05/05/05

PRODUCT RELIABILITY REPORT
FOR

DS4510, Rev A4

Dallas Semiconductor

4401 South Beltwood Parkway
Dallas, TX 75244-3292

Prepared by:

Don Lipps
Staff Reliability Engineer
Dallas Semiconductor
4401 South Beltwood Pkwy.
Dallas, TX 75244-3292
Email : don.lipps@dalsemi.com
ph: 972-371-3739
fax: 972-371-6016

Conclusion:

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

DS4510, 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 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): 134121 FITS: 0.9

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

Device Information:

Process:	D6W-2P2M,HPVt,E2,EPROGVt,TCZ ALOCOS:GOI
Passivation:	Passivation w/Nov TEOS Oxide-Nitride
Die Size:	85 x 58
Number of Transistors:	16559
Interconnect:	Aluminum / 1% Silicon / 0.5% Copper
Gate Oxide Thickness:	150 Å

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE		CONDITION	READPOINT		QTY	FAILS	FA#
ESD SENSITIVITY	0401	*	EOS/ESD S5.1 HBM 500 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0401	*	EOS/ESD S5.1 HBM 1000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0401	*	EOS/ESD S5.1 HBM 2000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0401	*	EOS/ESD S5.1 HBM 4000 VOLTS	1	PUL'S	3	0	
ESD SENSITIVITY	0401	*	EOS/ESD S5.1 HBM 8000 VOLTS	1	PUL'S	3	3	No FA
LATCH-UP	0401	*	JESD78, I-TEST 125C	2	DYS	6	0	
LATCH-UP	0401	*	JESD78, Vsupply TEST 125C	2	DYS	6	0	
					Total:		**3**	

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT		QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0251	125C, 6.0 VOLTS	1000	HRS	45	0	
HIGH VOLTAGE LIFE	0305	125C, 6.0 VOLTS	1000	HRS	45	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	1000	HRS	77	0	
HIGH VOLTAGE LIFE	0327	125C, 5.5 VOLTS	1000	HRS	45	0	

HIGH TEMP OP LIFE	0330		125C, 5.5 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	0333		125C, 3.5 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	0337		125C, 5.5 VOLTS	1000	HRS	44	0
HIGH TEMP OP LIFE	0339		125C, 5.5 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	0341		125C, 5.5 VOLTS	1000	HRS	45	0
HIGH TEMP OP LIFE	0341		125C, 5.5 VOLTS	1000	HRS	45	0
HIGH TEMP OP LIFE	0343		125C, 5.5 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	0348		125C, 3.5 VOLTS	1000	HRS	77	0
HIGH TEMP OP LIFE	0350		125C, 5.5 VOLTS	1000	HRS	45	0
HIGH TEMP OP LIFE	0401	*	125C, 5.5 VOLTS	1000	HRS	45	0
HIGH TEMP OP LIFE	0413		125C, 3.6 VOLTS	1000	HRS	45	0
HIGH TEMP OP LIFE	0425		125C, 3.6V (PSA) & -4.0V (PSB)	1000	HRS	45	0
HIGH TEMP OP LIFE	0507		125C, 5.25 VOLTS	408	HRS	77	0
					Total:		**0**

W/E ENDURANCE AND DATA RET'N

DESCRIPTION	DATE CODE	CONDITION	READPOINT		QTY	FAILS	FA#
WRITE CYCLE STRESS	0251	70 C, 6.0 VOLTS	30	KCYS	77	0	
STORAGE LIFE		150C	1000	HRS	77	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	
WRITE CYCLE STRESS	0330	70 C, 5.5 VOLTS	30	KCYS	77	0	
STORAGE LIFE		150C	1000	HRS	76	0	
WRITE CYCLE STRESS	0333	70 C, 3.6 VOLTS	5	KCYS	77	0	
STORAGE LIFE		150C	1000	HRS	76	0	
WRITE CYCLE STRESS	0339	70 C, 5.5 VOLTS	30	KCYS	77	1	30017817
STORAGE LIFE		150C	1000	HRS	76	0	
WRITE CYCLE STRESS	0343	85 C, 5.5 VOLTS	30	KCYS	77	0	
STORAGE LIFE		150C	1000	HRS	77	0	

WRITE CYCLE STRESS	0348		70 C, 3.6 VOLTS	10	KCYS	77	0	
STORAGE LIFE			150C	1000	HRS	77	0	
WRITE CYCLE STRESS	0350		70 C, 5.5 VOLTS	30	KCYS	77	0	
STORAGE LIFE			150C	1000	HRS	74	0	
WRITE CYCLE STRESS	0401	*	70 C, 5.5 VOLTS	30	KCYS	77	1	30019498
STORAGE LIFE		*	150C	1000	HRS	76	0	
WRITE CYCLE STRESS	0413		70 C, 3.6 VOLTS	10	KCYS	77	0	
STORAGE LIFE			150C	1000	HRS	75	0	
WRITE CYCLE STRESS	0507		70 C, 5.25 VOLTS	5	KCYS	77	0	
STORAGE LIFE			150C	500	HRS	77	0	
					Total:		**2**	

FAILURE RATE: **MTTF (YRS): 134121** **FITS: 0.9**

The single W/E Endurance failure (date code 0339, 30017817) failed to write a single row of memory due to a random gate oxide defect in the EE control circuitry. The single W/E Endurance failure (date code 0401, 30019498) is due to tunnel oxide degradation at a single cell.