PRODUCT RELIABILITY REPORT
FOR

MAX24001

Maxim Integrated

14460 Maxim Dr.
Dallas, TX 75244

Approved by:

Don Lipps
Manager, Reliability Engineering
Conclusion:
The following qualification successfully meets the quality and reliability standards required of all Maxim Integrated products:

MAX24001

In addition, Maxim Integrated'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.maximintegrated.com/qa/reliability/monitor.

Device Description:
A description of this device can be found in the product data sheet. You can find the product data sheet at http://www.maximintegrated.com/search/parts.mvp.

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

\[ AfT = \exp\left(\frac{Ea}{k} \left(\frac{1}{Tu} - \frac{1}{Ts}\right)\right) = \frac{tu}{ts} \]

\( AfT = \) Acceleration factor due to Temperature
\( tu = \) Time at use temperature (e.g. 55°C)
\( ts = \) Time at stress temperature (e.g. 125°C)
\( k = \) Boltzmann's Constant (8.617 x 10^-5 eV/^°K)
\( Tu = \) Temperature at Use (^°K)
\( Ts = \) Temperature at Stress (^°K)
\( Ea = \) 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.

\[ AfV = \exp\left(\frac{Vs - Vu}{B}\right) \]

\( AfV = \) Acceleration factor due to Voltage
\( Vs = \) Stress Voltage (e.g. 7.0 volts)
\( Vu = \) Maximum Operating Voltage (e.g. 5.5 volts)
\( B = \) 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:

\[ Fr = \frac{X}{(ts \cdot AfV \cdot AfT \cdot N \cdot 2)} \]

\( X = \) Chi-Sq statistical upper limit
\( N = \) Life test sample size
The calculated failure rate for this device/process is:

FAILURE RATE: 3.5  FITS: 3.5  MTTF (YRS): 32901  DEVICE HOURS: 264086792  FAILS: 0

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%  Ea: 0.7  B: 0  Tu: 25 °C  Vu: 3.5 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. **Bold**Product Number denotes specific product data.

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**Device Information:**
- **Process:** Global/Chartered 0.13um HP, single poly, 6 metal with DNWELL, MiMCap and HVt device.
- **Passivation:** SiN / SiO2
- **Die Size:** 96 x 96
- **Number of Transistors:** 124833
- **Interconnect:** Aluminum / 0.5% Copper
- **Gate Oxide Thickness:** 17 Å

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**ESD HBM**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT#</th>
<th>CONDITION</th>
<th>READPOINT</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
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<tbody>
<tr>
<td>ESD SENSITIVITY</td>
<td>1237 MAX24001</td>
<td>ZS135066AA JESD22-A114 HBM 500 VOLTS</td>
<td>1</td>
<td>PUL'S</td>
<td>5</td>
<td>0</td>
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<td>ESD SENSITIVITY</td>
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<td>ZS135066AA JESD22-A114 HBM 1000 VOLTS</td>
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<td>ZS135066AA JESD22-A114 HBM 1500 VOLTS</td>
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<td>PUL'S</td>
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<td>0</td>
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Total: 1

**LATCH-UP**

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<th>READPOINT</th>
<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATCH-UP I</td>
<td>1237 MAX24001</td>
<td>ZS135066AA JESD78A, I-TEST 25C 100mA</td>
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<td>LATCH-UP V</td>
<td>1237 MAX24001</td>
<td>ZS135066AA JESD78A, V-SUPPLY TEST 25C</td>
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</table>

Total: 0

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**OPERATING LIFE**

<table>
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<th>DESCRIPTION</th>
<th>DATE CODE/PRODUCT/LOT#</th>
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<th>QTY</th>
<th>FAILS</th>
<th>FA#</th>
</tr>
</thead>
</table>

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Failure Rates are reported in FITs (Failures in Time) or MTTF (Mean Time To Failure). The FIT rate is related to MTTF by:

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

**NOTE:** MTTF is frequently used interchangeably with MTBF.
Here is the table:

| HIGH TEMP OP LIFE | MAX24001 | ZS135066AA 125C, 3.5 V (PSA) | 500 HRS | 80 | 0 |
| HIGH TEMP OP LIFE | MAX24001 | ZS135066AA 125C, 3.5 V (PSA) | 1000 HRS | 80 | 0 |
| HIGH TEMP OP LIFE | MAX24001 | TS136191AC 125C, 3.5 V (PSA) | 1000 HRS | 80 | 0 |
| HIGH TEMP OP LIFE | MAX24001 | TS135210AB 125C, 3.5 V (PSA) | 1000 HRS | 80 | 0 |
| **Total:** | | | | | **0** |

**FAILURE RATE:**

| **FITS:** | **3.5** |

| **MTTF (YRS):** | **32901** |

| **DEVICE HOURS:** | **264086792** |

| **FAILS:** | **0** |

Passes +/- 100mA and overvoltage testing per JEDEC JESD78. Note: RX_INM and RX_INP pins passed +/-100mA with clamp voltage at MSV of 4.2V which is above AMR.

MAX24001 qualifies MAX24002 and MAX24003 by extension with all 3 products using the same die.

The failure rate is high due to limited devices hours and will become lower as additional life test data is available.