



RELIABILITY REPORT
FOR MAX9972xCCS+
PLASTIC ENCAPSULATED DEVICES

April 6, 2010

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

| |
|---------------------------------|
| Approved by |
| Richard Aburano |
| Quality Assurance |
| Manager, Reliability Operations |

Conclusion

The MAX9972xCCS+ 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 MAX9972 four-channel, ultra-low-power, pin-electronics IC includes, for each channel, a three-level pin driver, a window comparator, a passive load, and force-and-sense Kelvin-switched parametric measurement unit (PMU) connections. The driver features a -2.2V to +5.2V voltage range, includes high-impedance and active-termination (3rd-level drive) modes, and is highly linear even at low voltage swings. The window comparator features 500MHz equivalent input bandwidth and programmable output voltage levels. The passive load provides pullup and pulldown voltages to the device-under-test (DUT). Two grade versions are available, A grade and B grade. The A-grade version provides tight gain and offset matching for the driver and comparator, allowing reference levels to be shared across multiple channels. It also provides tighter tolerance of the load resistance values. The B-grade version is for system designs that incorporate independent reference levels for each channel. Low-leakage, high-impedance, and terminate controls are operational configurations that are programmed through a 3-wire, low-voltage, CMOS-compatible serial interface. High-speed PMU switching is realized through dedicated digital control inputs. This device is available in an 80-pin, 12mm x 12mm body, 1.0mm pitch TQFP with an exposed 6mm x 6mm die pad on the bottom of the package for efficient heat removal. The MAX9972 is specified to operate over the 0°C to +70°C commercial temperature range, and features a die temperature monitor output.

II. Manufacturing Information

| | |
|----------------------------------|--|
| A. Description/Function: | Quad, Ultra-Low-Power, 300Mbps ATE Drivers/Comparators |
| B. Process: | CB4 |
| C. Number of Device Transistors: | 8973 |
| D. Fabrication Location: | Oregon |
| E. Assembly Location: | Korea |
| F. Date of Initial Production: | April 22, 2006 |

III. Packaging Information

| | |
|--|--------------------------|
| A. Package Type: | 80-pin TQFP |
| B. Lead Frame: | Copper |
| C. Lead Finish: | 100% matte Tin |
| D. Die Attach: | Conductive |
| E. Bondwire: | Au (1 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-9000-4077 |
| H. Flammability Rating: | Class UL94-V0 |
| I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C | Level 3 |
| J. Single Layer Theta Ja: | °C/W |
| K. Single Layer Theta Jc: | °C/W |
| L. Multi Layer Theta Ja: | 28°C/W |
| M. Multi Layer Theta Jc: | 2°C/W |

IV. Die Information

| | |
|----------------------------|--|
| A. Dimensions: | 156 X 215 mils |
| B. Passivation: | Si ₃ N ₄ (Silicon nitride) |
| C. Interconnect: | Au |
| D. Backside Metallization: | None |
| E. Minimum Metal Width: | Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn) |
| F. Minimum Metal Spacing: | Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 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: | Richard Aburano (Manager, Reliability Operations) 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 288 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 3.8 \times 10^{-9}$$
$$\lambda = 3.8 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the CB4 Process results in a FIT Rate of 0.24 @ 25C and 4.09 @ 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 AT10 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of 250mA.

Table 1
Reliability Evaluation Test Results

MAX9972xCCS+

| 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 | 288 | 0 |
| Moisture Testing (Note 2) | | | | |
| HAST | Ta = 130°C RH = 85% Biased Time = 96hrs. | DC Parameters & functionality | 269 | 0 |
| Mechanical Stress (Note 2) | | | | |
| Temperature Cycle | -65°C/150°C 1000 Cycles Method 1010 | DC Parameters & functionality | 461 | 0 |

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

Note 2: Generic Package/Process data