PRODUCT RELIABILITY REPORT
FOR

DS24B33

Maxim Integrated Products

4401 South Beltwood Parkway
Dallas, TX 75244-3292

Prepared by:

Don Lipps
Manager, Reliability Engineering
Maxim Integrated Products
4401 South Beltwood Pkwy.
Dallas, TX 75244-3292
Email: don.lipps@maxim-ic.com
ph: 972-371-3739
Conclusion:
The following qualification successfully meets the quality and reliability standards required of all Maxim products:

DS24B33

In addition, Maxim's continuous reliability monitor program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards. The current status of the reliability monitor program can be viewed at http://www.maxim-ic.com/TechSupport/dsreliability.html.

Device Description:
A description of this device can be found in the product data sheet. You can find the product data sheet at http://dbserv.maxim-ic.com/l_datasheet3.cfm.

Reliability Derating:
The Arrhenius model will be used to determine the acceleration factor for failure mechanisms that are temperature accelerated.

\[ A_{TF} = \exp\left(\frac{(E_a / k)}{(1/T_u - 1/T_s)}\right) = \frac{tu}{ts} \]

\[ A_{TF} = \text{Acceleration factor due to Temperature} \]
\[ tu = \text{Time at use temperature (e.g. 55°C)} \]
\[ ts = \text{Time at stress temperature (e.g. 125°C)} \]
\[ k = \text{Boltzmann's Constant} \times \text{(eV/K)} \]
\[ T_u = \text{Temperature at Use (°K)} \]
\[ T_s = \text{Temperature at Stress (°K)} \]
\[ E_a = \text{Activation Energy (e.g. 0.7 ev)} \]

The activation energy of the failure mechanism is derived from either internal studies or industry accepted standards, or activation energy of 0.7ev will be used whenever actual failure mechanisms or their activation energies are unknown. All deratings will be done from the stress ambient temperature to the use ambient temperature.

An exponential model will be used to determine the acceleration factor for failure mechanisms, which are voltage accelerated.

\[ A_{VF} = \exp(B(V_s - V_u)) \]

\[ A_{VF} = \text{Acceleration factor due to Voltage} \]
\[ V_s = \text{Stress Voltage (e.g. 7.0 volts)} \]
\[ V_u = \text{Maximum Operating Voltage (e.g. 5.5 volts)} \]
\[ B = \text{Constant related to failure mechanism type (e.g. 1.0, 2.4, 2.7, etc.)} \]

The Constant, B, related to the failure mechanism is derived from either internal studies or industry accepted standards, or a B of 1.0 will be used whenever actual failure mechanisms or their B are unknown. All deratings will be done from the stress voltage to the maximum operating voltage.

Failure rate data from the operating life test is reported using a Chi-Squared statistical model at the 60% or 90% confidence level (Cf).

The failure rate, Fr, is related to the acceleration during life test by:

\[ Fr = \frac{X}{(ts \times A_{VF} \times A_{TF} \times N \times 2)} \]
\[ X = \text{Chi-Sq statistical upper limit} \]
\[ N = \text{Life test sample size} \]
Failure Rates are reported in FITs (Failures in Time) or MTTF (Mean Time To Failure). The FIT rate is related to MTTF by:

\[ MTTF = \frac{1}{Fr} \]

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

<table>
<thead>
<tr>
<th>FAILURE RATE:</th>
<th>FITS: 3.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTTF (YRS):</td>
<td>33370</td>
</tr>
<tr>
<td>DEVICE HOURS:</td>
<td>267851915</td>
</tr>
<tr>
<td>FAILS:</td>
<td>0</td>
</tr>
</tbody>
</table>

Only data from Operating Life or similar stresses are used for this calculation.

The parameters used to calculate this failure rate are as follows:

\[ Cf: 60\% \quad Ea: 0.7 \quad B: 0 \quad Tu: 25 \, ^\circ C \quad Vu: 5.25 \, \text{Volts} \]

The reliability data follows. At the start of this data is the device information. The next section is the detailed reliability data for each stress. The reliability data section includes the latest data available and may contain some generic data. 

**Device Information:**

- **Process:** SA E35K, 0.4μm, 3.3V CMOS with embedded Array EEPROM, embedded RSE EEPROM, 18V CMOS, P2-P1 ONO Cap, LVMOSCAP, HVMOSCAP, Varactor Cap, CP Diode, 3LM
- **Passivation:** TEOS Oxide-Nitride Passivation
- **Die Size:** 74.015748 x 70.472441
- **Number of Transistors:** 53512
- **Interconnect:** Aluminum / 0.5% Copper
- **Gate Oxide Thickness:** 120 Å

### ESD HBM

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT</th>
<th>CONDITION</th>
<th>READPOIN</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB JESD22-A114 HBM 500 VOLTS</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB JESD22-A114 HBM 1000 VOLTS</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB JESD22-A114 HBM 2000 VOLTS</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB JESD22-A114 HBM 4000 VOLTS</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB JESD22-A114 HBM 8000 VOLTS</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Total: 0

### ESD IEC

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT</th>
<th>CONDITION</th>
<th>READPOIN</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB IEC 61000-4-2 CONTACT 2000 VOLTS</td>
<td>PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB IEC 61000-4-2 CONTACT 4000 VOLTS</td>
<td>PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>1047 DS24B33</td>
<td>ZU156000CB IEC 61000-4-2 CONTACT 6000 VOLTS</td>
<td>PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Rev B, 1/3/08
### LATCH-UP

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT</th>
<th>CONDITION</th>
<th>READPOIN</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCH-UP</td>
<td>1047 ZU156000CB DS24B33</td>
<td>ZU156000CB JESD78, V-SUPPLY TEST 25C</td>
<td>6</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 0

### OPERATING LIFE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT</th>
<th>CONDITION</th>
<th>READPOIN</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0921 DSQC5G1</td>
<td>125C, 5.25 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0921 DSQC5G1</td>
<td>125C, 5.25 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0925 DSQC5G1</td>
<td>125C, 5.25 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0936 DSRB1</td>
<td>125C, 3.65 VOLTS</td>
<td>192 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>1037 DSQ3301-K04+</td>
<td>125C, 5.25 VOLTS</td>
<td>192 HRS</td>
<td>45</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>1046 DS2431</td>
<td>125C, 5.25 VOLTS</td>
<td>192 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>1047 DS24B33</td>
<td>125C, 5.25 VOLTS</td>
<td>192 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 0

**FAILURE RATE:**

- **MTTF (YRS):** 33370
- **FITS:** 3.4
- **DEVICE HOURS:** 267851915
- **FAILS:** 0