

RELIABILITY REPORT
FOR

DS2187, Rev C7

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:

DS2187, Rev C7

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.

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 is:

FAILURE RATE: **MTTF (YRS): 245656** **FITS: 0.5**

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, 1M, 2.0um, Pfield, Ndepletion
 Passivation: Laser/LTO Ox-Nit - No Pass - Gen.LaserP
 Die Size: 112 x 184
 Number of Transistors: 3600
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness: 250 Å

OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9435	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9435	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9452	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9452	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9504	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9504	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9522	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9522	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9527	125C, 7.0 VOLTS	48 HRS	315	0
HIGH TEMP OP LIFE	9527	125C, 5.5 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9527	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9544	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9544	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9531	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9531	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9552	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9552	125C, 7.0 VOLTS	1000 HRS	77	0

INFANT LIFE	9619	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9619	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9643	125C, 7.0 VOLTS	48 HRS	229	0
HIGH VOLTAGE LIFE	9643	125C, 7.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	9722	125C, 7.0 VOLTS	1000 HRS	153	0
INFANT LIFE	9712	125C, 7.0 VOLTS	48 HRS	231	0
HIGH VOLTAGE LIFE	9712	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9745	125C, 7.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	9745	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9811	125C, 7.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	9811	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	9838	125C, 7.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	9838	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	0001	125C, 7.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	0001	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	0016	125C, 7.0 VOLTS	48 HRS	237	0
HIGH VOLTAGE LIFE	0016	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	0042	125C, 7.0 VOLTS	48 HRS	234	0
HIGH VOLTAGE LIFE	0042	125C, 7.0 VOLTS	1000 HRS	77	0
INFANT LIFE	0046	125C, 7.0 VOLTS	48 HRS	233	0
HIGH VOLTAGE LIFE	0046	125C, 7.0 VOLTS	1000 HRS	77	0
HIGH VOLTAGE LIFE	0050	125C, 7.0 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	0328	125C, 5.5 VOLTS	1000 HRS	77	0
HIGH TEMP OP LIFE	0327	125C, 5.5 VOLTS	1000 HRS	77	0
				Total:	0

STORAGE LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
STORAGE LIFE	0328	150C	1000 HRS	77	0
STORAGE LIFE	0327	150C	1000 HRS	77	0
				Total:	0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9435	-55C TO 125C	1000 CYS	39	0
TEMP CYCLE	9452	-55C TO 125C	1000 CYS	39	0
TEMP CYCLE	9504	-55C TO 125C	1000 CYS	39	0
TEMP CYCLE	9522	-55C TO 125C	1000 CYS	39	0
TEMP CYCLE	9527	-55C TO 125C	1000 CYS	77	0
TEMP CYCLE	9527	-55C TO 125C	10 CYS	231	

BURN-IN		125C, 7.0 VOLTS	58	HRS	231	0
TEMP CYCLE	9527	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9544	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9531	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9552	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9619	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9643	-55C TO 125C	1000	CYS	36	0
TEMP CYCLE	9712	-55C TO 125C	1000	CYS	39	0
TEMP CYCLE	9745	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	9811	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	9838	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	0001	-55C TO 125C	1100	CYS	40	0
TEMP CYCLE	0016	-55C TO 125C	1000	CYS	60	0
TEMP CYCLE	0042	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	0046	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	0050	-55C TO 125C	1000	CYS	40	0
TEMP CYCLE	0328	-55C TO 125C	1000	CYS	77	0
TEMP CYCLE	0327	-55C TO 125C	1000	CYS	77	0
					Total:	0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	9435	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9452	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9504	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9522	85/85, 5.5 VOLTS	959 HRS	77	0
HAST	9527	120C, 85%R.H.,5.5V	200 HRS	76	0
BIASED MOISTURE	9527	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9544	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9531	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9552	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9619	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9643	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9712	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9745	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9811	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	9838	85/85, 5.5 VOLTS	959 HRS	77	0
BIASED MOISTURE	0001	85/85, 5.5 VOLTS	959 HRS	77	0
HAST	0016	130C, 85%R.H.,5.5V	100 HRS	59	0

BIASED MOISTURE	0042	85/85, 5.5 VOLTS	959	HRS	77	0
BIASED MOISTURE	0046	85/85, 5.5 VOLTS	959	HRS	77	0
BIASED MOISTURE	0050	85/85, 5.5 VOLTS	959	HRS	77	0
HAST	0328	130C, 85%R.H.,5.5V	96	HRS	77	0
HAST	0327	130C, 85%R.H.,5.5V	96	HRS	77	0
Total:						0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS	
AUTOCLAVE	9435	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9452	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9504	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9522	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9527	121C, 2 ATM STEAM, UNBIASED	168	HRS	45	0
AUTOCLAVE	9527	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9544	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9531	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9552	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9619	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9643	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9712	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	9745	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	9811	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	9838	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	0001	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	0016	121C, 2 ATM STEAM, UNBIASED	96	HRS	38	0
AUTOCLAVE	0042	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	0046	121C, 2 ATM STEAM, UNBIASED	96	HRS	39	0
AUTOCLAVE	0050	121C, 2 ATM STEAM, UNBIASED	96	HRS	40	0
AUTOCLAVE	0328	121C, 2 ATM STEAM, UNBIASED	168	HRS	77	0
AUTOCLAVE	0327	121C, 2 ATM STEAM, UNBIASED	168	HRS	77	0
Total:						0

Assembly Information:

Assembly Site: ATK (Amkor, K)
 Pin Count: 20
 Package Type: SOIC
 Body Size: 300x2.3
 Mold Compound: Sumitomo 6300H w/Q3-6646 Die Coat
 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: 9426 to 9426

PACKAGE TESTS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
SOLDERABILITY	9426	MIL-STD-883-2003		3	1
X-RAY	9426	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
CONSTRUCTION ANALY	9426	TO BE DONE BY F/A		5	
				Total:	1

PRECONDITIONING

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	9426	J-STD-020		5	0
				Total:	0

PRECONDITIONING LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9426	-55C TO 125C	11 CYS	281	
MOISTURE SOAK		85 C/85% R.H.	148 HRS	281	
SOLDER HEAT		HTC VAPOR PHASE	2 PASS	281	
EXTERNAL VISUAL		MIL-STD-883-2009		281	0
TEMP CYCLE	9426	-55C TO 125C	10 CYS	150	
MOISTURE SOAK		85 C/85% R.H.	147 HRS	150	
SOLDER HEAT		HTC VAPOR PHASE	3 PASS	150	0
				Total:	0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9426	-55C TO 125C	1000 CYS	77	0
				Total:	0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	9426	85/85, 5.5 VOLTS	959 HRS	77	29
BIASED MOISTURE	9426	85/85, 5.5 VOLTS	274 HRS	74	9
				Total:	38

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOClave	9426	121C, 2 ATM STEAM, UNBIASED	168 HRS	41	0
				Total:	0