

RELIABILITY REPORT
FOR

DS1302, Rev A4

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:

DS1302, Rev A4

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 (8.617×10^{-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:

$$\text{MTTF} = 1/\text{Fr}$$

NOTE: MTTF is frequently used interchangeably with MTBF.

The calculated failure rate for this device/process is:

FAILURE RATE: **MTTF (YRS): 47969** **FITS: 2.4**

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. 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.

Device Information:

Process: 1P, 2M, 0.8um, ESD Pdepletion, HP Vts, WJ BPSG, Ti/TiN M1+M2,
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 75 x 75
 Number of Transistors: 0
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 175 Å

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ESD SENSITIVITY	0248	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0248	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0248	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0248	EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0248	EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	0
LATCH-UP	0248	JESD78, I-TEST 125C		6	0
LATCH-UP	0248	JESD78, Vsupply TEST 125C		6	0
Total:					0

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	0105	125C, 6.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	0105	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0133	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH VOLTAGE LIFE	0204	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH VOLTAGE LIFE	0226	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH TEMP OP LIFE	0321	125C, 5.5 VOLTS	1000 HRS	80	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0105	-55C TO 125C	1000 CYS	40	0
TEMP CYCLE	0133	-55C TO 125C	1000 CYS	40	0
TEMP CYCLE	0204	-55C TO 125C	1000 CYS	45	0
TEMP CYCLE	0226	-55C TO 125C	1000 CYS	45	0
TEMP CYCLE	0321	-55C TO 125C	1000 CYS	45	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0105	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	0133	85/85, 5.5 VOLTS	959 HRS	77	1
BIASED MOISTURE	0204	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	0226	85/85, 5.5 VOLTS	1000 HRS	77	0
BIASED MOISTURE	0321	85/85, 5.5 VOLTS	1000 HRS	77	0
Total:					1

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	0105	121C, 2 ATM STEAM, UNBIASED	96 HRS	40	0
AUTOCLAVE	0133	121C, 2 ATM STEAM, UNBIASED	96 HRS	40	0
AUTOCLAVE	0204	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
AUTOCLAVE	0226	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
AUTOCLAVE	0321	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
Total:					0

FAILURE RATE:**MTTF (YRS): 47969****FITS: 2.4**