

RELIABILITY REPORT
FOR

DS80C310, D2

Dallas Semiconductor

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Conclusion:

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

DS80C310, D2

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): 48420** **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. Some of this data may be generic with other products.

Device Information:

Process: D6RL-1P1M,SILP1,LLVt,N+ESD PBL:GOI
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 157 x 136
 Number of Transistors: 0
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS80C310
 Assembly Site: ATP (Amkor, PI)
 Pin Count: 44
 Package Type: MQFP
 Body Size: 10x10x2
 Mold Compound: Nitto MP8000C
 Lead Frame: Stamped Copper C7025
 Lead Finish: SnPb Plate
 Die Attach: 8361J Epoxy Silverfilled Ablebond
 Bond Wire / Size: Au / 1.0 mil
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A) Level 3
 Date Code Range: 0010 to 0012

MOISTURE SENSITIVITY LEVEL 3

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ULTRASOUND	0010	J-STD-020	1 DYS	8	0	
STORAGE LIFE		125C	24 HRS	8		
MOISTURE SOAK		30C/60% R.H.	240 HRS	8		
CONVECTION REFLOW		235C +5/-0C	3 PASS	8	0	
EXTERNAL VISUAL		MIL-STD-883-2009	1 DYS	8	0	
PRECONDITION U/S		J-STD-020	1 DYS	8	0	

ULTRASOUND	0012	J-STD-020	1	DYS	8	0
STORAGE LIFE		125C	24	HRS	8	
MOISTURE SOAK		30C/60% R.H.	240	HRS	8	
CONVECTION REFLOW		235C +5/-0C	3	PASS	8	0
EXTERNAL VISUAL		MIL-STD-883-2009	1	DYS	8	0
PRECONDITION U/S		J-STD-020	1	DYS	8	0
Total:						0

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0010		125C, 6.0 VOLTS	1000 HRS	116	0	
HIGH VOLTAGE LIFE	0012		125C, 6.0 VOLTS	1000 HRS	116	0	
Total:						0	

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
SOLDERABILITY	0010		MIL-STD-883-2003	3 DYS	3	0	
X-RAY	0010		MIL-STD-883-2012 : TOP & SIDE VIEW	3 DYS	6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016	3 DYS	6	0	
MARK PERMANENCY			MIL-STD-883-2015	3 DYS	6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2	3 DYS	6	0	
SOLDERABILITY	0012		MIL-STD-883-2003	3 DYS	3	0	
X-RAY	0012		MIL-STD-883-2012 : TOP & SIDE VIEW	3 DYS	6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016	3 DYS	6	0	
MARK PERMANENCY			MIL-STD-883-2015	3 DYS	6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2	3 DYS	6	0	
Total:						0	

PRECONDITIONING LEVEL 3

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
STORAGE LIFE	0010		125C	24 HRS	315		
MOISTURE SOAK			30C/60% R.H.	240 HRS	315		
CONVECTION REFLOW			235C +5/-0C	3 PASS	315	0	
STORAGE LIFE	0012		125C	24 HRS	315		
MOISTURE SOAK			30C/60% R.H.	240 HRS	315		
CONVECTION REFLOW			235C +5/-0C	3 PASS	315	0	
Total:						0	

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0010		-55C TO 125C	1000 CYS	77	0	
TEMP CYCLE	0012		-55C TO 125C	1000 CYS	77	0	
Total:						0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0010		85/85, 5.5 VOLTS	959 HRS	77	0	
BIASED MOISTURE	0012		85/85, 5.5 VOLTS	959 HRS	77	0	
Total:						0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0010		121C, 2 ATM STEAM, UNBIASED	168 HRS	30	0	
AUTOCLAVE	0012		121C, 2 ATM STEAM, UNBIASED	168 HRS	39	0	
						Total:	0

Assembly Information:

Qualification Vehicle: DS80C320
Assembly Site: ATEC
Pin Count: 40
Package Type: PDIP
Body Size: 600
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 / 1.3 mil
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A)
Date Code Range: 0040 to 0351

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0040		125C, 6.0 VOLTS	1000 HRS	116	0	
HIGH TEMP OP LIFE	0323		125C, 5.5 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0351		125C, 5.5 VOLTS	1000 HRS	77	1	No FA
						Total:	1

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
SOLDERABILITY	0040		MIL-STD-883-2003	2 DYS	3	0	
X-RAY	0040		MIL-STD-883-2012 : TOP & SIDE VIEW	2 DYS	6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016	2 DYS	6	0	
MARK PERMANENCY			MIL-STD-883-2015	2 DYS	6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2	2 DYS	6	0	
						Total:	0

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0040		-55C TO 125C	1000 CYS	77	0	
TEMP CYCLE	0323		-55C TO 125C	1000 CYS	45	0	
TEMP CYCLE	0351		-55C TO 125C	1000 CYS	45	0	
						Total:	0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0040		85/85, 5.5 VOLTS	959 HRS	77	0	
BIASED MOISTURE	0323		85/85, 5.5 VOLTS	1000 HRS	77	0	

BIASED MOISTURE	0351	85/85, 5.5 VOLTS	500	HRS	77	0
Total:						0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0040	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0	
AUTOCLAVE	0323	121C, 2 ATM STEAM, UNBIASED	96 HRS	45	0	
AUTOCLAVE	0351	121C, 2 ATM STEAM, UNBIASED	96 HRS	45	0	
Total:						0

Assembly Information:

Qualification Vehicle: DS80C320
 Assembly Site: ATP (Amkor, PI)
 Pin Count: 40
 Package Type: PDIP
 Body Size: 600
 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)
 Date Code Range: 0230 to 0230

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0230	125C, 7.0 VOLTS	1000 HRS	77	0	
Total:						0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0230	-55C TO 125C	1000 CYS	45	0	
Total:						0

TEMPERATURE HUMIDITY BIAS

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

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0230	121C, 2 ATM STEAM, UNBIASED	96 HRS	45	0	
Total:						0

Assembly Information:

Qualification Vehicle: DS80C320
Assembly Site: CPS (ChipPac, China)
Pin Count: 40
Package Type: PDIP
Body Size: 600
Mold Compound: Sumitomo 6300H
Lead Frame: Stamped Copper CDA194
Lead Finish: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: /
Flammability: UL 94-V0
Moisture Sensitivity
(JEDEC J-STD20A)
Date Code Range: 0038 to 0111

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
INFANT LIFE	0038	125C, 7.0 VOLTS	48 HRS	234	0	
HIGH VOLTAGE LIFE	0038	125C, 7.0 VOLTS	1000 HRS	77	0	
INFANT LIFE	0049	125C, 7.0 VOLTS	48 HRS	234	0	
HIGH VOLTAGE LIFE	0049	125C, 7.0 VOLTS	1000 HRS	77	0	
HIGH VOLTAGE LIFE	0111	125C, 7.0 VOLTS	1000 HRS	77	0	
			Total:		0	

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0038	-55C TO 125C	1000 CYS	40	0	
TEMP CYCLE	0049	-55C TO 125C	1000 CYS	40	0	
TEMP CYCLE	0111	-55C TO 125C	1000 CYS	40	0	
			Total:		0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0038	85/85, 5.5 VOLTS	959 HRS	77	0	
BIASED MOISTURE	0049	85/85, 5.5 VOLTS	959 HRS	77	0	
BIASED MOISTURE	0111	85/85, 5.5 VOLTS	959 HRS	77	0	
			Total:		0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
AUTOCLAVE	0038	121C, 2 ATM STEAM, UNBIASED	96 HRS	37	0	
AUTOCLAVE	0049	121C, 2 ATM STEAM, UNBIASED	96 HRS	38	0	
AUTOCLAVE	0111	121C, 2 ATM STEAM, UNBIASED	96 HRS	40	0	
			Total:		0	

Assembly Information:

Qualification Vehicle: DS80C320
Assembly Site: OSEP
Pin Count: 44
Package Type: PLCC
Body Size: 650x650x3.87
Mold Compound: Nitto MP8000C
Lead Frame: Stamped Copper CDA151
Lead Finish: SnPb Plate
Die Attach: 8361J Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 3
Date Code Range: 0405 to 0405

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ESD SENSITIVITY	0405		EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0405		EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0405		EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0405		EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0405		EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	3	No FA
LATCH-UP	0405		JESD78, I-TEST 125C	2 DYS	6	0	
LATCH-UP	0405		JESD78, Vsupply TEST 125C	2 DYS	6	0	
				Total:		3	

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0405		125C, 5.5 VOLTS	1000 HRS	77	0	
				Total:		0	

FAILURE RATE: MTTF (YRS): 48420 FITS: 2.4