

RELIABILITY REPORT
FOR

DS2404

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:

DS2404

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.

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): 22107** **FITS: 5.2**

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 either used as a reliability test vehicle for a process / assembly qualification / monitor or a device used as part of a product qualification / monitor. 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 processes or assemblies used as part of this report, a description of each will follow which includes the respective reliability data for that process/assembly. The reliability data section includes the latest data available.

Device Information:

Device: DS2404
 Process: 1P, 1M, 1.2um, PdepletionDiode , TEOS Spacer,
 Passivation: Laser/TEOS Ox - Pass/Nit - Gen.LaserPrb
 Die Size: 175 x 136
 Number of Transistors: 45191
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper
 Gate Oxide Thickness:

Assembly Information:

Qualification Vehicle: DS2404
 Assembly Site: CPS (ChipPac, China)
 Pin Count: 16
 Package Type: PDIP
 Body Size: 300
 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 / 1.0 mil
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A)
 Date Code Range: 9731 to 9816

HIGH TEMPERATURE OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9731	125C, 7.0 VOLTS	48 HRS	315	0
OP-LIFE	9731	125C, 5.5 VOLTS	1000 HRS	116	0
HIGH VOLTAGE LIFE	9816	125C, 7.0 VOLTS	1000 HRS	153	0
				Total:	0

PACKAGE TESTS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
SOLDERABILITY	9731	MIL-STD-883-2003	1 DYS	3	0
X-RAY	9731	MIL-STD-883-2012 : TOP & SIDE VIEW	1 DYS	6	
PHYSICAL DIMENSIONS		MIL-STD-883-2016	2 DYS	6	
MARK PERMANENCY		MIL-STD-883-2015	3 DYS	6	
LEAD INTEGRITY		MIL-STD-883-2004 : COND B2	4 DYS	6	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9731	-55C TO 125C	1000 CYS	77	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
BIASED MOISTURE	9731	85/85, 5.5 VOLTS	959 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOCLAVE	9731	121C, 2 ATM STEAM, UNBIASED	168 HRS	45	0
Total:					0

Assembly Information:

Qualification Vehicle: DS2404
Assembly Site: ATK (Amkor, K)
Pin Count: 16
Package Type: SOIC
Body Size: 300x2.3
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 / 1.0 mil
Flammability: UL 94-V0
Moisture Sensitivity Level 1
(JEDEC J-STD20A)
Date Code Range: 9621 to 9621

MOISTURE SENSITIVITY LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	9621	J-STD-020	2 DYS	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	198 DYS	8	0
PRECONDITION U/S		J-STD-020	199 DYS	8	0
Total:					0

Assembly Information:

Qualification Vehicle: DS2404
Assembly Site: ATP (Amkor, PI)
Pin Count: 16
Package Type: SSOP
Body Size: 5.3x1.75
Mold Compound: Shinetsu 184
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 Level 1
(JEDEC J-STD20A)
Date Code Range: 9633 to 9712

HIGH TEMPERATURE OPERATING LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
INFANT LIFE	9712	125C, 7.0 VOLTS	48 HRS	315	1
OP-LIFE	9712	125C, 5.5 VOLTS	1000 HRS	116	0
Total:					1

MECHANICAL LIFE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
PIN HOLE TEST	9633	TO BE DONE BY F/A	1 DYS	1	0
Total:					0

MOISTURE SENSITIVITY LEVEL 1

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
ULTRASOUND	9712	J-STD-020	2 DYS	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	198 DYS	8	0
PRECONDITION U/S		J-STD-020	199 DYS	8	0
Total:					0

TEMPERATURE CYCLE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
TEMP CYCLE	9712	-55C TO 125C	1000 CYS	77	0
Total:					0

TEMPERATURE HUMIDITY BIAS

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
HAST	9712	120C, 85%R.H.,5.5V	100 HRS	77	0
Total:					0

UNBIASED MOISTURE RESISTANCE

DESCRIPTION	DATE CODE	CONDITION	READPOINT	QUANTITY	FAILS
AUTOClave	9712	121C, 2 ATM STEAM, UNBIASED	168 HRS	43	0
Total:					0

FAILURE RATE:

MTTF (YRS): 22107

FITS: 5.2