

RELIABILITY REPORT
FOR

DS80CH11, Rev A4

Dallas Semiconductor

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Prepared by:

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Conclusion:

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

DS80CH11, 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 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): 138361** **FITS: 0.8**

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: 1P, 2M, 0.6um, SiP1, NdA, PD, Ti/TiN M1+M2, WJ BPSG, N+E
 Passivation: Passivation w/Nov TEOS Oxide-Nitride
 Die Size: 273 x 340
 Number of Transistors: 0
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 150 Å

Assembly Information:

Qualification Vehicle: DS80CH11
 Assembly Site: ATP (Amkor, PI)
 Pin Count: 128
 Package Type: LQFP
 Body Size: 14x20x1.4
 Mold Compound: Sumitomo 7320CR
 Lead Frame: C18045 w/Ag Spot
 Lead Finsh: SnPb Plate
 Die Attach: M2500 Ag Polymer
 Bond Wire / Size: Au / 1.2 mil
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A) Level 4
 Date Code Range: 9926 to 0206

ELECTRICAL CHARACTERIZATION

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ESD SENSITIVITY	0206		EOS/ESD S5.1 HBM 500 VOLTS	2 PUL'S	3	0	
ESD SENSITIVITY	0206		EOS/ESD S5.1 HBM 1000 VOLTS	2 PUL'S	3	0	
ESD SENSITIVITY	0206		EOS/ESD S5.1 HBM 2000 VOLTS	2 PUL'S	3	0	
ESD SENSITIVITY	0206		EOS/ESD S5.1 HBM 4000 VOLTS	2 PUL'S	3	3	No FA
ESD SENSITIVITY	0206		EOS/ESD S5.1 HBM 8000 VOLTS	2 PUL'S	3	3	No FA

Total: 6

MOISTURE SENSITIVITY LEVEL 3

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
PRECONDITION U/S	9926		J-STD-020	2 DYS	8	0	
ULTRASOUND			J-STD-020	2 DYS	8	0	
STORAGE LIFE			125C	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	
Total:						0	

OPERATING LIFE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0206		125C, 6.0 VOLTS	1000 HRS	80	0	
HIGH VOLTAGE LIFE	0206		125C, 6.0 VOLTS	1000 HRS	80	0	
HIGH VOLTAGE LIFE	0206		125C, 6.0 VOLTS	1000 HRS	80	0	
INFANT LIFE	9926		125C, 6.0 VOLTS	48 HRS	340	0	
HIGH VOLTAGE LIFE	9926		125C, 6.0 VOLTS	1000 HRS	170	0	
Total:						0	

PACKAGE TESTS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
SOLDERABILITY	9926		MIL-STD-883-2003	1 DYS	3	0	
X-RAY	9926		MIL-STD-883-2012 : TOP & SIDE VIEW	2 DYS	6	0	
PHYSICAL DIMENSIONS			MIL-STD-883-2016	4 DYS	6	0	
MARK PERMANENCY			MIL-STD-883-2015	6 DYS	6	0	
LEAD INTEGRITY			MIL-STD-883-2004 : COND B2	8 DYS	6	0	
Total:						0	

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	9926		-55C TO 125C	1000 CYS	77	0	
Total:						0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	9926		85/85, 5.5 VOLTS	949 HRS	48	1	No FA
Total:						1	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST, NO BIAS	9926		130C, 85% R.H.	200 HRS	45	0	
Total:						0	

Assembly Information:

Qualification Vehicle: DS80CH11
Assembly Site: ATK (Amkor, K)
Pin Count: 128
Package Type: LQFP
Body Size: 14x20x1.4
Mold Compound: Sumitomo 7320CR
Lead Frame: EFTEC 64T w/Ag Spot
Lead Finish: SnPb Plate
Die Attach: M2500 Ag Polymer
Bond Wire / Size: Au / 1.2 mil
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 4
Date Code Range: 9908 to 0113

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0018	125C, 6.0 VOLTS	1000 HRS	116	0	
INFANT LIFE	0033	125C, 6.0 VOLTS	48 HRS	235	0	
HIGH VOLTAGE LIFE	0033	125C, 6.0 VOLTS	1000 HRS	77	0	
HIGH VOLTAGE LIFE	0103	125C, 6.0 VOLTS	1000 HRS	77	0	
INFANT LIFE	0103	125C, 6.0 VOLTS	48 HRS	235	0	
HIGH VOLTAGE LIFE	0113	125C, 6.0 VOLTS	1000 HRS	80	0	
INFANT LIFE	9908	125C, 6.0 VOLTS	48 HRS	263	0	
HIGH VOLTAGE LIFE	9908	125C, 6.0 VOLTS	1000 HRS	170	0	
HIGH VOLTAGE LIFE	9949	125C, 6.0 VOLTS	1000 HRS	116	0	
			Total:		0	

PRECONDITIONING LEVEL 3

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ULTRASOUND	0033	J-STD-020	1 DYS	4	0	
STORAGE LIFE	0033	125C	24 HRS	239		
MOISTURE SOAK		30C/60% R.H.	240 HRS	239		
CONVECTION REFLOW		235C +5/-0C	3 PASS	239	0	
PRECONDITION U/S	0033	J-STD-020	1 DYS	4	0	
ULTRASOUND	0103	J-STD-020	1 DYS	4	0	
STORAGE LIFE	0103	125C	24 HRS	239		
MOISTURE SOAK		30C/60% R.H.	240 HRS	239		
CONVECTION REFLOW		235C +5/-0C	3 PASS	239		
PRECONDITION U/S	0103	J-STD-020	1 DYS	4	0	
ULTRASOUND	0113	J-STD-020	1 DYS	4	0	
STORAGE LIFE	0113	125C	24 HRS	244		
MOISTURE SOAK		30C/60% R.H.	192 HRS	244		
CONVECTION REFLOW		235C +5/-0C	3 PASS	244	1	NONE
PRECONDITION U/S	0113	J-STD-020	1 DYS	4	0	

Total: 1

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0033	-55C TO 125C	1000 CYS	70	0	
TEMP CYCLE	0103	-55C TO 125C	1000 CYS	70	0	
TEMP CYCLE	0113	-55C TO 125C	1000 CYS	70	0	
TEMP CYCLE	9908	-55C TO 125C	1000 CYS	77	0	
Total:					0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0033	85/85, 5.5 VOLTS	959 HRS	32	0	
BIASED MOISTURE	0103	85/85, 5.5 VOLTS	959 HRS	48	0	
BIASED MOISTURE	0113	85/85, 5.5 VOLTS	959 HRS	31	0	
Total:					0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST, NO BIAS	0033	130C, 85% R.H.	100 HRS	39	0	
HAST, NO BIAS	0103	130C, 85% R.H.	100 HRS	40	0	
HAST, NO BIAS	0113	130C, 85% R.H.	100 HRS	44	0	
Total:					0	

Assembly Information:

Qualification Vehicle: DS80CH11
Assembly Site: Stats
Pin Count: 128
Package Type: LQFP
Body Size: 14x20x1.4
Mold Compound: Sumitomo 7320CR
Lead Frame: Stamped Copper C7025
Lead Finsh: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.2 mil
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 4
Date Code Range: 0110 to 0110

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH VOLTAGE LIFE	0110	125C, 6.0 VOLTS	1000 HRS	80	0	
Total:					0	

PRECONDITIONING LEVEL 3

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ULTRASOUND	0110	J-STD-020	1 DYS	4	0	
STORAGE LIFE	0110	125C	24 HRS	242		

MOISTURE SOAK	0110	60C/60% R.H.	40	HRS	242	
CONVECTION REFLOW		235C +5/-0C	3	PASS	242	0
PRECONDITION U/S	0110	J-STD-020	1	DYS	4	0
Total:						0

TEMPERATURE CYCLE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
TEMP CYCLE	0110		-55C TO 125C	1000 CYS	70	0	
Total:						0	

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
BIASED MOISTURE	0110		85/85, 5.5 VOLTS	959 HRS	42	0	
Total:						0	

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HAST, NO BIAS	0110		130C, 85% R.H.	100 HRS	40	0	
Total:						0	

FAILURE RATE: **MTTF (YRS): 138361** **FITS: 0.8**