

RELIABILITY REPORT
FOR

DS80C390, Rev C3

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:

DS80C390, Rev C3

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): 47667** **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. 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: DS80C390
 Process: 1P, 3M, 0.5um, Sil.P1, Ti/TiN M1+M2+M3 ,
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 206 x 204
 Number of Transistors: 1200000
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness:

Assembly Information:

Qualification Vehicle: DS80C390
 Assembly Site: ATK (Amkor, K)
 Pin Count: 64
 Package Type: LQFP
 Body Size: 10x10x1.4
 Mold Compound: Sumitomo 7320CR
 Lead Frame: C18045 w/Ag Spot
 Lead Finsh: SnPb Plate
 Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
 Bond Wire / Size: Au / 1.2 mil
 Theta JA: 40
 Theta JC: 8
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A) Level 1
 Date Code Range: 0051 to 0403

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
INFANT LIFE	0051	125C, 6.0 VOLTS	48 HRS	116	0	
HIGH VOLTAGE LIFE	0051	125C, 6.0 VOLTS	1000 HRS	114	0	
HIGH TEMP OP LIFE	0403	125C, 5.5 VOLTS	1000 HRS	77	0	

Total: 0

Assembly Information:

Qualification Vehicle: DS80C390
Assembly Site: ATP (Amkor, PI)
Pin Count: 68
Package Type: PLCC
Body Size: 950x950x3.87
Mold Compound: Nitto MP8000C
Lead Frame: Stamped Copper CDA151
Lead Finsh: SnPb Plate
Die Attach: 8361J Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Theta JA: 68
Theta JC: 19
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 4
Date Code Range: 0404 to 0404

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ESD SENSITIVITY	0404	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0404	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0404	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	3	No FA
ESD SENSITIVITY	0404	EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	3	No FA
ESD SENSITIVITY	0404	EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	3	No FA
LATCH-UP	0404	JESD78, I-TEST 125C		6	0	
LATCH-UP	0404	JESD78, Vsupply TEST 125C		6	0	
Total:					9	

Assembly Information:

Qualification Vehicle: DS80C390
Assembly Site: Stats
Pin Count: 64
Package Type: LQFP
Body Size: 10x10x1.4
Mold Compound: Sumitomo 7320CR
Lead Frame: C18045 w/Ag Spot
Lead Finsh: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.2 mil
Theta JA: 40
Theta JC: 8
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 4
Date Code Range: 9918 to 9936

MOISTURE SENSITIVITY LEVEL 2

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
-------------	-----------	-----------	-----------	-----	-------	-----

ULTRASOUND	9918	J-STD-020			8	0
STORAGE LIFE		125C	24	HRS	8	
MOISTURE SOAK		85 C/60% R.H.	240	HRS	8	
CONVECTION REFLOW		235C +5/-0C	3	PASS	8	0
PRECONDITION U/S		J-STD-020			8	0
Total:					8	0

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
INFANT LIFE	9918		125C, 6.0 VOLTS	48 HRS	300	0	
HIGH VOLTAGE LIFE	9918		125C, 6.0 VOLTS	1000 HRS	116	0	
INFANT LIFE	9936		125C, 6.0 VOLTS	48 HRS	77	0	
HIGH VOLTAGE LIFE	9936		125C, 6.0 VOLTS	1000 HRS	75	0	
Total:					668	0	

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
SOLDERABILITY (Sn/Pb)	9918		MIL-STD-883-2003		3	0	
X-RAY	9918		MIL-STD-883-2012 : TOP & SIDE VIEW		6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016		6	0	
MARK PERMANENCY			MIL-STD-883-2015		6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2		6	0	
Total:					27	0	

PRECONDITIONING LEVEL 3

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
STORAGE LIFE	9918		125C	24 HRS	304		
MOISTURE SOAK			30C/60% R.H.	240 HRS	304		
CONVECTION REFLOW			235C +5/-0C	3 PASS	304	0	
Total:					912	0	

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	9918		-55C TO 125C	1000 CYS	77	0	
Total:					77	0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST	9918		130C, 85%R.H.,5.5V	100 HRS	63	0	
Total:					63	0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST, NO BIAS	9918		130C, 85% R.H.	200 HRS	38	0	
Total:					38	0	

FAILURE RATE: MTTF (YRS): 47667 FITS: 2.4