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**RELIABILITY REPORT**
**FOR**

# DS1232, Rev C2

## Dallas Semiconductor

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**Conclusion:**

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

DS1232, Rev C2

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 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.

AfT = exp((Ea/k)*(1/Tu - 1/Ts)) = 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(B*(Vs - Vu))
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 = X/(ts * AfV * AfT * N * 2)
X = Chi-Sq statistical upper limit
N = 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 = 1/Fr

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

**FAILURE RATE: MTTF (YRS): 103129 FITS: 1.1**

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

**Cf: 60% Ea: 0.7 B: 0 Tu: 25 °C Vu: 5.5 Volts**

The reliability data follows. A 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: | 1P, 1M, 0.8um, PdplDiode, Low Vts , N+ESDII, WJ BPSG, |
| Passivation: | Passivation w/Nov TEOS Oxide-Nitride |
| Die Size: | 78 x 50 |
| Number of Transistors: | 1150 |
| Interconnect: | Aluminum / 1% Silicon / 0.5% Copper |
| Gate Oxide Thickness: | 175 Å |

**OPERATING LIFE**

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | QUANTITY | FAILS |
|---|---|---|---|---|---|
| HIGH VOLTAGE LIFE | 9515 | 125C, 7.0 VOLTS | 1000 HRS | 153 | 0 |
| INFANT LIFE | 9515 | 125C, 7.0 VOLTS | 48 HRS | 307 | 0 |
| HIGH VOLTAGE LIFE | 9515 | 125C, 7.0 VOLTS | 1000 HRS | 153 | 0 |
| INFANT LIFE | 9518 | 125C, 7.0 VOLTS | 48 HRS | 307 | 0 |
| HIGH VOLTAGE LIFE | 9518 | 125C, 7.0 VOLTS | 1000 HRS | 153 | 0 |
| HIGH VOLTAGE LIFE | 9532 | 125C, 7.0 VOLTS | 1000 HRS | 153 | 0 |
| INFANT LIFE | 9601 | 125C, 7.0 VOLTS | 48 HRS | 315 | 0 |
| HIGH VOLTAGE LIFE | 9601 | 125C, 7.0 VOLTS | 1000 HRS | 116 | 0 |
| INFANT LIFE | 9613 | 125C, 7.0 VOLTS | 48 HRS | 315 | 0 |
| HIGH VOLTAGE LIFE | 9613 | 125C, 7.0 VOLTS | 1000 HRS | 116 | 0 |
| INFANT LIFE | 9620 | 125C, 7.0 VOLTS | 48 HRS | 307 | 0 |
| HIGH VOLTAGE LIFE | 9620 | 125C, 7.0 VOLTS | 1000 HRS | 153 | 0 |
| INFANT LIFE | 9649 | 125C, 7.0 VOLTS | 48 HRS | 315 | 0 |
| HIGH VOLTAGE LIFE | 9649 | 125C, 7.0 VOLTS | 1000 HRS | 116 | 0 |
| INFANT LIFE | 9730 | 125C, 7.0 VOLTS | 48 HRS | 192 | 0 |
| HIGH VOLTAGE LIFE | 9730 | 125C, 7.0 VOLTS | 1000 HRS | 114 | 0 |
| INFANT LIFE | 9731 | 125C, 7.0 VOLTS | 48 HRS | 192 | 0 |
| HIGH VOLTAGE LIFE | 9731 | 125C, 7.0 VOLTS | 1000 HRS | 108 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| INFANT LIFE | 9733 | 125C, 7.0 VOLTS | 48 | HRS | 192 | 0 |
| HIGH VOLTAGE LIFE | 9733 | 125C, 7.0 VOLTS | 1000 | HRS | 108 | 0 |
| INFANT LIFE | 9830 | 125C, 7.0 VOLTS | 48 | HRS | 232 | 0 |
| HIGH VOLTAGE LIFE | 9830 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 9848 | 125C, 7.0 VOLTS | 48 | HRS | 234 | 0 |
| HIGH VOLTAGE LIFE | 9848 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 9848 | 125C, 7.0 VOLTS | 48 | HRS | 234 | 0 |
| HIGH VOLTAGE LIFE | 9848 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 9904 | 125C, 7.0 VOLTS | 48 | HRS | 174 | 0 |
| INFANT LIFE | 9904 | 125C, 7.0 VOLTS | 48 | HRS | 174 | 0 |
| HIGH VOLTAGE LIFE | 9904 | 125C, 7.0 VOLTS | 1000 | HRS | 108 | 0 |
| HIGH VOLTAGE LIFE | 9904 | 125C, 7.0 VOLTS | 1000 | HRS | 108 | 0 |
| INFANT LIFE | 9948 | 125C, 7.0 VOLTS | 48 | HRS | 234 | 2 |
| HIGH VOLTAGE LIFE | 9948 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 0011 | 125C, 7.0 VOLTS | 48 | HRS | 233 | 0 |
| HIGH VOLTAGE LIFE | 0011 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 0024 | 125C, 7.0 VOLTS | 48 | HRS | 234 | 0 |
| HIGH VOLTAGE LIFE | 0024 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 0039 | 125C, 7.0 VOLTS | 48 | HRS | 232 | 0 |
| HIGH VOLTAGE LIFE | 0039 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| INFANT LIFE | 0051 | 125C, 7.0 VOLTS | 48 | HRS | 233 | 0 |
| HIGH VOLTAGE LIFE | 0051 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| HIGH VOLTAGE LIFE | 0105 | 125C, 7.0 VOLTS | 1000 | HRS | 77 | 0 |
| HIGH VOLTAGE LIFE | 0105 | 125C, 7.0 VOLTS | 1000 | HRS | 80 | 0 |
| HIGH VOLTAGE LIFE | 0111 | 125C, 7.0 VOLTS | 1000 | HRS | 79 | 0 |
| HIGH VOLTAGE LIFE | 0252 | 125C, 7.0 VOLTS | 1000 | HRS | 80 | 0 |
| HIGH TEMP OP LIFE | 0310 | 125C, 5.5 VOLTS | 1000 | HRS | 80 | 0 |
| HIGH TEMP OP LIFE | 0327 | 125C, 5.5 VOLTS | 1000 | HRS | 80 | 0 |
| | | | | **Total:** | | **2** |

**TEMPERATURE CYCLE**

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | | QUANTITY | FAILS |
|---|---|---|---|---|---|---|
| TEMP CYCLE | 9515 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9518 | -55C TO 125C | 1000 | CYS | 76 | 0 |
| TEMP CYCLE | 9601 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9613 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9620 | -55C TO 125C | 1000 | CYS | 69 | 0 |
| TEMP CYCLE | 9649 | -55C TO 125C | 1000 | CYS | 77 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| TEMP CYCLE | 9730 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9731 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9733 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9830 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 9848 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 9848 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 9904 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9904 | -55C TO 125C | 1000 | CYS | 77 | 0 |
| TEMP CYCLE | 9948 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0011 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0024 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0039 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0051 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0105 | -55C TO 125C | 1000 | CYS | 40 | 1 |
| TEMP CYCLE | 0105 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0111 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0252 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0310 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| TEMP CYCLE | 0327 | -55C TO 125C | 1000 | CYS | 40 | 0 |
| | | | | **Total:** | | **1** |

**TEMPERATURE HUMIDITY BIAS**

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | | QUANTITY | FAILS |
|---|---|---|---|---|---|---|
| HAST | 9515 | 120C, 85%R.H.,5.5V | 200 | HRS | 77 | 0 |
| BIASED MOISTURE | 9518 | 85/85, 5.5 VOLTS | 959 | HRS | 77 | 0 |
| HAST | 9601 | 120C, 85%R.H.,5.5V | 200 | HRS | 77 | 0 |
| HAST | 9613 | 120C, 85%R.H.,5.5V | 200 | HRS | 77 | 0 |
| BIASED MOISTURE | 9620 | 85/85, 5.5 VOLTS | 959 | HRS | 77 | 0 |
| HAST | 9649 | 120C, 85%R.H.,5.5V | 100 | HRS | 77 | 0 |
| BIASED MOISTURE | 9730 | 85/85, 5.5 VOLTS | 959 | HRS | 78 | 0 |
| BIASED MOISTURE | 9731 | 85/85, 5.5 VOLTS | 959 | HRS | 78 | 0 |
| BIASED MOISTURE | 9733 | 85/85, 5.5 VOLTS | 959 | HRS | 78 | 0 |
| HAST | 9830 | 120C, 85%R.H.,5.5V | 100 | HRS | 77 | 0 |
| HAST | 9848 | 120C, 85%R.H.,5.5V | 100 | HRS | 77 | 0 |
| HAST | 9848 | 130C, 85%R.H.,5.5V | 100 | HRS | 77 | 0 |
| BIASED MOISTURE | 9904 | 85/85, 5.5 VOLTS | 959 | HRS | 63 | 0 |
| BIASED MOISTURE | 9904 | 85/85, 5.5 VOLTS | 959 | HRS | 66 | 0 |
| HAST | 9948 | 130C, 85%R.H.,5.5V | 100 | HRS | 77 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| HAST | 0011 | 130C, 85%R.H.,5.5V | 100 | HRS | 76 | 0 |
| HAST | 0024 | 130C, 85%R.H.,5.5V | 100 | HRS | 76 | 0 |
| HAST | 0039 | 130C, 85%R.H.,5.5V | 100 | HRS | 76 | 0 |
| HAST | 0051 | 130C, 85%R.H.,5.5V | 100 | HRS | 77 | 2 |
| HAST | 0105 | 130C, 85%R.H.,5.5V | 88 | HRS | 77 | 0 |
| HAST | 0105 | 130C, 85%R.H.,5.5V | 100 | HRS | 77 | 1 |
| HAST | 0111 | 130C, 85%R.H.,5.5V | 96 | HRS | 77 | 0 |
| HAST | 0252 | 130C, 85%R.H.,5.5V | 96 | HRS | 77 | 0 |
| HAST | 0310 | 130C, 85%R.H.,5.5V | 96 | HRS | 77 | 0 |
| HAST | 0327 | 130C, 85%R.H.,5.5V | 96 | HRS | 77 | |
| | | | | **Total:** | | **4** |

**UNBIASED MOISTURE RESISTANCE**

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | | QUANTITY | FAILS |
|---|---|---|---|---|---|---|
| AUTOCLAVE | 9601 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9613 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9649 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9730 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9731 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9733 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9830 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 37 | 0 |
| AUTOCLAVE | 9848 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 40 | 0 |
| AUTOCLAVE | 9848 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 36 | 0 |
| AUTOCLAVE | 9904 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9904 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 45 | 0 |
| AUTOCLAVE | 9948 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 38 | 0 |
| AUTOCLAVE | 0011 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 40 | 0 |
| AUTOCLAVE | 0024 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 39 | 0 |
| AUTOCLAVE | 0039 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 39 | 0 |
| AUTOCLAVE | 0051 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 39 | 0 |
| AUTOCLAVE | 0105 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 40 | 0 |
| AUTOCLAVE | 0105 | 121C, 2 ATM STEAM, UNBIASED | 96 | HRS | 39 | 0 |
| AUTOCLAVE | 0111 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 40 | 0 |
| AUTOCLAVE | 0252 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 40 | 0 |
| AUTOCLAVE | 0310 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 40 | 0 |
| AUTOCLAVE | 0327 | 121C, 2 ATM STEAM, UNBIASED | 168 | HRS | 40 | 0 |
| | | | | **Total:** | | **0** |

**FAILURE RATE: MTTF (YRS): 103129 FITS: 1.1**