

**PRODUCT RELIABILITY REPORT  
FOR**

**DS3988, Rev A3**

**Dallas Semiconductor**

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**Conclusion:**

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

DS3988, Rev A3

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 device 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:

<b>FAILURE RATE:</b>	<b>MTTF (YRS):</b>	<b>89962</b>	<b>FITS:</b>	<b>1.3</b>
	<b>DEVICE HOURS:</b>	<b>765608</b>	<b>FAILS:</b>	<b>0</b>

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. The next section is the detailed reliability data for each stress. The reliability data section includes the latest data available and may contain some generic data. "\*" after DATE CODE denotes specific product data.

**Device Information:**

Process: E35WN-3P3M,DPE2,NTC,DSD,PDES D,PDRES,Cap,ENPN,DPT,HTO,SgHalo  
 Passivation: TEOS Ox-Nit 2-Mask Laser/Pass for E35WM; Full BEOL at X3; PT only in Dallas  
 Die Size: 127 x 115  
 Number of Transistors: 70200  
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper  
 Gate Oxide Thickness: 120 Å

**ELECTRICAL CHARACTERIZATION**

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QTY	FAILS	FA#
ESD SENSITIVITY	0604	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0604	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0604	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	2	No FA
ESD SENSITIVITY	0604	EOS/ESD S5.1 HBM 4000 VOLTS	1 PUL'S	3	3	No FA
ESD SENSITIVITY	0604	EOS/ESD S5.1 HBM 8000 VOLTS	1 PUL'S	3	3	No FA
LATCH-UP	0604	JESD78, I-TEST 125C		6	0	
LATCH-UP	0604	JESD78, V-SUPPLY TEST 125C		6	0	
ESD SENSITIVITY	0642 *	EOS/ESD S5.1 HBM 500 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0642 *	EOS/ESD S5.1 HBM 1000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0642 *	EOS/ESD S5.1 HBM 1500 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0642 *	EOS/ESD S5.1 HBM 2000 VOLTS	1 PUL'S	3	0	
ESD SENSITIVITY	0642 *	EOS/ESD S5.1 HBM 3000 VOLTS	1 PUL'S	3	0	
LATCH-UP	0642 *	JESD78, I-TEST 125C		6	0	
LATCH-UP	0642 *	JESD78, V-SUPPLY TEST 125C		6	0	

**Total: 8**

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**OPERATING LIFE**

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
HIGH TEMP OP LIFE	0538		125C, 5.5 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0541		125C, 5.5 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0602		125C, 5.5 V (PSA) & 0.0 V (PSB)	1000 HRS	77	0	
HIGH TEMP OP LIFE	0604		125C, 5.5 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0620		125C, 5.25 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0624		125C, 5.5 VOLTS	192 HRS	72	0	
HIGH TEMP OP LIFE	0624		125C, 5.25 VOLTS	1000 HRS	45	0	
HIGH TEMP OP LIFE	0627		125C, 5.25 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0629		125C, 3.5 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0629		125C, 5.25 VOLTS	1000 HRS	76	0	
HIGH TEMP OP LIFE	0629		125C, 5.25 VOLTS	1000 HRS	77	0	
HIGH TEMP OP LIFE	0642	*	125C, 5.5 VOLTS	192 HRS	77	0	
<b>Total:</b>						<b>0</b>	

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**W/E ENDURANCE AND DATA RET'N**

DESCRIPTION	DATE	CODE	CONDITION	READPOINT	QTY	FAILS	FA#
WRITE CYCLE STRESS (CYS)	0538		50 C, 5.5 VOLTS	500 CYS	77	0	
STORAGE LIFE			150C	1000 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	
WRITE CYCLE STRESS (KCYS)	0538		85 C, 5.5 VOLTS	5 KCYS	77	0	
			50 C, 5.5 VOLTS	25 KCYS	77	0	
STORAGE LIFE			150C	96 HRS	77	0	

WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	76	0
WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	76	0
WRITE CYCLE STRESS (KCYS)	0538	50 C, 5.5 VOLTS	25	KCYS	77	0
STORAGE LIFE		150C	96	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0541	85 C, 5.5 VOLTS	50	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0602	85 C, 5.5 V (PSA) & 15.0 V (PSB)	1	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0604	70 C, 5.5 VOLTS	30	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0604	85 C, 5.5 VOLTS	50	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0620	85 C, 5.25 VOLTS	50	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0624	70 C, 5.5 VOLTS	50	KCYS	72	0
STORAGE LIFE		150C	1000	HRS	72	0
STORAGE LIFE	0625	150C	96	HRS	77	0
WRITE CYCLE STRESS (KCYS)		70 C, 5.5 VOLTS	30	KCYS	77	0
WRITE CYCLE STRESS (KCYS)	0627	85 C, 5.25 VOLTS	50	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0629	85 C, 3.5 VOLTS	10	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0629	25 C, 3.5 VOLTS	40	KCYS	77	0
STORAGE LIFE		150C	1000	HRS	77	0
WRITE CYCLE STRESS (KCYS)	0629	85 C, 5.25 VOLTS	50	KCYS	76	0

STORAGE LIFE	0629	150C	1000 HRS	76	0
WRITE CYCLE STRESS (KCYS)	0629	85 C, 5.25 VOLTS	50 KCYS	77	0
STORAGE LIFE		150C	1000 HRS	77	0
WRITE CYCLE STRESS (KCYS)	0642 *	70 C, 5.5 VOLTS	30 KCYS	77	0
STORAGE LIFE	*	150C	1000 HRS	77	0
			<b>Total:</b>		<b>0</b>

**FAILURE RATE:                    MTTF (YRS):                    89962                    FITS:                    1.3**

**DEVICE HOURS:                    765608                    FAILS:                    0**