

RELIABILITY REPORT
FOR

DS2401, Rev D1

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

DS2401, Rev D1

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):	63334	FITS:	1.8
	DEVICE HOURS:	539000	FAILS:	0

Only data from Operating Life or similar stresses are used for this calculation.

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 for this report. 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 assemblies used as part of this report, a description of each will follow which includes the respective reliability data for that assembly. The reliability data section includes the latest data available.

Device Information:

Device:	DS2401
Process:	E6P-2P1M,HPVt,N+ESD,TCN3 ALOCOS:GOI
Passivation:	Pass w/Nov.TEOS Oxide-OxyNit (NO REGLASS)
Die Size:	54 x 28
Number of Transistors:	2371
Interconnect:	Aluminum / 1% Silicon / 0.5% Copper
Gate Oxide Thickness:	150 Å

Assembly Information:

Qualification Vehicle	DS2401
Assembly Site:	CIRTEK
Pin Count:	3
Package Type:	TO92
Body Size:	150
Mold Compound:	Sumitomo 6710S
Lead Frame:	Stamped Copper CDA194
Lead Finsh:	SnPb Plate
Die Attach:	84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size:	Au / 1.0 mil
Theta JA:	
Theta JC:	
Flammability:	UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A)	NA
Date Code Range:	0517 to 0614

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0517	125C, 6.0 VOLTS	1000 HRS	80	0	

HIGH TEMP OP LIFE	0527	125C, 6.0 VOLTS	1000 HRS	75	0
HIGH TEMP OP LIFE	0607	125C, 6.0 VOLTS	1000 HRS	80	0
HIGH TEMP OP LIFE	0614	125C, 6.0 VOLTS	1000 HRS	80	0
Total:				0	0

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
DROP	0527		25 C	36 CYS	250		
Total:						0	

STORAGE LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
STORAGE LIFE	0607		150C	1000 HRS	77	0	
STORAGE LIFE	0614		150C	1000 HRS	77	0	
Total:						0	

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0517		-55C TO 125C	1000 CYS	45	0	
TEMP CYCLE	0527		-55C TO 125C	1000 CYS	45	0	
TEMP CYCLE	0607		-55C TO 125C	1000 CYS	45	0	
TEMP CYCLE	0614		-55C TO 125C	1000 CYS	45	0	
Total:						0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST	0517		130C, 85%R.H.,5.5V	96 HRS	77	0	
HAST	0527		130C, 85%R.H.,5.5V	96 HRS	70	0	
HAST	0607		130C, 85%R.H.,5.5V	96 HRS	77	0	
HAST	0614		130C, 85%R.H.,5.5V	96 HRS	77	0	
Total:						0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0517		121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0	
AUTOCLAVE	0527		121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0	
AUTOCLAVE	0607		121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0	
AUTOCLAVE	0614		121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0	
Total:						0	

Assembly Information:

Qualification Vehicle DS2401
Assembly Site: Dallas-8"
Pin Count: 2
Package Type: Flip Chip glob
Body Size: 18
Mold Compound: ?
Lead Frame: Unknown
Lead Finsh: High Pb Ball (95/5)
Die Attach: Glob Top 4323, Dexter Hysol
Bond Wire / Size: /
Theta JA:
Theta JC:
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A) Level 1
Date Code Range: 0413 to 0413

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0413	-40 TO 85C	1000 CYS	80	0	
TEMP CYCLE	0413	-40 TO 85C	1000 CYS	80	0	
Total:					0	

Assembly Information:

Qualification Vehicle DS2401
Assembly Site: Dallas-8"
Pin Count: 2
Package Type: Flip Chip no encap
Body Size: 18
Mold Compound: ?
Lead Frame: Unknown
Lead Finsh: High Pb Ball (95/5)
Die Attach: No Underfill
Bond Wire / Size: /
Theta JA:
Theta JC:
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A) Level 1
Date Code Range: 0403 to 0403

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0403	125C, 5.5 VOLTS	1000 HRS	48	0	
HIGH TEMP OP LIFE	0403	125C, 5.5 VOLTS	1000 HRS	48	0	
HIGH TEMP OP LIFE	0403	125C, 5.5 VOLTS	1000 HRS	48	0	
Total:					0	

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
STORAGE LIFE	0403	125C	1000 HRS	80	0	

STORAGE LIFE	0403	125C	1000 HRS	80	0
STORAGE LIFE	0403	125C	1000 HRS	80	0
Total:				0	0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0403		85/85, 5.5 VOLTS	1000 HRS	80	0	
BIASED MOISTURE	0403		85/85, 5.5 VOLTS	1000 HRS	80	0	
BIASED MOISTURE	0403		85/85, 5.5 VOLTS	1000 HRS	80	0	
Total:					0	0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0403		121C, 2 ATM STEAM, UNBIASED	168 HRS	80	0	
AUTOCLAVE	0403		121C, 2 ATM STEAM, UNBIASED	168 HRS	80	0	
AUTOCLAVE	0403		121C, 2 ATM STEAM, UNBIASED	168 HRS	80	0	
Total:					0	0	

Assembly Information:

Qualification Vehicle DS2401
 Assembly Site: Dallas-8"
 Pin Count: 2
 Package Type: Flip Chip underfill
 Body Size: 18
 Mold Compound: ?
 Lead Frame: Unknown
 Lead Finsh: High Pb Ball (95/5)
 Die Attach: Underfill FP4549, Dexter Hysol
 Bond Wire / Size: /
 Theta JA:
 Theta JC:
 Flammability: UL 94-V0
 Moisture Sensitivity Level 1
 (JEDEC J-STD20A)
 Date Code Range: 0413 to 0413

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0413		-40 TO 85C	1000 CYS	80	0	
TEMP CYCLE	0413		-40 TO 85C	1000 CYS	80	0	
Total:					0	0	

