PRODUCT RELIABILITY REPORT
FOR

DS3501, Rev A2

Dallas Semiconductor

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Prepared by:

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Conclusion:
The following qualification successfully meets the quality and reliability standards required of all Dallas
Semiconductor products:

DS3501, Rev A2

In addition, Dallas Semiconductor'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

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

\[
AfT = \exp((Ea/k)*(1/Tu - 1/Ts)) = tu/ts \\
AfT = \text{Acceleration factor due to Temperature} \\
tu = \text{Time at use temperature (e.g. 55°C)} \\
ts = \text{Time at stress temperature (e.g. 125°C)} \\
k = \text{Boltzmann's Constant (8.617 x 10^{-5} eV/°K)} \\
Tu = \text{Temperature at Use (°K)} \\
Ts = \text{Temperature at Stress (°K)} \\
Ea = \text{Activation Energy (e.g. 0.7 ev)}
\]

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.

\[
AfV = \exp(B*(Vs - Vu)) \\
AfV = \text{Acceleration factor due to Voltage} \\
Vs = \text{Stress Voltage (e.g. 7.0 volts)} \\
Vu = \text{Maximum Operating Voltage (e.g. 5.5 volts)} \\
B = \text{Constant related to failure mechanism type (e.g. 1.0, 2.4, 2.7, etc.)}
\]

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:

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

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

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:</th>
<th>2.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTTF (YRS):</td>
<td>54287</td>
<td></td>
</tr>
<tr>
<td>DEVICE HOURS:</td>
<td>46200</td>
<td>FAILS: 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:

- \( C_f: 60\% \)
- \( E_a: 0.7 \)
- \( B: 0 \)
- \( T_u: 25°C \)
- \( V_u: 5.5 \text{ Volts} \)

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. "*" after DATE CODE denotes specific product data.

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### Device Information:
- **Process:** E6WA-2P2M, HPVt, E2, EPROMVt, TCZ, PF ALOCOS: GOI
- **Passivation:** Passivation w/Nov TEOS Oxide-Nitride
- **Die Size:** 62 x 87
- **Number of Transistors:** 0
- **Interconnect:** Aluminum / 1% Silicon / 0.5% Copper
- **Gate Oxide Thickness:** 150 Å

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### ELECTRICAL CHARACTERIZATION

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE</th>
<th>CONDITION</th>
<th>READPOINT</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* EOS/ESD S5.1 HBM 500 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* EOS/ESD S5.1 HBM 1000 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>0</td>
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<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* EOS/ESD S5.1 HBM 2000 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
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<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* EOS/ESD S5.1 HBM 4000 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
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<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* EOS/ESD S5.1 HBM 8000 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>3</td>
<td>No FA</td>
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<tr>
<td>LATCH-UP</td>
<td>0645</td>
<td>* JESD78, I-TEST 125C</td>
<td>6</td>
<td>0</td>
<td></td>
<td></td>
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<tr>
<td>LATCH-UP</td>
<td>0645</td>
<td>* JESD78, V-SUPPLY TEST 125C</td>
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</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-A115 MM 50 VOLTS</td>
<td>1 PUL'S</td>
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<td>0</td>
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<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-A115 MM 100 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>0</td>
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</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-A115 MM 200 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-A115 MM 400 VOLTS</td>
<td>1 PUL'S</td>
<td>3</td>
<td>3</td>
<td>No FA</td>
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<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-C101 CDM 100 VOLTS</td>
<td>3</td>
<td>PUL'S</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
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<td>* JESD22-C101 CDM 200 VOLTS</td>
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<td>PUL'S</td>
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<td>0</td>
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<tr>
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<td>PUL'S</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>ESD SENSITIVITY</td>
<td>0645</td>
<td>* JESD22-C101 CDM 1000 VOLTS</td>
<td>3</td>
<td>PUL'S</td>
<td>3</td>
<td>0</td>
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</tbody>
</table>
### OPERATING LIFE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE</th>
<th>CONDITION</th>
<th>READPOINT</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0548</td>
<td>125C, 5.5V (PSA) &amp; 3.6V (PSB)</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0549</td>
<td>125C, 5.5 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0552</td>
<td>125C, +5.5V (PSA), +5.5V (PSD)</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0612</td>
<td>125C, 5.5 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0623</td>
<td>125C, 5.5V (PSA), -7.0V (PSC) &amp; +7.0V (PSD)</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HIGH TEMP OP LIFE</td>
<td>0645</td>
<td>125C, 5.5 VOLTS</td>
<td>1000 HRS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### W/E ENDURANCE AND DATA RET'N

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE</th>
<th>CONDITION</th>
<th>READPOINT</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRITE CYCLE STRESS (KCYS)</td>
<td>0548</td>
<td>70 C, 5.5V (PSA) &amp; 3.6V (PSB)</td>
<td>50 KCYS</td>
<td>77</td>
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<tr>
<td>STORAGE LIFE</td>
<td>0549</td>
<td>85 C, 5.5 VOLTS</td>
<td>30 KCYS</td>
<td>77</td>
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<tr>
<td>WRITE CYCLE STRESS (KCYS)</td>
<td>0552</td>
<td>70C, +5.5V (PSA), +5.5V (PSD)</td>
<td>30 KCYS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>STORAGE LIFE</td>
<td>0612</td>
<td>70 C, 5.5 VOLTS</td>
<td>30 KCYS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>WRITE CYCLE STRESS (KCYS)</td>
<td>0623</td>
<td>70C, 5.5V (PSA), -7.0V (PSC) &amp; +7.0V (PSD)</td>
<td>30 KCYS</td>
<td>77</td>
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</tr>
<tr>
<td>STORAGE LIFE</td>
<td>0709</td>
<td>25 C, 5.5 VOLTS</td>
<td>200 KCYS</td>
<td>77</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 0

### FAILURE RATE:

- **MTTF (YRS):** 54287
- **FITS:** 2.1
- **DEVICE HOURS:** 462000
- **FAILS:** 0