



12/18/2008

RELIABILITY REPORT
FOR

DS2434, Rev D1

Maxim Integrated Products

4401 South Beltwood Parkway
Dallas, TX 75244-3292

Prepared by:

Ken Wendel

Ken Wendel
Director, Reliability Engineering
Maxim Integrated Products
4401 South Beltwood Pkwy.
Dallas, TX 75244-3292
Email : ken.wendel@maxim-ic.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 Maxim products and processes:

DS2434, Rev D1

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): | 27143 | FITS: | 4.2 |
| | DEVICE HOURS: | 231000 | FAILS: | 0 |

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. 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.

Device Information:

Device: DS2434
 Process: D8W-1P1M,HPVt,E2 LOCOS:GOI
 Passivation: Pass w/Nov TEOS Ox-OxyNit; No UV Erase
 Die Size: 92 x 154
 Number of Transistors: 24700
 Interconnect: Aluminum / 0.5% Copper
 Gate Oxide Thickness: 175 Å

Assembly Information:

Qualification Vehicle: DS2434
 Assembly Site: Hana AYUTHAYA
 Pin Count: 3
 Package Type: PR35 (Pb-Free) (TO226)
 Body Size: 185
 Mold Compound: Sumitomo 6710S
 Lead Frame: Stamped Copper CDA194
 Lead Finsh: Sn Plate 100% Matte (With Anneal Bake)
 Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
 Bond Wire / Size: Au / 1.0 mil
 Theta JA:
 Theta JC:
 Flammability: UL 94-V0
 Moisture Sensitivity (JEDEC J-STD20A) Level 1
 Date Code Range: 0527 to 0529

DATE CODE: 0527 **LOT NUMBER:** ZU540101AB

PACKAGE TESTS

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------|-----------|-----------|-----------|-----|-------|-----|
|-------------|-----------|-----------|-----------|-----|-------|-----|

| | | | | |
|-------------------------|------|------------------------------------|----------|----------|
| SOLDERABILITY (Sn/Pb) | 0527 | JESD22-B102, COND C (215C) | 3 | 0 |
| SOLDERABILITY (Pb-Free) | 0527 | JESD22-B102, COND C (245C) | 3 | 0 |
| X-RAY | 0527 | MIL-STD-883-2012 : TOP & SIDE VIEW | 6 | 0 |
| PHYSICAL DIMENSIONS | 0527 | JESD22-B100 | 6 | 0 |
| MARK PERMANENCY | 0527 | JESD22-B107 | 6 | 0 |
| LEAD INTEGRITY | 0527 | JESD22-B105, COND B | 6 | 0 |
| EDX | 0527 | 25 C | 6 | 0 |
| Total: | | | 0 | 0 |

STORAGE LIFE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------|-----------|-----|----------|----------|
| STORAGE LIFE | 0527 | | 150C | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0527 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | 0 |

TEMPERATURE CYCLE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------------------------|------|------|-----------------|-----------|-----|----------|----------|
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0527 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0527 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | 0 |

TEMPERATURE HUMIDITY BIAS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|--------------------|-----------|-----|----------|----------|
| HAST | 0527 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0527 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | 0 |

UNBIASED MOISTURE RESISTANCE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------------------|-----------|-----|----------|----------|
| AUTOCLAVE | 0527 | | 121C, 2 ATM STEAM, UNBIASED | 168 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0527 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | 0 |

DATE CODE: 0528 **LOT NUMBER:** ZU540101AC

PACKAGE TESTS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------------|------|------|------------------------------------|-----------|-----|----------|----------|
| SOLDERABILITY (Sn/Pb) | 0528 | | JESD22-B102, COND C (215C) | | 3 | 0 | |
| SOLDERABILITY (Pb-Free) | 0528 | | JESD22-B102, COND C (245C) | | 3 | 0 | |
| X-RAY | 0528 | | MIL-STD-883-2012 : TOP & SIDE VIEW | | 6 | 0 | |
| PHYSICAL DIMENSIONS | 0528 | | JESD22-B100 | | 6 | 0 | |
| MARK PERMANENCY | 0528 | | JESD22-B107 | | 6 | 0 | |
| LEAD INTEGRITY | 0528 | | JESD22-B105, COND B | | 6 | 0 | |
| Total: | | | | | | 0 | 0 |

STORAGE LIFE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------|------|------|-----------|-----------|-----|-------|-----|
| STORAGE LIFE | 0528 | | 150C | 1000 HRS | 77 | 0 | |

| | | | | | | |
|-------------------|------|-----------------|--|---|----------|--|
| VISUAL INSPECTION | 0528 | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | 0 | |

TEMPERATURE CYCLE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------------------------|------|------|-----------------|-----------|-----|----------|-----|
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0528 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0528 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

TEMPERATURE HUMIDITY BIAS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|--------------------|-----------|-----|----------|-----|
| HAST | 0528 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0528 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

UNBIASED MOISTURE RESISTANCE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------------------|-----------|-----|----------|-----|
| AUTOCLAVE | 0528 | | 121C, 2 ATM STEAM, UNBIASED | 168 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0528 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

DATE CODE: 0529 **LOT NUMBER:** ZU540101AD

PACKAGE TESTS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------------|------|------|------------------------------------|-----------|-----|----------|-----|
| SOLDERABILITY (Sn/Pb) | 0529 | | JESD22-B102, COND C (215C) | | 3 | 0 | |
| SOLDERABILITY (Pb-Free) | 0529 | | JESD22-B102, COND C (245C) | | 3 | 0 | |
| X-RAY | 0529 | | MIL-STD-883-2012 : TOP & SIDE VIEW | | 6 | 0 | |
| PHYSICAL DIMENSIONS | 0529 | | JESD22-B100 | | 6 | 0 | |
| MARK PERMANENCY | 0529 | | JESD22-B107 | | 6 | 0 | |
| LEAD INTEGRITY | 0529 | | JESD22-B105, COND B | | 6 | 0 | |
| Total: | | | | | | 0 | |

STORAGE LIFE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------|-----------|-----|----------|-----|
| STORAGE LIFE | 0529 | | 150C | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0529 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

TEMPERATURE CYCLE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------------------------|------|------|-----------------|-----------|-----|----------|-----|
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0529 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0529 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

TEMPERATURE HUMIDITY BIAS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|--------------------|-----------|-----|-------|-----|
| HAST | 0529 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0529 | | WHISKERS < 50uM | | 3 | 0 | |

Total: 0

UNBIASED MOISTURE RESISTANCE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------------------|-----------|-----|----------|-----|
| AUTOCLAVE | 0529 | | 121C, 2 ATM STEAM, UNBIASED | 168 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0529 | | WHISKERS < 50uM | | 3 | 0 | |
| Total: | | | | | | 0 | |

Assembly Information:

Qualification Vehicle: DS2434
Assembly Site: Hana AYUTHAYA
Pin Count: 3
Package Type: PR35 (Pb-Free) (TO226)
Body Size: 185
Mold Compound: Sumitomo G600
Lead Frame: Stamped Copper CDA194
Lead Finish: Sn Plate 100% Matte (With Anneal Bake)
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Theta JA:
Theta JC:
Flammability: UL 94-V0
Moisture Sensitivity (JEDEC J-STD20A) Level 1
Date Code Range: 0742 to 0742

DATE CODE: 0742 **LOT NUMBER:** ZU723402AB

OPERATING LIFE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------|-----------|-----|----------|-----|
| HIGH TEMP OP LIFE | 0742 | | 125C, 6.4 VOLTS | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| HIGH TEMP OP LIFE | 0742 | | 125C, 6.4 VOLTS | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| HIGH TEMP OP LIFE | 0742 | | 125C, 6.4 VOLTS | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| Total: | | | | | | 0 | |

PACKAGE TESTS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------------|------|------|------------------------------------|-----------|-----|-------|-----|
| SOLDERABILITY (Sn/Pb) | 0742 | | JESD22-B102, COND C (215C) | | 3 | 0 | |
| SOLDERABILITY (Pb-Free) | 0742 | | JESD22-B102, COND C (245C) | | 3 | 0 | |
| X-RAY | 0742 | | MIL-STD-883-2012 : TOP & SIDE VIEW | | 6 | 0 | |
| PHYSICAL DIMENSIONS | 0742 | | JESD22-B100 | | 6 | 0 | |
| MARK PERMANENCY | 0742 | | JESD22-B107 | | 6 | 0 | |
| LEAD INTEGRITY | 0742 | | JESD22-B105, COND B | | 6 | 0 | |
| EDX | 0742 | | 25 C | | 6 | 0 | |
| SOLDERABILITY (Sn/Pb) | 0742 | | JESD22-B102, COND C (215C) | | 3 | 0 | |
| SOLDERABILITY (Pb-Free) | 0742 | | JESD22-B102, COND C (245C) | | 3 | 0 | |

| | | | | |
|-------------------------|------|------------------------------------|----------|----------|
| X-RAY | 0742 | MIL-STD-883-2012 : TOP & SIDE VIEW | 6 | 0 |
| PHYSICAL DIMENSIONS | 0742 | JESD22-B100 | 6 | 0 |
| MARK PERMANENCY | 0742 | JESD22-B107 | 6 | 0 |
| LEAD INTEGRITY | 0742 | JESD22-B105, COND B | 6 | 0 |
| EDX | 0742 | 25 C | 6 | 0 |
| SOLDERABILITY (Sn/Pb) | 0742 | JESD22-B102, COND C (215C) | 3 | 0 |
| SOLDERABILITY (Pb-Free) | 0742 | JESD22-B102, COND C (245C) | 3 | 0 |
| X-RAY | 0742 | MIL-STD-883-2012 : TOP & SIDE VIEW | 6 | 0 |
| PHYSICAL DIMENSIONS | 0742 | JESD22-B100 | 6 | 0 |
| MARK PERMANENCY | 0742 | JESD22-B107 | 6 | 0 |
| LEAD INTEGRITY | 0742 | JESD22-B105, COND B | 6 | 0 |
| EDX | 0742 | 25 C | 6 | 0 |
| Total: | | | 0 | 0 |

STORAGE LIFE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|-----------------|-----------|-----|----------|----------|
| STORAGE LIFE | 0742 | | 150C | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| STORAGE LIFE | 0742 | | 150C | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| STORAGE LIFE | 0742 | | 150C | 1000 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| Total: | | | | | | 0 | 0 |

TEMPERATURE CYCLE

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------------------------|------|------|-----------------|-----------|-----|----------|----------|
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0742 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0742 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| TEMP CYCLE, 5' RAMP, 10' DWELL | 0742 | | -55C TO 125C | 1000 CYS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| Total: | | | | | | 0 | 0 |

TEMPERATURE HUMIDITY BIAS

| DESCRIPTION | DATE | CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-------------------|------|------|--------------------|-----------|-----|----------|----------|
| HAST | 0742 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| HAST | 0742 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| HAST | 0742 | | 130C, 85%R.H.,5.5V | 96 HRS | 77 | 0 | |
| VISUAL INSPECTION | 0742 | | WHISKERS < 50uM | | 77 | 0 | |
| Total: | | | | | | 0 | 0 |

Assembly Information:

Qualification Vehicle: DS2434
Assembly Site: Hana AYUTHAYA
Pin Count: 3
Package Type: PR35 (TO226)
Body Size: 185
Mold Compound: Sumitomo 6710S
Lead Frame: Stamped Copper CDA194
Lead Finsh: SnPb Plate
Die Attach: 84-1 LMISR4 Epoxy Silverfilled Ablebond
Bond Wire / Size: Au / 1.0 mil
Theta JA:
Theta JC:
Flammability: UL 94-V0
Moisture Sensitivity Level 1
(JEDEC J-STD20A)
Date Code Range: 0529 to 0529

DATE CODE: 0529 **LOT NUMBER:** ZU540101AD

PACKAGE TESTS

| DESCRIPTION | DATE CODE | CONDITION | READPOINT | QTY | FAILS | FA# |
|-----------------------|-----------|----------------------------|---------------|---------------|------------|-----|
| SOLDERABILITY (Sn/Pb) | 0529 | JESD22-B102, COND C (215C) | | 6 | 0 | |
| | | | Total: | | 0 | |
| FAILURE RATE: | | MTTF (YRS): | 27143 | FITS: | 4.2 | |
| | | DEVICE HOURS: | 231000 | FAILS: | 0 | |