

RELIABILITY REPORT
FOR

DS1100 & DS1100L, 20ns to 500 ns

Dallas Semiconductor

4401 South Beltwood Parkway
Dallas, TX 75244-3292

Prepared by:

Ken Wendel

Ken Wendel
Reliability Engineering Manager
Dallas Semiconductor
4401 South Beltwood Pkwy.
Dallas, TX 75244-3292
Email : ken.wendel@dalsemi.com
ph: 972-371-3726
fax: 972-371-6016
mbl: 214-435-6610

Conclusion:

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

DS1100 & DS1100L, 20ns to 500 ns

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 the device used in this qualification 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/assembly is:

FAILURE RATE: **MTTF (YRS): 156326** **FITS: 0.7**

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. This is a description of the device either used as a reliability test vehicle for a process / assembly qualification / monitor or a device used as part of a product qualification / monitor. Following this is the assembly information. This section includes a description of the assembly vehicle used to generate this reliability data for both qualifications and monitors. The next section is the detailed reliability data for each stress found in the qualification / monitor. If there are additional processes or assemblies used as part of this report, a description of each will follow which includes the respective reliability data for that process/assembly. The reliability data section includes the latest data available.

Device Information:

Device: DS1100
 Process: D6W-1P2M,HPVt,E2,TCZ PBL:GOI
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 48 x 70
 Number of Transistors: 0
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS1100
 Assembly Site: CPS (ChipPac, China)
 Pin Count: 8
 Package Type: PDIP
 Body Size: 300
 Mold Compound: Sumitomo 6300H
 Lead Frame: Stamped Copper CDA194
 Lead Finsh: SnPb Plate
 Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
 Bond Wire / Size: Au / 1.0 mil
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A)
 Date Code Range: 9950 to 9950

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	9950	125C, 6.0 VOLTS	1000 HRS	256	0
HIGH VOLTAGE LIFE	9950	125C, 6.0 VOLTS	1000 HRS	256	0
Total:					0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	9950	125C	24 HRS	45	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	45	
CONVECTION REFLOW		235C	3 PASS	45	
STORAGE LIFE	9950	125C	24 HRS	45	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	45	
VAPOR PHASE REFLOW		220C	3 PASS	45	
Total:					

Assembly Information:

Qualification Vehicle: DS1100
Assembly Site: ATP (Amkor, PI)
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finsh: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A) Level 1
Date Code Range: 9905 to 0333

LOW TEMPERATURE OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED BAKE	9905	-20C, 6.0 VOLTS	1000 HRS	77	0
Total:					0

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	0126	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0132	125C, 6.0 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	0312	125C, 5.5 VOLTS	1000 HRS	80	0
INFANT LIFE	9905	125C, 6.0 VOLTS	48 HRS	347	0
HIGH VOLTAGE LIFE	9905	125C, 6.0 VOLTS	1000 HRS	116	0
Total:					0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	0126	J-STD-020	1 DYS	4	0
STORAGE LIFE	0126	125C	24 HRS	238	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	238	
CONVECTION REFLOW		235C	3 PASS	238	0
PRECONDITION U/S	0126	J-STD-020	1 DYS	4	0
ULTRASOUND	0132	J-STD-020	1 DYS	4	0

STORAGE LIFE	0132	125C	24	HRS	238	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	238	
CONVECTION REFLOW		235C	3	PASS	238	0
PRECONDITION U/S	0132	J-STD-020	1	DYS	4	0
ULTRASOUND	0312	J-STD-020	1	DYS	4	0
STORAGE LIFE	0312	125C	24	HRS	241	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	241	
CONVECTION REFLOW		235C	3	PASS	241	0
PRECONDITION U/S	0312	J-STD-020	1	DYS	4	0
ULTRASOUND	0333	J-STD-020	1	DYS	4	0
STORAGE LIFE	0333	125C	24	HRS	241	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	241	
CONVECTION REFLOW		235C	3	PASS	241	0
				Total:		0

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	9905	150C	1000 HRS	77	0
				Total:	0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0126	-55C TO 125C	1000 CYS	40	0
TEMP CYCLE	0132	-55C TO 125C	1000 CYS	40	0
TEMP CYCLE	0312	-55C TO 125C	1000 CYS	40	0
TEMP CYCLE	0333	-55C TO 125C	500 CYS	40	
TEMP CYCLE	9905	-55C TO 125C	1000 CYS	77	0
				Total:	0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0126	85/85, 5.5 VOLTS	1000 HRS	77	0
BIASED MOISTURE	0132	85/85, 5.5 VOLTS	1000 HRS	77	0
BIASED MOISTURE	0312	85/85, 5.5 VOLTS	1000 HRS	77	0
BIASED MOISTURE	0333	85/85, 5.5 VOLTS	500 HRS	77	
				Total:	0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	0126	121C, 2 ATM STEAM, UNBIASED	168 HRS	40	0
AUTOCLAVE	0132	121C, 2 ATM STEAM, UNBIASED	168 HRS	39	0
AUTOCLAVE	0312	121C, 2 ATM STEAM, UNBIASED	168 HRS	39	0
AUTOCLAVE	0333	121C, 2 ATM STEAM, UNBIASED	168 HRS	40	
				Total:	0

Assembly Information:

Qualification Vehicle: DS1100
Assembly Site: Carsem
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity Level 1
(JEDEC J-STD20A)
Date Code Range: 0243 to 0243

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	0243	125C, 6.0 VOLTS	1000 HRS	80	0
Total:					0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	0243	J-STD-020	1 DYS	4	0
STORAGE LIFE	0243	125C	24 HRS	241	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	241	
CONVECTION REFLOW		235C	3 PASS	241	0
PRECONDITION U/S	0243	J-STD-020	1 DYS	4	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0243	-55C TO 125C	1000 CYS	40	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0243	85/85, 5.5 VOLTS	1000 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOClave	0243	121C, 2 ATM STEAM, UNBIASED	168 HRS	40	0
Total:					0

Assembly Information:

Qualification Vehicle: DS1100
Assembly Site: NSEB
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6600CS
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity Level 1
(JEDEC J-STD20A)
Date Code Range: 0323 to 0323

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH TEMP OP LIFE	0323	125C, 5.5 VOLTS	1000 HRS	80	0
Total:					0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	0323	J-STD-020	1 DYS	4	0
STORAGE LIFE	0323	125C	24 HRS	241	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	241	
CONVECTION REFLOW		235C	3 PASS	241	0
PRECONDITION U/S	0323	J-STD-020	1 DYS	4	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0323	-55C TO 125C	1000 CYS	40	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0323	85/85, 5.5 VOLTS	1000 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOClave	0323	121C, 2 ATM STEAM, UNBIASED	168 HRS	40	0
Total:					0

Assembly Information:

Qualification Vehicle: DS1100
Assembly Site: OSEP
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity Level 1
(JEDEC J-STD20A)
Date Code Range: 0230 to 0230

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	0230	125C, 6.0 VOLTS	1000 HRS	80	0
Total:					0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	0230	J-STD-020	1 DYS	4	0
STORAGE LIFE	0230	125C	24 HRS	241	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	241	
CONVECTION REFLOW		235C	3 PASS	241	0
PRECONDITION U/S	0230	J-STD-020	1 DYS	4	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0230	-55C TO 125C	1000 CYS	40	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	0230	85/85, 5.5 VOLTS	1000 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOClave	0230	121C, 2 ATM STEAM, UNBIASED	168 HRS	40	0
Total:					0

Device Information:

Device: DS1100L
Process: D6W-2P2M,HPVt,E2,EPROGVt,TCZ PBL:GOI
Passivation: Passivation w/Nov TEOS Oxide-Nitride
Die Size: 58 x 84
Number of Transistors: 11800
Interconnect: Aluminum / 1% Silicon / 0.5% Copper
Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS1100L
Assembly Site: ATP (Amkor, PI)
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 1
Date Code Range: 0226 to 0226

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ESD SENSITIVITY	0226	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0226	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0226	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0226	EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	0
ESD SENSITIVITY	0226	EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	3
LATCH-UP	0226	JESD78, I-TEST 125C	2 DYS	3	0
LATCH-UP	0226	JESD78, Vsupply TEST 125C	2 DYS	3	0
				Total:	3

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	0226	125C, 6.0 VOLTS	1000 HRS	77	0
				Total:	0

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	0226	150C	1000 HRS	77	0
				Total:	0

Device Information:

Device: DS1100L
Process: D6W-1P2M,HPVt,E2,TCZ PBL:GOI
Passivation: Passivation w/Nov TEOS Oxide-Nitride
Die Size: 70 x 48
Number of Transistors: 5000
Interconnect: Aluminum / 1% Silicon / 0.5% Copper
Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS1100L
Assembly Site: ATP (Amkor, PI)
Pin Count: 8
Package Type: PDIP
Body Size: 300
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.3 mil
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A)
Date Code Range: 0017 to 0017

LOW TEMPERATURE OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED BAKE	0017	-20C, 6.0 VOLTS	1000 HRS	77	0
Total:					0

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	0017	125C, 6.0 VOLTS	54 HRS	347	0
HIGH VOLTAGE LIFE	0017	125C, 6.0 VOLTS	1000 HRS	116	0
Total:					0

PRECONDITIONING

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
VAPOR PHASE REFLOW	0017	220C	3 PASS	45	0
STORAGE LIFE	0017	125C	24 HRS	45	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	45	
VAPOR PHASE REFLOW		220C	3 PASS	45	0
Total:					0

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	0017	150C	1000 HRS	77	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	0017	-55C TO 125C	1000 CYS	77	0

Total: 0

Assembly Information:

Qualification Vehicle: DS1100L
Assembly Site: OSEP
Pin Count: 8
Package Type: SOIC
Body Size: 150x1.4
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 1
Date Code Range: 0019 to 0019

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ESD SENSITIVITY	0019	EOS/ESD S5.1 HBM 500 VOLTS	2 PUL'S	3	0
ESD SENSITIVITY	0019	EOS/ESD S5.1 HBM 1000 VOLTS	2 PUL'S	3	0
ESD SENSITIVITY	0019	EOS/ESD S5.1 HBM 2000 VOLTS	2 PUL'S	3	0
ESD SENSITIVITY	0019	EOS/ESD S5.1 HBM 4000 VOLTS	2 PUL'S	3	1
ESD SENSITIVITY	0019	EOS/ESD S5.1 HBM 8000 VOLTS	2 PUL'S	3	3
LATCH-UP	0019	JESD78, I-TEST 85C	2 DYS	3	0
LATCH-UP	0019	JESD78, Vsupply TEST 85C	2 DYS	3	0
				Total:	4

FAILURE RATE: MTTF (YRS): 156326 FITS: 0.7