RELIABILITY REPORT
FOR
MAX7219CNG+
PLASTIC ENCAPSULATED DEVICES

May 19, 2011

MAXIM INTEGRATED PRODUCTS
120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
Sokhom Chum
Quality Assurance
Reliability Engineer
Conclusion

The MAX7219CNG+ 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
II. Manufacturing Information
III. Packaging Information
IV. Die Information
V. Quality Assurance Information
VI. Reliability Evaluation

I. Device Description

A. General

The MAX7219/MAX7221 are compact, serial input/output common-cathode display drivers that interface microprocessors (µPs) to 7-segment numeric LED displays of up to 8 digits, bar-graph displays, or 64 individual LEDs. Included on-chip are a BCD code-B decoder, multiplex scan circuitry, segment and digit drivers, and an 8x8 static RAM that stores each digit. Only one external resistor is required to set the segment current for all LEDs. The MAX7221 is compatible with SPI(tm), QSPI(tm), and MICROWIRE(tm), and has slew-rate-limited segment drivers to reduce EMI. A convenient 4-wire serial interface connects to all common µPs. Individual digits may be addressed and updated without rewriting the entire display. The MAX7219/MAX7221 also allow the user to select code-B decoding or no-decode for each digit. The devices include a 150µA low-power shutdown mode, analog and digital brightness control, a scan-limit register that allows the user to display from 1 to 8 digits, and a test mode that forces all LEDs on. For applications requiring 3V operation or segment blinking, refer to the MAX6951 data sheet.
II. Manufacturing Information

A. Description/Function: Serially Interfaced, 8-Digit, LED Display Drivers
B. Process: B12
C. Number of Device Transistors: 
D. Fabrication Location: Oregon
E. Assembly Location: Philippines
F. Date of Initial Production: Pre 1997

III. Packaging Information

A. Package Type: 24-pin PDIP
B. Lead Frame: Copper
C. Lead Finish: 100% matte Tin
D. Die Attach: Conductive
E. Bondwire: Au (1.3 mil dia.)
F. Mold Material: Epoxy with silica filler
G. Assembly Diagram: #05-0501-0136
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: 75°C/W
K. Single Layer Theta Jc: 30°C/W
L. Multi Layer Theta Ja: N/A
M. Multi Layer Theta Jc: N/A

IV. Die Information

A. Dimensions: 80 X 85 mils
B. Passivation: Si$_3$N$_4$/SiO$_2$ (Silicon nitride/Silicon dioxide)
C. Interconnect: Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization: None
E. Minimum Metal Width: 1.2 microns (as drawn)
F. Minimum Metal Spacing: 1.2 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:
   Richard Aburano (Manager, Reliability Engineering)
   Don Lipps (Manager, Reliability Engineering)
   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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ($\lambda$) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 160 \times 2}$$

(Chi square value for MTTF upper limit)

(Chi square value for MTTF upper limit)

($\text{MTTF} = 192 \times 4340 \times 160 \times 2$)

(Chi square value for MTTF upper limit)

($\text{MTTF} = 192 \times 4340 \times 160 \times 2$)

($\lambda = 6.9 \times 10^{-9}$)

($\lambda = 6.9 \text{ F.I.T. (60% confidence level @ 25°C)}$)

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 B12 Process results in a FIT Rate of 0.06 @ 25°C and 1.06 @ 55°C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (ESD lot IW7ABA098B D/C 0221, Latch-Up lot SW7ACQ001E D/C 0329)

The DD12 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250mA.
Table 1
Reliability Evaluation Test Results

<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Life Test (Note 1)</td>
<td>Ta = 135°C</td>
<td>DC Parameters</td>
<td>80</td>
<td>0</td>
<td>IW7ABA098B, D/C 0221</td>
</tr>
<tr>
<td>Biased</td>
<td>&amp; functionality</td>
<td>80</td>
<td>0</td>
<td>IW7AAA009B, D/C 9921</td>
<td></td>
</tr>
</tbody>
</table>

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