



# ***Reliability Report***

**Report Title:** SOIC-W Assembly Transfer to CP1 Qualification

**Report Number:** 19988

**Revision:** A

**Date:** 9 August 2022

## Summary

This report summarizes the reliability qualification data for the Wide variant of the Small Outline IC package (SOIC-W) assembly transfer at Cirtek Philippines (CP1).

The DS3234 and MAX3535ECWI+ are used as device vehicles for this qualification.

- The DS3234 is a low-cost, extremely accurate SPI bus real-time clock (RTC) with an integrated temperature-compensated crystal oscillator (TCXO) and crystal. Table 1 describes the DS3234 product characteristics. Reference Legacy Maxim Reliability data is documented in Appendix A.
- The MAX3535ECWI+ is an isolated RS-485/RS-422 full duplex transceiver providing 2500VRMS of galvanic isolation between the RS-485/RS-422 side and the processor or control logic side. Table 2 describes the MAX3535ECWI+ product characteristics. Reference Legacy Maxim Reliability data is documented in Appendix B.

This qualification is also supported by historical data from Legacy Maxim as documented in Appendix C.

**Table 1: DS3234 Product Characteristics**
**Die/Fab**

|                           |  |
|---------------------------|--|
| Die Id                    | 8YB73 A  |
| Die Size (mm)             | 102 x 141  |
| Wafer Fabrication Process | E6E-2P2M, HPVt, EPROM,<br>LV-NRDS, PF ALOCOS:GOI |
| Passivation               | Passivation w/ Nov TEOS<br>Oxide-OxyNitride      |
| Interconnect              | Aluminum / 1% Silicon / 0.5%<br>Copper           |

**Package/Assembly**

|                                      |                      |
|--------------------------------------|----------------------|
| Package                              | 20 SOIC              |
| Body Size (mm)                       | 300 x 2.3            |
| Assembly Location                    | Cirtek (CP1)         |
| Molding Compound                     | Sumitomo G600        |
| Wire Type                            | Au Wire              |
| Wire Diameter (mils)                 | 1.0                  |
| Die Attach                           | Ablestik 84-1LMIS R4 |
| Lead Frame Material                  | Copper               |
| Lead Finish                          | 100% Sn, Matte       |
| Moisture Sensitivity Level           | MSL 1                |
| Maximum Peak Reflow Temperature (°C) | 260 °C               |

## Table 2: MAX3535ECWI+ Product Characteristics

### Die/Fab

|        |       |
|--------|-------|
| Die Id | RT47W |
|--------|-------|

### Package/Assembly

|                                      |                      |
|--------------------------------------|----------------------|
| Package                              | 28 SOIC-W            |
| Assembly Location                    | Cirtek (CP1)         |
| Molding Compound                     | Sumitomo G600        |
| Wire Type                            | Au Wire              |
| Wire Diameter (mils)                 | 1.0                  |
| Die Attach                           | Ablestik 84-1LMIS R4 |
| Lead Frame Material                  | Copper               |
| Lead Finish                          | 100% Matte Sn        |
| Moisture Sensitivity Level           | MSL 1                |
| Maximum Peak Reflow Temperature (°C) | 260 °C               |

## Description / Results of Tests Performed

Table 3 provides a description of the qualification tests conducted and the associated test results for products manufactured on the same technologies as described in Tables 1 and 2. All devices were electrically tested before and after each stress. Any device that did not meet all electrical data sheet limits following stressing would be considered a valid (stress-attributable) failure unless there was conclusive evidence to indicate otherwise.

**Table 3: SOIC-W Assembly Transfer to CP1 Qualification Test Results**

| Test Name  | Specification | Conditions                         | Device       | Lot #    | Sample Size | Qty. Failures |
|--|---------------|------------------------------------|--------------|----------|-------------|---------------|
| High Temperature Storage Life (HTSL)               | JESD22-A103   | 125°C, 1,000 Hours                 | DS3234       | 0601     | 77          | 0             |
|  |               | 150°C, 1,000 Hours                 | MAX3535ECWI+ | R090132A | 77          | 0             |
|  |               |                                    |              | R090132B | 77          | 0             |
|  |               |                                    |              | R090132C | 77          | 0             |
| Solder Heat Resistance (SHR) <sup>1</sup>          | J-STD-020     | MSL-1                              | DS3234       | 0601     | 22          | 0             |
| Temperature Cycling (TC) <sup>1</sup>              | JESD22-A104   | -40°C/+85°C, 1000 Cycles           | DS3234       | 0601     | 77          | 0             |
|  |               | 65°C/+150°C, 1000 Cycles           | MAX3535ECWI+ | R090132A | 77          | 0             |
|  |               |                                    |              | R090132B | 77          | 0             |
|  |               |                                    |              | R090132C | 77          | 0             |
| Autoclave (AC) <sup>1</sup>                        | JESD22-A102   | 121°C<br>100%RH<br>2ATM, 168 Hours | DS3234       | 0601     | 77          | 0             |
| Temperature, Humidity Bias (THB) <sup>1</sup>      | JESD22-A108F  | 85°C<br>85%RH,<br>1000Hrs          | DS3234       | 0601     | 45          | 0             |
| Highly Accelerated Stress Test (HAST) <sup>1</sup> | JESD22-A110   | 130°C<br>85%RH, 100 Hours          | MAX3535ECWI+ | R090132A | 45          | 0             |
|  |               |                                    |              | R090132B | 45          | 0             |
|  |               |                                    |              | R090132C | 45          | 0             |

<sup>1</sup> These samples were subjected to preconditioning (per J-STD-020 Level 1) prior to the start of the stress test. Level 1 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 168 hrs @ 85°C, 85%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

Samples of the many devices manufactured with these package and process technologies are continuously undergoing reliability evaluation as part of the ADI Reliability Monitor Program. Additional qualification data is available on [Analog Devices' web site](#).

## **Approvals**

Reliability Engineer: Pernell Marc Mosuela

## **Additional Information**

Data sheets and other additional information are available on [Analog Devices' web site](#)

## Appendix

### Appendix A: Reliability Report for DS3234, Rev A1.



1/31/2007

RELIABILITY REPORT  
FOR

**DS3234, Rev A1**

**Dallas Semiconductor**

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**Conclusion:**

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

DS3234, Rev A1

**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](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.

$A_{fT} = \exp((E_a/k)(1/T_u - 1/T_s)) = t_u/t_s$   
 $A_{fT}$  = Acceleration factor due to Temperature  
 $t_u$  = Time at use temperature (e.g. 55°C)  
 $t_s$  = Time at stress temperature (e.g. 125°C)  
 $k$  = Boltzmann's Constant (8.617 x 10<sup>-5</sup> eV/°K)  
 $T_u$  = Temperature at Use (°K)  
 $T_s$  = Temperature at Stress (°K)  
 $E_a$  = 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.

$A_{fV} = \exp(B(V_s - V_u))$   
 $A_{fV}$  = Acceleration factor due to Voltage  
 $V_s$  = Stress Voltage (e.g. 7.0 volts)  
 $V_u$  = 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,  $F_r$ , is related to the acceleration during life test by:

$F_r = X/(t_s * A_{fV} * A_{fT} * N * 2)$   
 $X$  = 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):   | 5288  | FITS:  | 21.6 |
|               | DEVICE HOURS: | 45000 | 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.

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**Device Information:**

Device: DS3234  
 Process: E6E-2P2M,HPVt,EPROM,LV-NRDSD,PF ALOCOS:GOI  
 Passivation: Passivation w/Nov TEOS Oxide-OxyNitride  
 Die Size: 102 x 141  
 Number of Transistors: 0  
 Interconnect: Aluminum / 1% Silicon / 0.5% Copper  
 Gate Oxide Thickness: 150 Å

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**Assembly Information:**

Qualification Vehicle: DS3234  
 Assembly Site: CIRTEK  
 Pin Count: 20  
 Package Type: SOIC Welded Crystal (RoHS)  
 Body Size: 300x2.3  
 Mold Compound: Sumitomo G600  
 Lead Frame: Etched Copper CDA194 & welded With Oscilent crystal onl  
 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: 0601 to 0601

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**ELECTRICAL CHARACTERIZATION**

| DESCRIPTION     | DATE CODE | CONDITION                  | READPOINT | QTY | FAILS | FA# |
|-----------------|-----------|----------------------------|-----------|-----|-------|-----|
| ESD SENSITIVITY | 0601      | EOS/ESD S5.1 HBM 500 VOLTS | 1 PUL'S   | 3   | 0     |     |

|                 |      |                             |   |       |   |          |       |
|-----------------|------|-----------------------------|---|-------|---|----------|-------|
| ESD SENSITIVITY | 0601 | EOS/ESD S5.1 HBM 1000 VOLTS | 1 | PUL'S | 3 | 0        |       |
| ESD SENSITIVITY | 0601 | EOS/ESD S5.1 HBM 2000 VOLTS | 1 | PUL'S | 3 | 0        |       |
| ESD SENSITIVITY | 0601 | EOS/ESD S5.1 HBM 3000 VOLTS | 1 | PUL'S | 3 | 2        | No FA |
| ESD SENSITIVITY | 0601 | EOS/ESD S5.1 HBM 4000 VOLTS | 1 | PUL'S | 3 | 3        | No FA |
| LATCH-UP        | 0601 | JESD78, I-TEST 125C         |   |       | 6 | 0        |       |
| LATCH-UP        | 0601 | JESD78, V-SUPPLY TEST 125C  |   |       | 6 | 0        |       |
| <b>Total:</b>   |      |                             |   |       |   | <b>5</b> |       |

**MOISTURE SENSITIVITY LEVEL 1**

| DESCRIPTION       | DATE CODE | CONDITION                          | READPOINT | QTY | FAILS    | FA# |
|-------------------|-----------|------------------------------------|-----------|-----|----------|-----|
| ULTRASOUND        | 0601      | J-STD-020                          |           | 22  | 0        |     |
| STORAGE LIFE      |           | 125C                               | 24 HRS    | 22  |          |     |
| MOISTURE SOAK     |           | 85 C/85% R.H.                      | 188 HRS   | 22  |          |     |
| CONVECTION REFLOW |           | 280C +/-5C                         | 2 PASS    | 22  | 0        |     |
| X-RAY             |           | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 22  | 0        |     |
| EXTERNAL VISUAL   |           | J-STD-020, 6.1a                    |           | 22  | 0        |     |
| PRECONDITION U/S  |           | J-STD-020                          |           | 22  | 0        |     |
| <b>Total:</b>     |           |                                    |           |     | <b>0</b> |     |

**OPERATING LIFE**

| DESCRIPTION       | DATE CODE | CONDITION       | READPOINT | QTY | FAILS    | FA# |
|-------------------|-----------|-----------------|-----------|-----|----------|-----|
| HIGH TEMP OP LIFE | 0601      | 125C, 5.5 VOLTS | 1000 HRS  | 45  | 0        |     |
| <b>Total:</b>     |           |                 |           |     | <b>0</b> |     |

**PACKAGE TESTS**

| DESCRIPTION             | DATE CODE | CONDITION                          | READPOINT | QTY | FAILS    | FA# |
|-------------------------|-----------|------------------------------------|-----------|-----|----------|-----|
| SOLDERABILITY (Pb-Free) | 0601      | JESD22-B102, COND C                |           | 6   | 0        |     |
| SOLDERABILITY (Sn/Pb)   |           | JESD22-B102, COND C                |           | 6   | 0        |     |
| X-RAY                   | 0601      | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 6   | 0        |     |
| PHYSICAL DIMENSIONS     |           | JESD22-B100                        |           | 6   | 0        |     |
| MARK PERMANENCY         |           | JESD22-B107                        |           | 6   | 0        |     |
| LEAD INTEGRITY          |           | JESD22-B105, COND B                |           | 6   | 0        |     |
| <b>Total:</b>           |           |                                    |           |     | <b>0</b> |     |

**PRECONDITIONING LEVEL 1**

| DESCRIPTION       | DATE CODE | CONDITION     | READPOINT | QTY | FAILS    | FA# |
|-------------------|-----------|---------------|-----------|-----|----------|-----|
| STORAGE LIFE      | 0601      | 125C          | 24 HRS    | 353 |          |     |
| MOISTURE SOAK     |           | 85 C/85% R.H. | 188 HRS   | 353 |          |     |
| CONVECTION REFLOW |           | 280C +/-5C    | 2 PASS    | 353 | 0        |     |
| <b>Total:</b>     |           |               |           |     | <b>0</b> |     |

**STORAGE LIFE**

| DESCRIPTION   | DATE CODE | CONDITION | READPOINT | QTY | FAILS    | FA# |
|---------------|-----------|-----------|-----------|-----|----------|-----|
| STORAGE LIFE  | 0601      | 125C      | 1000 HRS  | 77  | 0        |     |
| <b>Total:</b> |           |           |           |     | <b>0</b> |     |

**TEMPERATURE CYCLE**

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

|            |      |            |               |    |          |
|------------|------|------------|---------------|----|----------|
| TEMP CYCLE | 0601 | -40 TO 85C | 1000 CYS      | 77 | 0        |
|            |      |            | <b>Total:</b> |    | <b>0</b> |

**TEMPERATURE HUMIDITY BIAS**

| DESCRIPTION     | DATE CODE | CONDITION        | READPOINT     | QTY | FAILS    | FA# |
|-----------------|-----------|------------------|---------------|-----|----------|-----|
| BIASED MOISTURE | 0601      | 85/85, 5.5 VOLTS | 1000 HRS      | 45  | 0        |     |
|                 |           |                  | <b>Total:</b> |     | <b>0</b> |     |

**UNBIASED MOISTURE RESISTANCE**

| DESCRIPTION | DATE CODE | CONDITION                   | READPOINT     | QTY | FAILS    | FA# |
|-------------|-----------|-----------------------------|---------------|-----|----------|-----|
| AUTOCLAVE   | 0601      | 121C, 2 ATM STEAM, UNBIASED | 168 HRS       | 77  | 0        |     |
|             |           |                             | <b>Total:</b> |     | <b>0</b> |     |

|                      |                      |              |               |             |
|----------------------|----------------------|--------------|---------------|-------------|
| <b>FAILURE RATE:</b> | <b>MTTF (YRS):</b>   | <b>5288</b>  | <b>FITS:</b>  | <b>21.6</b> |
|                      | <b>DEVICE HOURS:</b> | <b>45000</b> | <b>FAILS:</b> | <b>0</b>    |

## Appendix B: Cirtek (Philippines) 28L WSOIC (300-mil) Hybrid Lead-Free Package Qualification

Qualification  
 Evaluation

Report#: R090132FQ  
 Date: 3/20/09

### MAXIM RELIABILITY QUALIFICATION REPORT

#### SUBJECT

Cirtek (Philippines) 28L WSOIC (300-mil) Hybrid Lead-Free Package Qualification.

#### PURPOSE

Qualify assembler Cirtek to build 28L WSOIC (300-mil) hybrid package with lead-free plating process. This package is made with 100% Matte Tin plating, copper alloy leadframe, Sumitomo G600 molding compound, silver-filled epoxy die attach from vendor Ablestik (84-1LMISR4), and 1.0 mil diameter gold bond wire. MAX3535ECWI+ in 28L WSOIC lead-free package was used as a test vehicle.

#### CONCLUSION

All qualification lots assembled at Cirtek have passed Maxim reliability requirements. In addition, the package has completed moisture level 1 testing per JEDEC J-STD-020D and solder reflow at 260°C peak temperature. Therefore, assembler Cirtek is qualified to build 28L WSOIC hybrid lead-free package.

#### SAMPLE DESCRIPTIONS

Table 1.

|           |                   |            |           |
|-----------|-------------------|------------|-----------|
| REL#:     | R090132A          | PROCESS:   | B8EIFW    |
| DEVICE:   | MAX3535ECWI+      | LOT#:      | 8QL0ADKQ1 |
| DIE TYPE: | RT47W=RT45Z+RT46Z | TOP MARK:  | Q1        |
| PACKAGE:  | 28L WSOIC         | DATE CODE: | 0828      |
| REL#:     | R090132B          | PROCESS:   | B8EIFW    |
| DEVICE:   | MAX3535ECWI+      | LOT#:      | 8QL0ADKQ2 |
| DIE TYPE: | RT47W=RT45Z+RT46Z | TOP MARK:  | Q2        |
| PACKAGE:  | 28L WSOIC         | DATE CODE: | 0828      |
| REL#:     | R090132C          | PROCESS:   | B8EIFW    |
| DEVICE:   | MAX3535ECWI+      | LOT#:      | 8QL0ADKQ3 |
| DIE TYPE: | RT47W=RT45Z+RT46Z | TOP MARK:  | Q3        |
| PACKAGE:  | 28L WSOIC         | DATE CODE: | 0828      |

#### TEST RESULT

See Table 3 for details.

|   |  |
|---|--|
| <br>Alex Arreola<br>SMTS, Reliability Engineer | <br>Ping Lin<br>Director, Reliability |
|---|--|

**DISCUSSION**

**I. Failure Rate Calculation**

Based on the 1000 hours 135°C life test results from the qualification lots, the calculated failure in time rate is 1.54 (FIT) at 60% confidence level and 0.8eV activation energy when derated to 25°C. This is an acceptable failure rate.

**II. Qualification Requirements/Acceptance Criteria**

The reliability test requirements and acceptance criteria are defined as follow:

Table 2.

| Stress Test                            | Test Condition               | Sampling Plan |
|--|------------------------------|---------------|
| Life Test                              | 135°C, 1000 hours            | 0/45          |
| Convection Solder Reflow *1            | 260°C, 3X                    | 0/250         |
| Temperature Cycle *2                   | -65°C to +150°C, 1000 cycles | 0/77          |
| High Temperature Storage *2            | 150°C, 1000 hours            | 0/77          |
| HAST *2                                | 130°C/85% R.H., 100 hours    | 0/45          |
| Wire Bond Pull                         | 5 grams minimum              | 0/200 wires   |
| Solder Shock                           | 260°C, 10 seconds            | 0/15          |
| Resistance to Soldering Heat           | 300°C, 10 seconds            | 0/15          |
| Physical Dimensions                    | Per specification            | 0/15          |
| Solderability                          | 245°C, 8 hours steam aging   | 0/15          |
| Solderability (Backward Compatibility) | 215°C, 8 hours steam aging   | 0/15          |
| Plating Thickness                      | 400 u-inch minimum           | 0/10          |

Note: \*1. Level 1 soak (168hrs of 85°C/85% R.H.) is used as preconditioning.  
 \*2. Convection solder reflow at 260°C Tp. is used as preconditioning.

**III. Qualification Test Results**

The tests in item II (Qualification Requirements/Acceptance Criteria) were implemented on all qualification lots assembled at Cirtek. All lots in 28L WSOIC package with lead-free plating process have passed Maxim reliability requirements as well as JEDEC J-STD-020D moisture sensitivity level 1 requirements with zero failures. This package is considered non-moisture sensitive and does not require dry-pack.

**SUMMARY**

All qualification lots have shown good reliability performance. Therefore, assembler Cirtek (Philippines) is qualified to build 28L WSOIC (300-mil) hybrid lead-free package.

TEST RESULTS/ LOT INFORMATION:

Table 3.

| TEST                  | REL#: R090132A       | REL#: R090132B       | REL#: R090132C       |
|-----------------------|----------------------|----------------------|----------------------|
|                       | DEVICE: MAX3535ECWI+ | DEVICE: MAX3535ECWI+ | DEVICE: MAX3535ECWI+ |
|                       | DIE: RT47W           | DIE: RT47W           | DIE: RT47W           |
|                       | LOT# 8QL0ADKQ1       | LOT# 8QL0ADKQ2       | LOT# 8QL0ADKQ3       |
|                       | D/C: 0828            | D/C: 0828            | D/C: 0828            |
| LIFE TEST             | 1000 HRS - 0/45      | 1000 HRS - 0/45      | 1000 HRS - 0/45      |
| CONVECTION REFLOW *1  | 0/300                | 0/300                | 0/300                |
| TEMP CYCLE *2         | 1000X - 0/77         | 1000X - 0/77         | 1000X - 0/77         |
| HIGH TEMP STORAGE *2  | 1000 HRS - 0/77      | 1000 HRS - 0/77      | 1000 HRS - 0/77      |
| HAST *2               | 100 HRS - 0/45       | 100 HRS - 0/45       | 100 HRS - 0/45       |
| WIRE BOND PULL        | 0/200 wires          | 0/200 wires          | 0/200 wires          |
| SOLDER SHOCK          | 0/15                 | 0/15                 | 0/15                 |
| RESIST SOLDER HEAT    | 0/15                 | 0/15                 | 0/15                 |
| PHYSICAL DIMENSIONS   | 0/15                 | 0/15                 | 0/15                 |
| SOLDERABILITY (245°C) | 0/15                 | 0/15                 | 0/15                 |
| SOLDERABILITY (215°C) | 0/15                 | 0/15                 | 0/15                 |
| PLATING THICKNESS     | 0/10                 | 0/10                 | 0/10                 |

Note: \*1 - MSL 1 (168hrs of 85°C/85% R.H.) is used as preconditioning.  
 \*2 - Convection Reflow at 260°C peak temperature is used as preconditioning.

## **Appendix C: Package Reliability Report for Cirtek, 16L SOIC w/ Crystal, 300 Mil, RoHS**



9/12/2005

PACKAGE RELIABILITY REPORT  
FOR

**Cirtek, 16L SOIC w/Crystal, 300 Mil, RoHS**

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**Conclusion**

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

Cirtek, 16L SOIC w/Crystal, 300 Mil, RoHS

In addition, Dallas Semiconductor's continuous reliability monitor program ensures that all outgoing assemblies 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>.

**Package 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): 15863**                      **FITS: 7.2**

The parameters used to calculate this failure rate are as follows:

**Cf: 60%**                      **Ea: 0.7**                      **B: 0**                      **Tu: 25 °C**                      **Vu: 5.5 Volt**

The reliability data follows. Some of the data in this report may be generic. At the start of this data is a description of the 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. Where appropriate, preconditioning is performed before all stresses and the bond crater test unless otherwise noted. The reliability data section includes the latest data available.

**Assembly Information:**

Assembly Site: CIRTEK  
 Pin Count: 16  
 Package Type: SOIC w/Welded Crystal (RoHS)  
 Body Size: 300x2.3  
 Mold Compound: Sumitomo G600  
 Lead Frame: Etched 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  
 Flammability: UL 94-V0  
 Theta JA:  
 Theta JC:  
 Moisture Sensitivity (JEDEC J-STD20A) Level 1  
 Date Code Range: 0520 to 0520

**CONSTRUCTION ANALYSIS**

| DESCRIPTION               | DATE COD | CONDITION                  | READPOINT | QTY | FAILS    | FA# |
|---------------------------|----------|----------------------------|-----------|-----|----------|-----|
| PACKAGE, ASSEMBLY PROCESS | 0520     | PERFORMED BY ASSEMBLY SITE |           | 5   | 0        |     |
| <b>Total:</b>             |          |                            |           |     | <b>0</b> |     |

**MOISTURE SENSITIVITY LEVEL 1**

| DESCRIPTION       | DATE COD | CONDITION                          | READPOINT | QTY | FAILS | FA# |
|-------------------|----------|------------------------------------|-----------|-----|-------|-----|
| ULTRASOUND        | 0520     | J-STD-020                          |           | 44  | 0     |     |
| STORAGE LIFE      |          | 125C                               | 24 HRS    | 44  |       |     |
| MOISTURE SOAK     |          | 85 C/85% R.H.                      | 168 HRS   | 44  |       |     |
| CONVECTION REFLOW |          | 280C +/-5C                         | 2 PASS    | 44  | 0     |     |
| X-RAY             |          | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 44  | 0     |     |
| EXTERNAL VISUAL   |          | J-STD-020, 6.1a                    |           | 44  | 0     |     |
| PRECONDITION U/S  |          | J-STD-020                          |           | 44  | 0     |     |
| ULTRASOUND        | 0520     | J-STD-020                          |           | 44  | 0     |     |
| STORAGE LIFE      |          | 125C                               | 24 HRS    | 44  |       |     |

|                   |      |                                    |     |      |          |   |
|-------------------|------|------------------------------------|-----|------|----------|---|
| MOISTURE SOAK     | 0520 | 85 C/85% R.H.                      | 168 | HRS  | 44       |   |
| CONVECTION REFLOW |      | 260C +/-5C                         | 2   | PASS | 44       | 0 |
| X-RAY             |      | MIL-STD-883-2012 : TOP & SIDE VIEW |     |      | 44       | 0 |
| EXTERNAL VISUAL   |      | J-STD-020, 6.1a                    |     |      | 44       | 0 |
| PRECONDITION U/S  |      | J-STD-020                          |     |      | 44       | 0 |
| ULTRASOUND        | 0520 | J-STD-020                          |     |      | 44       | 0 |
| STORAGE LIFE      |      | 125C                               | 24  | HRS  | 44       |   |
| MOISTURE SOAK     |      | 85 C/85% R.H.                      | 168 | HRS  | 44       |   |
| CONVECTION REFLOW |      | 260C +/-5C                         | 2   | PASS | 44       | 0 |
| X-RAY             |      | MIL-STD-883-2012 : TOP & SIDE VIEW |     |      | 44       | 0 |
| EXTERNAL VISUAL   |      | J-STD-020, 6.1a                    |     |      | 44       | 0 |
| PRECONDITION U/S  |      | J-STD-020                          |     |      | 44       | 0 |
| <b>Total:</b>     |      |                                    |     |      | <b>0</b> |   |

**OPERATING LIFE**

| DESCRIPTION       | DATE COD | CONDITION       | READPOINT | QTY | FAILS    | FA# |
|-------------------|----------|-----------------|-----------|-----|----------|-----|
| HIGH TEMP OP LIFE | 0520     | 125C, 5.5 VOLTS | 1000 HRS  | 45  | 0        |     |
| HIGH TEMP OP LIFE | 0520     | 125C, 5.5 VOLTS | 1000 HRS  | 45  | 0        |     |
| HIGH TEMP OP LIFE | 0520     | 125C, 5.5 VOLTS | 1000 HRS  | 45  | 0        |     |
| <b>Total:</b>     |          |                 |           |     | <b>0</b> |     |

**PACKAGE TESTS**

| DESCRIPTION             | DATE COD | CONDITION                          | READPOINT | QTY | FAILS    | FA# |
|-------------------------|----------|------------------------------------|-----------|-----|----------|-----|
| SOLDERABILITY (Pb-Free) | 0520     | JESD22-B102, COND C                |           | 3   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 6   | 0        |     |
| PHYSICAL DIMENSIONS     |          | JESD22-B100                        |           | 6   | 0        |     |
| MARK PERMANENCY         |          | JESD22-B107                        |           | 6   | 0        |     |
| LEAD INTEGRITY          |          | JESD22-B105, COND B                |           | 6   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 397 | 0        |     |
| SOLDERABILITY (Pb-Free) | 0520     | JESD22-B102, COND C                |           | 3   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 6   | 0        |     |
| PHYSICAL DIMENSIONS     |          | JESD22-B100                        |           | 6   | 0        |     |
| MARK PERMANENCY         |          | JESD22-B107                        |           | 6   | 0        |     |
| LEAD INTEGRITY          |          | JESD22-B105, COND B                |           | 6   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 397 | 0        |     |
| SOLDERABILITY (Pb-Free) | 0520     | JESD22-B102, COND C                |           | 3   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 6   | 0        |     |
| PHYSICAL DIMENSIONS     |          | JESD22-B100                        |           | 6   | 0        |     |
| MARK PERMANENCY         |          | JESD22-B107                        |           | 6   | 0        |     |
| LEAD INTEGRITY          |          | JESD22-B105, COND B                |           | 6   | 0        |     |
| X-RAY                   | 0520     | MIL-STD-883-2012 : TOP & SIDE VIEW |           | 397 | 0        |     |
| <b>Total:</b>           |          |                                    |           |     | <b>0</b> |     |

**PRECONDITIONING LEVEL 1**

| DESCRIPTION  | DATE COD | CONDITION | READPOINT | QTY | FAILS | FA# |
|--------------|----------|-----------|-----------|-----|-------|-----|
| STORAGE LIFE | 0520     | 125C      | 24 HRS    | 353 |       |     |

|                   |      |                                    |     |      |     |          |  |
|-------------------|------|------------------------------------|-----|------|-----|----------|--|
| MOISTURE SOAK     | 0520 | 85 C/85% R.H.                      | 188 | HRS  | 353 |          |  |
| CONVECTION REFLOW |      | 260C +/-5C                         | 2   | PASS | 353 | 0        |  |
| X-RAY             |      | MIL-STD-883-2012 : TOP & SIDE VIEW |     |      | 353 | 0        |  |
| STORAGE LIFE      | 0520 | 125C                               | 24  | HRS  | 353 |          |  |
| MOISTURE SOAK     |      | 85 C/85% R.H.                      | 188 | HRS  | 353 |          |  |
| CONVECTION REFLOW |      | 260C +/-5C                         | 2   | PASS | 353 | 0        |  |
| X-RAY             |      | MIL-STD-883-2012 : TOP & SIDE VIEW |     |      | 353 | 0        |  |
| STORAGE LIFE      | 0520 | 125C                               | 24  | HRS  | 353 |          |  |
| MOISTURE SOAK     |      | 85 C/85% R.H.                      | 188 | HRS  | 353 |          |  |
| CONVECTION REFLOW |      | 260C +/-5C                         | 2   | PASS | 353 | 0        |  |
| X-RAY             |      | MIL-STD-883-2012 : TOP & SIDE VIEW |     |      | 353 | 0        |  |
| <b>Total:</b>     |      |                                    |     |      |     | <b>0</b> |  |

**STORAGE LIFE**

| DESCRIPTION   | DATE COD | CONDITION | READPOINT | QTY | FAILS | FA#      |
|---------------|----------|-----------|-----------|-----|-------|----------|
| STORAGE LIFE  | 0520     | 125C      | 1000 HRS  | 77  | 0     |          |
| STORAGE LIFE  | 0520     | 125C      | 1000 HRS  | 77  | 0     |          |
| STORAGE LIFE  | 0520     | 125C      | 1000 HRS  | 77  | 0     |          |
| <b>Total:</b> |          |           |           |     |       | <b>0</b> |

**TEMPERATURE CYCLE**

| DESCRIPTION   | DATE COD | CONDITION  | READPOINT | QTY | FAILS | FA#      |
|---------------|----------|------------|-----------|-----|-------|----------|
| TEMP CYCLE    | 0520     | -40 TO 85C | 1000 CYS  | 77  | 0     |          |
| TEMP CYCLE    | 0520     | -40 TO 85C | 1000 CYS  | 77  | 0     |          |
| TEMP CYCLE    | 0520     | -40 TO 85C | 1000 CYS  | 77  | 0     |          |
| <b>Total:</b> |          |            |           |     |       | <b>0</b> |

**TEMPERATURE HUMIDITY BIAS**

| DESCRIPTION     | DATE COD | CONDITION        | READPOINT | QTY | FAILS | FA#      |
|-----------------|----------|------------------|-----------|-----|-------|----------|
| BIASED MOISTURE | 0520     | 85/85, 5.5 VOLTS | 1000 HRS  | 77  | 0     |          |
| BIASED MOISTURE | 0520     | 85/85, 5.5 VOLTS | 1000 HRS  | 77  | 0     |          |
| BIASED MOISTURE | 0520     | 85/85, 5.5 VOLTS | 1000 HRS  | 77  | 0     |          |
| <b>Total:</b>   |          |                  |           |     |       | <b>0</b> |

**UNBIASED MOISTURE RESISTANCE**

| DESCRIPTION   | DATE COD | CONDITION                   | READPOINT | QTY | FAILS | FA#      |
|---------------|----------|-----------------------------|-----------|-----|-------|----------|
| AUTOCLAVE     | 0520     | 121C, 2 ATM STEAM, UNBIASED | 188 HRS   | 77  | 0     |          |
| AUTOCLAVE     | 0520     | 121C, 2 ATM STEAM, UNBIASED | 188 HRS   | 77  | 0     |          |
| AUTOCLAVE     | 0520     | 121C, 2 ATM STEAM, UNBIASED | 188 HRS   | 77  | 0     |          |
| <b>Total:</b> |          |                             |           |     |       | <b>0</b> |

FAILURE RATE: MTF (YRS): 15863 FITS: 7.2