrs. | DC Parameters & functionality | 77 | 0 |
| Mechanical Stress (Note 2) Temperature Cycle | -65°C/150°C 1000 Cycles Method 1010 | DC Parameters & functionality | 77 | 0 |

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

Note 2: Generic Package/Process data