RELIABILITY REPORT
FOR
MAX31D80T+
PLASTIC ENCAPSULATED DEVICES

June 28, 2010

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

Approved by
Don Lipps
Quality Assurance Manager, Reliability Engineering
Conclusion

The MAX31D80T+ 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.

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I. Device Description

A. General

The MAX31C80/MAX31D80 are spread-spectrum clock generators that contain a phase-locked loop (PLL) that generates a 2MHz to 134MHz clock from an input clock or crystal. The PLL can provide a spread-spectrum down-dithered (MAX31D80) or center-dithered (MAX31C80) frequency-modulated clock. The devices also buffer the incoming clock and provide this output on a separate pin. The MAX31C80/MAX31D80 are provided in a 10-pin TDFN package and operate over a full -40°C to +125°C automotive temperature range. Devices can be factory programmed for multiple combinations of input and output frequencies (see the Ordering Information table). A low-cost, low-frequency crystal can be used at the input to generate frequencies up to 134MHz.
II. Manufacturing Information

A. Description/Function: Spread-Spectrum Clock Generators
B. Process: S4
C. Number of Device Transistors: 19739
D. Fabrication Location: California, Texas or Japan
E. Assembly Location: Thailand
F. Date of Initial Production: April 23, 2010

III. Packaging Information

A. Package Type: 10-pin TDFN 3x3
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:
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: 54°C/W
K. Single Layer Theta Jc: 8.5°C/W
L. Multi Layer Theta Ja: 41°C/W
M. Multi Layer Theta Jc: 8.5°C/W

IV. Die Information

A. Dimensions: 62 X 70 mils
B. Passivation: Si$_3$N$_4$/SiO$_2$ (Silicon nitride/ Silicon dioxide)
C. Interconnect: Al with Ti/TiN Barrier
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:
   - Don Lipps (Manager, 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (\( \lambda \)) is calculated as follows:

\[
\lambda = \frac{1}{MTTF} = \frac{1}{1.83} = 0.5461
\]

(Chi square value for MTTF upper limit)

\[
MTTF = \frac{192 \times 4340 \times 45 \times 2}{(4340 = \text{Temperature Acceleration factor assuming an activation energy of 0.8eV})}
\]

\[\lambda = 43.2 \times 10^{-9}\]

\[\lambda = 43.2 \text{ F.I.T. (60% confidence level @ 25°C)}\]

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 S4 Process results in a FIT Rate of 0.05 @ 25C and 0.83 @ 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 MI06 die type has been found to have all pins able to withstand a HBM transient pulse of +/-4000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA.
# Table 1

Reliability Evaluation Test Results

## MAX31D80+

<table>
<thead>
<tr>
<th>TEST ITEM</th>
<th>TEST CONDITION</th>
<th>FAILURE IDENTIFICATION</th>
<th>SAMPLE SIZE</th>
<th>NUMBER OF FAILURES</th>
</tr>
</thead>
</table>
| **Static Life Test** (Note 1) | Ta = 135°C  
Biased  
Time = 192 hrs. | DC Parameters & functionality | 45          | 0                  |
| **Moisture Testing** (Note 2) | HASTTa = 130°C  
RH = 85%  
Biased  
Time = 96hrs. | DC Parameters & functionality | 77          | 0                  |
| **Mechanical Stress** (Note 2) | Temperature -65°C/150°C  
Cycle 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