

RELIABILITY REPORT  
FOR

**DS1780, Rev A4, 24 TSSOP 4.4mm**

**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:

DS1780, Rev A4, 24 TSSOP 4.4mm

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 this assembly can be found in the product data sheet. You can find the product data sheet at [http://dbserv.maxim-ic.com/l\\_datasheet3.cfm](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<sup>-5</sup> 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 is:

**FAILURE RATE:**                      **MTTF (YRS): 62136**                      **FITS: 1.8**

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 a description of the device / assembly vehicle used to generate this reliability data. The next section is the detailed reliability data for each stress. 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:**

Process: 1P, 2M, 0.8um, Neg ZTC P1R, PdpID, Low Vts, Ti/TiN M1/M2, E  
 Passivation: Laser/LTO Ox - Pass/Nit - SRAM LaserPrb  
 Die Size: 113 x 80  
 Number of Transistors: 12000  
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper  
 Gate Oxide Thickness: 175 Å

**OPERATING LIFE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9814	125C, 7.0 VOLTS	24 HRS	1950	0
HIGH VOLTAGE LIFE	9814	125C, 7.0 VOLTS	1000 HRS	134	0
HIGH VOLTAGE LIFE	9936	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9938	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9940	125C, 7.0 VOLTS	1000 HRS	116	0
<b>Total:</b>					<b>0</b>

**TEMPERATURE CYCLE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9936	-55C TO 125C	1000 CYS	77	0
TEMP CYCLE	9938	-55C TO 125C	1000 CYS	77	0
TEMP CYCLE	9940	-55C TO 125C	1000 CYS	77	0
<b>Total:</b>					<b>0</b>

**TEMPERATURE HUMIDITY BIAS**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HAST	9936	130C, 85%R.H., 5.5V	100 HRS	42	0
HAST	9938	130C, 85%R.H., 5.5V	100 HRS	42	0
HAST	9940	130C, 85%R.H., 5.5V	100 HRS	42	0
<b>Total:</b>					<b>0</b>

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**UNBIASED MOISTURE RESISTANCE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	9814	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
AUTOCLAVE	9936	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
AUTOCLAVE	9938	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
AUTOCLAVE	9940	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
<b>Total:</b>					<b>0</b>

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**Assembly Information:**

Assembly Site: ATK (Amkor, K)  
Pin Count: 24  
Package Type: TSSOP  
Body Size: 4.4x0.9  
Mold Compound: Shinetsu 184  
Lead Frame: Stamped copper  
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: 9626 to 9814

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**OPERATING LIFE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9626	125C, 7.0 VOLTS	48 HRS	315	1
HIGH VOLTAGE LIFE	9626	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9728	125C, 5.5 VOLTS	1000 HRS	153	0
INFANT LIFE	9814	125C, 7.0 VOLTS	24 HRS	1950	0
HIGH VOLTAGE LIFE	9814	125C, 7.0 VOLTS	1000 HRS	134	0
<b>Total:</b>					<b>1</b>

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**TEMPERATURE CYCLE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9626	-55C TO 125C	1000 CYS	77	0
<b>Total:</b>					<b>0</b>

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**TEMPERATURE HUMIDITY BIAS**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HAST	9626	120C, 85%R.H.,5.5V	200 HRS	77	0
<b>Total:</b>					<b>0</b>

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**UNBIASED MOISTURE RESISTANCE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	9626	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
AUTOCLAVE	9814	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
<b>Total:</b>					<b>0</b>

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**Assembly Information:**

Assembly Site: ATP (Amkor, PI)  
Pin Count: 24  
Package Type: TSSOP  
Body Size: 4.4x0.9  
Mold Compound: Sumitomo 7351T  
Lead Frame: Stamped Copper C7025  
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 Level 1  
(JEDEC J-STD20A)  
Date Code Range: 9723 to 9841

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**MOISTURE SENSITIVITY LEVEL 1**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	9723	J-STD-020		8	0
STORAGE LIFE		125C	26 HRS	8	
MOISTURE SOAK		85 C/85% R.H.	194 HRS	8	
SOLDER HEAT		HTC VAPOR PHASE	3 PASS	8	
EXTERNAL VISUAL		MIL-STD-883-2009		8	0
PRECONDITION U/S		J-STD-020		8	0
ULTRASOUND	9841	J-STD-020		8	0
STORAGE LIFE		125C	26 HRS	8	
MOISTURE SOAK		85 C/85% R.H.	194 HRS	8	
CONVECTION REFLOW		235C	3 PASS	8	
EXTERNAL VISUAL		MIL-STD-883-2009		8	0
PRECONDITION U/S		J-STD-020		8	0
<b>Total:</b>					<b>0</b>

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**OPERATING LIFE**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9723	125C, 7.0 VOLTS	48 HRS	314	0
HIGH VOLTAGE LIFE	9723	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH TEMP OP LIFE	9841	125C, 5.5 VOLTS	1000 HRS	116	0
<b>Total:</b>					<b>0</b>

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**PACKAGE TESTS**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
SOLDERABILITY	9841	MIL-STD-883-2003		3	0
X-RAY	9841	MIL-STD-883-2012 : TOP & SIDE VIEW		6	
PHYSICAL DIMENSIONS		MIL-STD-883-2016		6	
MARK PERMANENCY		MIL-STD-883-2015		6	
LEAD INTEGRITY		MIL-STD-883-2004 : COND B2		6	0
<b>Total:</b>					<b>0</b>

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**PRECONDITIONING LEVEL 1**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	9723	125C	24 HRS	315	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	315	

SOLDER HEAT	9723	HTC VAPOR PHASE	3	PASS	315	0
STORAGE LIFE	9841	125C	24	HRS	315	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	315	
CONVECTION REFLOW		235C	3	PASS	315	0
<b>Total:</b>					<b>0</b>	<b>0</b>

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#### TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS	
TEMP CYCLE	9723	-55C TO 125C	1000	CYS	77	0
TEMP CYCLE	9841	-55C TO 125C	1000	CYS	77	0
<b>Total:</b>					<b>0</b>	<b>0</b>

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#### TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS	
HAST	9723	120C, 85%R.H.,5.5V	100	HRS	77	0
HAST	9841	120C, 85%R.H.,5.5V	100	HRS	77	0
<b>Total:</b>					<b>0</b>	<b>0</b>

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#### UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS	
AUTOCLAVE	9723	121C, 2 ATM STEAM, UNBIASED	168	HRS	44	0
AUTOCLAVE	9841	121C, 2 ATM STEAM, UNBIASED	168	HRS	44	0
<b>Total:</b>					<b>0</b>	<b>0</b>

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#### Assembly Information:

Assembly Site: OSEP  
 Pin Count: 24  
 Package Type: TSSOP  
 Body Size: 4.4x0.9  
 Mold Compound: Sumitomo 7351T  
 Lead Frame: Stamped Copper C7025  
 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: 9936 to 9940

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#### MOISTURE SENSITIVITY LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS	
EXTERNAL VISUAL	9936	MIL-STD-883-2009		8	0	
ULTRASOUND		J-STD-020		8	0	
STORAGE LIFE		125C	24	HRS	8	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	8	
CONVECTION REFLOW		235C	3	PASS	8	0
EXTERNAL VISUAL		MIL-STD-883-2009		8	0	
PRECONDITION U/S		J-STD-020		8	0	
EXTERNAL VISUAL	9938	MIL-STD-883-2009		8	0	
ULTRASOUND		J-STD-020		8	0	
STORAGE LIFE		125C	24	HRS	8	

MOISTURE SOAK	9938	85 C/85% R.H.	168	HRS	8	
CONVECTION REFLOW		235C	3	PASS	8	0
EXTERNAL VISUAL		MIL-STD-883-2009			8	0
PRECONDITION U/S		J-STD-020			8	0
EXTERNAL VISUAL	9940	MIL-STD-883-2009			8	0
ULTRASOUND		J-STD-020			8	0
STORAGE LIFE		125C	24	HRS	8	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	8	
CONVECTION REFLOW		235C	3	PASS	8	0
EXTERNAL VISUAL		MIL-STD-883-2009			8	0
PRECONDITION U/S		J-STD-020			8	0
<b>Total:</b>					<b>0</b>	<b>0</b>

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#### OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HIGH VOLTAGE LIFE	9936	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9938	125C, 7.0 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9940	125C, 7.0 VOLTS	1000 HRS	116	0
<b>Total:</b>					<b>0</b>

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#### PACKAGE TESTS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
CONSTRUCTION ANALY	9936	SENT TO OUTSIDE SOURCE		5	0
SOLDERABILITY	9936	MIL-STD-883-2003		3	0
X-RAY	9936	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
CONSTRUCTION ANALY	9938	SENT TO OUTSIDE SOURCE		5	0
SOLDERABILITY	9938	MIL-STD-883-2003		3	0
X-RAY	9938	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
SOLDERABILITY	9940	MIL-STD-883-2003		3	0
X-RAY	9940	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
<b>Total:</b>					<b>0</b>

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#### PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	9936	125C	24 HRS	315	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	315	
CONVECTION REFLOW		235C	3 PASS	315	0
STORAGE LIFE	9938	125C	24 HRS	315	
MOISTURE SOAK		85 C/85% R.H.	168 HRS	315	

CONVECTION REFLOW	9938	235C	3	PASS	315	0
STORAGE LIFE	9940	125C	24	HRS	315	
MOISTURE SOAK		85 C/85% R.H.	168	HRS	315	
CONVECTION REFLOW		235C	3	PASS	315	0
				<b>Total:</b>		<b>0</b>

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#### TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9936	-55C TO 125C	1000 CYS	77	0
TEMP CYCLE	9938	-55C TO 125C	1000 CYS	77	0
TEMP CYCLE	9940	-55C TO 125C	1000 CYS	77	0
				<b>Total:</b>	<b>0</b>

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#### TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HAST	9936	130C, 85%R.H.,5.5V	100 HRS	42	0
HAST	9938	130C, 85%R.H.,5.5V	100 HRS	42	0
HAST	9940	130C, 85%R.H.,5.5V	100 HRS	42	0
				<b>Total:</b>	<b>0</b>

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#### UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	9936	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
AUTOCLAVE	9938	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
AUTOCLAVE	9940	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
				<b>Total:</b>	<b>0</b>