

RELIABILITY REPORT
FOR

DS3904, Rev A1

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 and processes:

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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): 59192** **FITS: 1.9**

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: D6W-2P2M,HPVt,E2,EPROGVt,TCZ ALOCOS:GOI
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 58 x 84
 Number of Transistors: 7835
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 150 Å

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ESD SENSITIVITY	0251	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0251	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0251	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0251	EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0251	EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	3
LATCH-UP	0251	JESD78, I-TEST 125C		6	0
LATCH-UP	0251	JESD78, Vsupply TEST 125C		6	0
Total:					3

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	0251	125C, 6.0 VOLTS	1000 HRS	45	0
HIGH VOLTAGE LIFE	0252	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0252	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0301	125C, 6.0V (PSA) &12.0V (PSB)	1016 HRS	77	0
HIGH VOLTAGE LIFE	0303	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0305	125C, 6.0 VOLTS	1000 HRS	77	1
HIGH VOLTAGE LIFE	0305	125C, 6.0 VOLTS	1000 HRS	45	0
HIGH VOLTAGE LIFE	0306	125C, 6.0V (PSA) &12.0V (PSB)	1000 HRS	77	0

HIGH VOLTAGE LIFE	0307	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH VOLTAGE LIFE	0307	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH TEMP OP LIFE	0312	125C, 5.5 VOLTS	1000 HRS	45	0
HIGH TEMP OP LIFE	0312	125C, 5.5 VOLTS	1000 HRS	80	0
HIGH TEMP OP LIFE	0315	125C, 5.5 VOLTS	1000 HRS	45	0
HIGH TEMP OP LIFE	0320	125C, 3.6 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	0325	125C, 5.5 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	0325	125C, 5.5 VOLTS	192 HRS	77	0
HIGH VOLTAGE LIFE	0327	125C, 5.5 VOLTS	1000 HRS	45	0
HIGH TEMP OP LIFE	0330	125C, 5.5 VOLTS	192 HRS	77	0
Total:					1

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	0305	150C	1000 HRS	77	0
STORAGE LIFE	0320	150C	192 HRS	77	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0307	-55C TO 125C	1000 CYS	80	0
TEMP CYCLE	0307	-55C TO 125C	1000 CYS	80	0
TEMP CYCLE	0312	-55C TO 125C	1000 CYS	40	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0312	85/85, 5.5 VOLTS	1000 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	0312	121C, 2 ATM STEAM, UNBIASED	168 HRS	39	0
Total:					0

W/E ENDURANCE AND DATA RET'N

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
WRITE CYCLE STRESS	0251	70 C, 6.0 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0252	85 C, 6.0 VOLTS	25 KCYS	77	0
STORAGE LIFE		150C	2000 HRS	76	0
WRITE CYCLE STRESS	0252	85 C, 6.0 VOLTS	25 KCYS	77	0
STORAGE LIFE		150C	2000 HRS	77	0
WRITE CYCLE STRESS	0252	85 C, 5.5 VOLTS	25 KCYS	500	0

STORAGE LIFE	0252	150C	1000 HRS	425	0
WRITE CYCLE STRESS	0252	85 C, 5.5 VOLTS	25 KCYS	500	1
STORAGE LIFE		150C	1000 HRS	443	0
WRITE CYCLE STRESS	0301	85 C, 6.0 V (PSA): 12.0 V (PSB)	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	75	0
WRITE CYCLE STRESS	0303	85 C , 5.25 VOLTS	20 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0303	25 C, 5.25 VOLTS	50 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0303	25 C, 5.25 VOLTS	40 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	1
WRITE CYCLE STRESS	0305	85 C, 6.0 VOLTS	50 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0306	85 C, 6.0 V (PSA): 12.0 V (PSB)	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0312	85 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	72	0
WRITE CYCLE STRESS	0314	70 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0315	70 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS	0325	85 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	76	0
WRITE CYCLE STRESS	0327	70 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0

Total: **2**

FAILURE RATE:

MTTF (YRS): 59192

FITS: 1.9