
# Analog Mixed Signal

## Reliability Report

**Revision E**
**October 2016**

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# 1.0 Reliability Program Overview

Reliability is defined as product performance to specification over time in response to varied (specified) environmental stress conditions.

The reliability function "R(t)" indicates the ratio of the conforming products that can function properly when the time "t" elapses after starting use.

Microsemi - AMS publishes this report to provide customers with the intent to notify about the reliability of our product portfolio.

Some of the important features of our program are,

- Product qualifications are performed per internal procedures aligned to the industry standards mentioned above.
- Product reliability is measured periodically to ensure that the product performance meets or exceeds requirements.
- Reliability tests are executed in response to internal requirements.
- Report is published annually.

## 1.1 Qualification

Reliability tests used in the qualification of new devices (wafer process and package) are designed to ensure that Microsemi – AMS's products satisfy applicable industry standards as part of new product introduction process. Products are required to be qualified based on applicable following standards before they are released to production,

- Automotive products -- AECQ100
- Commerical products -- JEDEC
- Hi Reliability/Space products -- MIL PRF 38535
  (Applicable test methods from MIL STD 883 for QML Q & V)

## 1.2 Ongoing Reliability Monitor (ORM) Program

- The reliability monitor program is based on the maturity of the wafer process, existing data (tied to the number of device hours, FIT rate) and current run rate.
- Reliability data shown in this report is based on products/product families (based upon the same logic elements, embedded storage elements, interconnect technology, etc).
- Product families are qualified based upon the internal requirements and usually include products with a range of densities, package types, and package lead counts.
- The tests used as part of ORM test suite are determined per internal requirements.
- Units that are planned for ORM use are tested using production test equipment to data sheet limits before being stressed. Post test measurements are also done on the same production test equipment to data sheet limits. Any unit that does not meet the data sheet specification is considered a reject.

## 2.0 Product Portfolio

Microsemi AMS Group's products are categorized primarily into the following product families,

| Product Family | Product/Product Family |
|---|---|
| **Sensors** | AA 51X, AA 54X, AA 55X, AA 56X, AA 57X, AA58X, AA 61X, AA66X, AAP 1XX, AAP 2XX, AAP 6XX & AAP 8XX |
| | LX 19XX & LX 33XX |
| | P 31X |
| **Backlighting** | AAC 2XX, AA 6XX & AA 7XX |
| | LX 22XXX, LX 24XXX, LX 27XXX & LX 95XX |
| | LXE 19XX, LXM16XX, LXMG 19XX & 22XX |
| | SGE 13XXX, SGE 23XX, SGE 24XX & SGE 25XX |
| **Hi Rel** | AAHS2XX & AA7XX/AA7XX |
| | LX 45XX & LX 77XX |
| | SG 07XXX, SG 109X, SG 117XXX, SG 120 XXX, SG 137 XXX, SG 140 XXX, SG 143 XXX, SG150 XXX, SG15XX XXX, SG16XX XXX, SG 17XX XXX, SG 18XX XXX, SG 20XX XXX, SG 22XX XXX, SG 28XX XXX, SG 32XX, SG 35 XX, SG55XX XXX, SG 7XX XXX, SG 78XX XXX & SG 79XX XXX |
| | SGR 11X XXX & SGR 18XX XXX |
| | UC 18XXXX & UC 28XXXX |
| **Power Management** | AAX 2XX |
| | IPS 10XX, IPS 18XX & IPS 21X |
| | LX12 XXX, LX16 XX, LX 17XX, LX 18XX, LX 22XX, LX 24XX & LX 27XX, LX 71XX, LX 73XX, LX 82XX, LX 83XX, LX 85XX & LX 95XX |
| | LXE 16XX, LXE 17XX, LXE 18XX, LXE 9XXX, NX 2XXX, NX 4XXX, NX 7XXX & NX 9XXX |
| | SG 2XXX, SG 3XXX & SG 7XXX |
| | UC 28XXX & UC 38XXX |

# 3.0 Accelerated Reliability Testing

Microsemi AMS Group performs accelerated testing to assess reliability of its devices,

- Overstresses are used to produce the same failure mechanisms that would be seen under normal conditions but in a much shorter period of time.
- Acceleration factors (Temperature and Voltage) are used by Microsemi AMS to estimate failure rates based on the results of accelerated testing.
- The objective of accelerated testing is to identify the failure mechanisms and eliminate them as a cause of failure during the useful life of our products.

## 3.1 FIT Rate Calculation and Assumptions

Microsemi uses exponential distribution of failures in time and predicts constant failure rate at operating conditions,

- Extrapolation uses thermal and voltage acceleration factors based on JEDEC formulas (JEP122).
- FIT rate is calculated using JESD85 (Methods for Calculating Failure Rates in Units of FITs) standard.
- All of the FIT (Failure in Time) rate and MTTF (Mean Time to Failure) numbers reported here use a base set of assumptions.
    - The failure rate is calculated using Chi-square distribution at 60% confidence interval from the small number of failures and limited sample size of the population tested.
    - The Chi-squared value is calculated from the inverse Chi-squared distribution using the desired probability level and degrees of freedom.
    - The failure rate is then calculated from the Chi-square value:

      **Failure Rate =** $\dfrac{x^2 \ 10^9}{2 \text{ (A.F. * Device Hours)}}$

      where $x^2$ = Chi-Squared value at 60% confidence level and (2f + 2) degrees of freedom,

      where f is the number of failures, Device Hours = (No. of Devices) * (No. of Hours)

- The Acceleration Factor (A.F.) is calculated using Arrhenius relationship.

  **Acceleration Factor = Exp $\{(E_a/k) \times (1/T_{use} - 1/T_{stress})\}$**

  Where:

  $E_a$ = Activation Energy (eV), assumed 0.7 eV
  k = Boltzmann's constant ($8.617 \times 10^{-5}$ eV/ºK)
  $T_{stress}$ = Temperature at accelerated conditions in degrees Kelvin (°K = 125°C + 273.16)
  $T_{use}$ = Temperature at normal use conditions in degrees Kelvin (°K = 55°C + 273.16)
  A.F. = Acceleration Factor

## 4.0 Silicon Reliability Summary

Using the above mentioned methodology, summary of failure rates for various process nodes (with active products) are as shown below,

**Table 4.0.1: High Temperature Operational Life Test/Burn In (HTOL/BI)**

| Foundry Process | | Total Units | Failures | Total Device Hours | FIT Rate |
|---|---|---|---|---|---|
| 0.18um | (Global Foundries) | 1128 | 0 | 3098869 | 3.7937 |
| 0.18um | (Jazz) | 154 | 0 | 438946 | 26.7828 |
| 0.35um | (Dongbu) | 750 | 0 | 2965434 | 3.9644 |
| 0.35um | (Magnachip) | 3526 | 0 | 2925027 | 4.0191 |
| 0.35um | (XFAB) | 1417 | 0 | 2073400 | 5.67 |
| 0.50um | (Magnachip) | 796 | 0 | 656364 | 17.9111 |
| 0.5um | (Excel Power) | 150 | 0 | 68935 | 170.5413 |
| 0.5um | (Jazz) | 450 | 0 | 379996 | 30.9377 |
| 0.6um | (XFAB) | 1952 | 0 | 1698937 | 6.9197 |
| 0.8um | (XFAB) | 879 | 0 | 593872 | 19.7958 |
| 1.0um | (Excel Power) | 200 | 0 | 164916 | 71.2862 |
| 1.0um | (XFAB) | 519 | 0 | 1193000 | 9.8543 |
| 1.4um | (Microsemi GG) | 200 | 0 | 150213 | 78.2638 |
| 2.0um | (Microsemi GG) | 50 | 0 | 30738 | 382.4603 |
| 3.0um | (Microsemi GG) | 349 | 0 | 88399 | 132.9911 |
| 6.0um | (Microsemi GG) | 400 | 0 | 408490 | 28.7797 |

Notes:

1. FIT rates are calculated based on 0.7ev, 60% confidence level & Tj = 55C
2. Total device hours are normalized to Tj = 125C

**Table 4.0.2: Early Life Failure Rate (ELFR)**

| Product | Foundry | Process Node | Conditions | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LX82XX | Global Foundries | 0.18um | 125C @ 48hrs | 2400 | 0 | 115200 |
| LX82XX | Global Foundries | 0.18um | 150C @ 48hrs | 4800 | 0 | 230400 |
| **Total =** | | | | **7200** | **0** | **345600** |

**Table 4.0.3: High Temperature Storage Life (HTSL) – Wafer level**

| Product | Package | Condition | Hours | Wafers | Failures | Wafer Hours |
|---|---|---|---|---|---|---|
| AAP8XX | 8 pin SB | 150C | 1000 | 1 | 0 | 1000 |
| AAP8XX | 8 pin SB | 150C | 1000 | 1 | 0 | 1000 |
| AAP1XX | Bump Die | 150C | 1000 | 1 | 0 | 1000 |
| **Total =** | | | | **3** | **0** | **3000** |

**Additional wafer level reliability data (like GOI, TDDB, EM, etc) is maintained by the foundry as applicable per their internal ongoing monitoring program.**

## 4.1 ESD Summary

**Table 4.1.1: ESD Summary (Data from HBM, CDM & MM models as applicable)**

| Process/Foundry | Product | HBM | CDM | MM |
|---|---|---|---|---|
| 0.18um Global Foundries | LX82XX | 4000V | 2000V | 150V |
| 0.18um Global Foundries | LX82XX | 2000V | 2000V | |
| 0.18um Global Foundries | LX24XX | 8000V | 2000V | |
| 0.18um Global Foundries | LX24XX | 1500V | 2000V | |
| 0.18um Jazz | LX24XXAVIG | 8000V | 2000V | 2000V |
| 0.35um Dongbu | LX65XX | 5000V | 700V | 200V |
| 0.35um Dongbu | LX19XX | 5000V | 1500V | 250V |
| 0.35um Magnachip | LX71XX | 500V | | |
| 0.35um Magnachip | LX13XXX | 1000V | | |
| 0.35um Magnachip | LX22XX | 1000V | 500V | 150V |
| 0.35um Magnachip | LX23XXX | 3000V | 1500V | 200V |
| 0.35um Magnachip | LX23XXX | 4000V | 2000V | 350V |
| 0.35um Magnachip | LX24XXX | 5000V | 2000V | 250V |
| 0.35um Magnachip | LX24XXX | 6000V | 2000V | 250V |
| 0.35um Magnachip | LX65XX | 3000V | 2000V | 300V |
| 0.35um Magnachip | LX71XX | 600V | 2000V | |
| 0.35um Magnachip | LX71XX | 1000V | 750V | 25V |
| 0.35um Magnachip | LX71XX | 2000V | 2000V | 250V |
| 0.35um Magnachip | LX71XX | 2500V | 2000V | 200V |
| 0.35um Magnachip | LX71XX | 1500V | 1500V | 100V |
| 0.35um Magnachip | LX71XX | 1500V | 2000V | 75V |
| 0.35um Magnachip | LX71XX | 2000V | 2000V | 50V |
| 0.35um Magnachip | LX71XX | 1500V | 1500V | |
| 0.35um Magnachip | LX73XX | 1000V | 2000V | 100V |

| | | | | |
|---|---|---|---|---|
| 0.35um Magnachip | LX82XX | 5000V | 2000V | 150V |
| 0.35um Magnachip | LX27XXX | 3000V | 2000V | |
| 0.35um XFAB | AA6XX | 1000 | | |
| 0.35um XFAB | AA5XX | 1000V | | |
| 0.35um XFAB | LX23XXX | 1500V | 1500V | 350V |
| 0.50um Excel Power | LX82XX | 1500V | 2000V | 200 |
| 0.35um XFAB | AAP8XX | 150V (i/p to gnd; 2000V (FB1, FB2 & HPF to gnd) & 7500V (o/p to gnd) | | |
| 0.35um XFAB | LX33XX | 2000V | 750V corner pins, 500V all other pins | |
| 0.50um Jazz | LX13XXX | 5500V | 1500 | 500V |
| 0.50um Jazz | LX73XX | 1500V | 1000V | 100V |
| 0.50um Jazz | LX96XX | 3500V | 2000V | 200V |
| 0.50um Magnachip | NX41XX | 1000V | 500V | |
| 0.60um XFAB | LX27XX | 1000V | | |
| 0.60um XFAB | NX95XX | 500V | 2000V | 50V |
| 0.60um XFAB | LX65XX | 3500V | 1500V | 250V |
| 0.60um XFAB | LX17XX | | 1000V | |
| 0.60um XFAB | LX27XXX | 5000V | 2000V | 200V |
| 0.60um XFAB | LX27XXX | 4000V | 2000V | 150V |
| 0.80um XFAB | LX65XX | 4000V | 1500V | 250V |
| 1.0um Excel Power | LX65XX | 3500V | 1500V | 250V |
| 6.0um Microsemi GG | LX23XXX | 4000V | | |
| 6.0um Microsemi GG | LX23XXX | 4000V | | |
| 6.0um Microsemi GG | LX23XXX | 4000V | | |

## 5.0 Non-Volatile Memory Reliability Summary

Exiting data on non-volatile memory is listed below,

**Table 5.1: Program/Erase Endurance Cycling – High temperature**

| Product | Process Node | Package | Temperature | # of Cycles | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|---|
| LX33XX | 0.35um | 16QSOP | 85C | 100 | 231 | 0 | 23100 |
| | | 14-pin TSSOP (RoHS) | 125C | 100 | 154 | 0 | 15400 |
| **Total =** | | | | | **385** | **0** | **38500** |

**Table 5.2: Program/Erase Endurance Cycling – Low temperature**

| Product | Process Node | Package | Temperature | # of Cycles | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|---|
| LX33XX | 0.35 um | 14-pin TSSOP (RoHS) | <55C | 100 | 77 | 0 | 7700 |
| **Total =** | | | | | **77** | **0** | **7700** |

**Table 5.3: Low Temperature Data Retention**

| Product | Process Node | Package | Temperature | # of Hrs | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|---|
| LX33XX | 0.35um | 16QSOP | <55C | 1000 | 231 | 0 | 231000 |
| | | 14-pin TSSOP (RoHS) | <55C | 1000 | 77 | 0 | 77000 |
| **Total =** | | | | | **308** | **0** | **308000** |

**Table 5.4: High Temperature Storage**

| Product | Process Node | Package | Temperature | # of Hrs | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|---|
| LX33XX | 0.35um | 16QSOP | 150C | 1000 | 231 | 0 | 231000 |
| | | 14-pin TSSOP (RoHS) | 175C | 1000 | 77 | 0 | 77000 |
| **Total =** | | | | | **308** | **0** | **308000** |

# 6.0 Package Reliability Summary

Package level data is provided below in the following categories

- By package
- By products (currently supported)

## 6.1 Package Reliability (By Package)

**Table 6.1.1: Power Temp Cycles (PTC)**

| Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|
| LGA | -65 to 150C | 2000 | 50 | 0 | 100000 |
| LFGA | -40 to 125C | 1000 | 50 | 0 | 50000 |
| QFN | -65 to 150C | 1000 | 50 | 0 | 50000 |
| Module | -65 to 150C | 1000 | 50 | 0 | 50000 |
| QFN | -40 to 85C | 1000 | 25 | 0 | 25000 |
| **Total =** | | | **225** | **0** | **275000** |

**Table 6.1.2: High Temperature Storage Life (HTSL)**

| Package | Temperature | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|
| DFN | 150 | 100 | 25 | 0 | 2500 |
| | | 1000 | 554 | 0 | 554000 |
| LFGA | 130 | 1000 | 75 | 0 | 75000 |
| | 150 | 1000 | 45 | 0 | 45000 |
| LGA | 150 | 1000 | 50 | 0 | 50000 |
| Microphone Carrier Board | 150 | 1000 | 45 | 0 | 45000 |
| QFN | 150 | 1000 | 170 | 0 | 170000 |
| QFN (FC) | 150 | 1000 | 404 | 0 | 404000 |
| QSOP | 150 | 1000 | 50 | 0 | 50000 |
| | 175 | 1000 | 231 | 0 | 231000 |
| SOIC (NB) | 150 | 1000 | 75 | 0 | 75000 |
| SOIC (WB) | 150 | 1000 | 50 | 0 | 50000 |
| WLCSP | 150 | 1000 | 50 | 0 | 50000 |
| TSSOP | 175 | 1000 | 122 | 0 | 122000 |
| **Total =** | | | **1946** | **0** | **1923500** |

**Table 6.1.3: UnBiased Highly Accelerated Stress Test (UHAST)**

| Package | Condition | Hours | Unit | Failures | Device Hours |
|---|---|---|---|---|---|
| SOIC (NB) | 110C/85RH | 96 | 25 | 0 | 2400 |
| MSOP | 110C/85RH | 264 | 50 | 0 | 13200 |
| QSOP | 110C/85RH | 96 | 75 | 0 | 7200 |
| QSOP | 130C/85RH | 96 | 46 | 0 | 4416 |
| TSSOP | 130C/85RH | 96 | 77 | 0 | 7392 |
| **Total =** | | | **273** | **0** | **34608** |

**Table 6.1.4: Highly Accelerated Stress Test (HAST)**

| Package | Condition | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|
| DFN | 130C/85RH | 96 | 75 | 0 | 7200 |
| LFGA | 130C/85RH | 96 | 100 | 0 | 9600 |
| QFN (FC) | 130C/85RH | 96 | 275 | 0 | 26400 |
| TSSOP | 130C/85RH | 96 | 77 | 0 | 7392 |
| **Total =** | | | **527** | **0** | **50592** |

**Table 6.1.5: High Temperature Reverse Bias (HTRB)**

| Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|
| LGA | 150 | 1000 | 50 | 0 | 50000 |
| Module | 150 | 1000 | 50 | 0 | 50000 |
| LFGA | 132 | 2000 | 154 | 0 | 308000 |
| **Total =** | | | **254** | **0** | **408000** |

**Table 6.1.6: Thermal Shock (TS)**

| Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|
| Ceramic SOIC | -55C to +125C | 15 | 30 | 0 | 450 |
| CERDIP | -55C to +125C | 100 | 150 | 0 | 15000 |
| DFN | -55C to +125C | 100 | 549 | 0 | 54900 |
| | | 1000 | 700 | 0 | 700000 |
| LFGA | -55C to +125C | 1000 | 77 | 0 | 77000 |
| LGA | -55C to +125C | 1000 | 50 | 0 | 50000 |
| | | 2000 | 150 | 0 | 300000 |
| Module | -55C to +125C | 1000 | 50 | 0 | 50000 |
| MSOP | -40C to +100C | 100 | 400 | 0 | 40000 |
| | -55C to +125C | 100 | 50 | 0 | 5000 |
| PDIP | -55C to +125C | 100 | 50 | 0 | 5000 |
| Plastic 1206 | -40C to +100C | 100 | 46 | 0 | 4600 |
| PLCC | -55C to +125C | 100 | 50 | 0 | 5000 |
| QFN | -55C to +125C | 100 | 1045 | 0 | 104500 |

| | | | | | |
|---|---|---|---|---|---|
| | | 1000 | 149 | 0 | 149000 |
| QFN (FC) | -55C to +125C | 1000 | 199 | 0 | 199000 |
| QSOP | -55C to +125C | 100 | 98 | 0 | 9800 |
| | | 1000 | 100 | 0 | 100000 |
| SC70 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SOIC (NB) | -55C to +125C | 100 | 1050 | 0 | 105000 |
| | | 1000 | 50 | 0 | 50000 |
| SOIC (WB) | -55C to +125C | 100 | 300 | 0 | 30000 |
| | | 1000 | 50 | 0 | 50000 |
| SOT 23 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SSOP | -55C to +125C | 100 | 100 | 0 | 10000 |
| TO 220 | -55C to +125C | 100 | 100 | 0 | 10000 |
| TSOT | -55C to +125C | 100 | 100 | 0 | 10000 |
| TSOT 23 | -55C to +125C | 100 | 150 | 0 | 15000 |
| TSSOP | -55C to +125C | 100 | 298 | 0 | 29800 |
| UDFN | -55C to +125C | 100 | 50 | 0 | 5000 |
| **Total =** | | | **6341** | **0** | **2194050** |

**Table 6.1.7: Auto Clave (AC)**

| Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|
| CERDIP | 121C, 15 psig | 96 | 150 | 0 | 14400 |
| DFN | 121C, 15 psig | 96 | 1397 | 0 | 134112 |
| MSOP | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| PDIP | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| PLCC | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| QFN | 121C | 96 | 50 | 0 | 4800 |
| | 121C, 15 psig | 96 | 1199 | 0 | 110304 |
| QFN (FC) | 121C, 15 psig | 96 | 250 | 0 | 24000 |
| QSOP | 121C | 96 | 253 | 0 | 24288 |
| | 121C, 15 psig | 96 | 200 | 0 | 19200 |
| SC70 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SOIC (NB) | 121C, 15 psig | 96 | 998 | 0 | 95808 |
| | 130C, 85%RH | 96 | 50 | 0 | 4800 |
| SOIC (WB) | 121C, 15 psig | 96 | 350 | 0 | 33600 |
| SOT | 121C | 96 | 77 | 0 | 7392 |
| SOT 23 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SSOP | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| TO 220 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| TSOT | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| TSOT 23 | 121C, 15 psig | 96 | 149 | 0 | 14304 |
| TSSOP | 121C, 15 psig | 96 | 531 | 0 | 50976 |
| UDFN | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| **Total =** | | | **6254** | **0** | **595584** |

**Table 6.1.8: Temperature Cycles (TC)**

| Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|
| Ceramic SOIC | method 1010, condition C | 100 | 30 | 0 | 3000 |
| CERDIP | -65C to +150C | 100 | 150 | 0 | 15000 |
| CQFP | method 1010, condition C | 100 | 15 | 0 | 1500 |
| DFN | -65C to +150C | 100 | 700 | 0 | 70000 |
| | | 500 | 700 | 0 | 350000 |
| | | 1000 | 154 | 0 | 154000 |
| LFGA | -65C to +150C | 500 | 154 | 0 | 77000 |
| LGA | -65C to +150C | 500 | 50 | 0 | 25000 |
| | | 1000 | 150 | 0 | 150000 |
| Module | -65C to +150C | 500 | 50 | 0 | 25000 |
| MSOP | -40C to +100C | 100 | 400 | 0 | 40000 |
| | -65C to +150C | 100 | 50 | 0 | 5000 |
| PDIP | -65C to +150C | 100 | 50 | 0 | 5000 |
| Plastic 1206 | -40C to +100C | 100 | 49 | 0 | 4900 |
| PLCC | -65C to +150C | 100 | 50 | 0 | 5000 |
| QFN | -55C to + 125C | 700 | 75 | 0 | 52500 |
| | -65C to +150C | 100 | 898 | 0 | 89800 |
| | | 500 | 224 | 0 | 112000 |
| | | 100 | 50 | 0 | 5000 |
| QFN (FC) | -65C to +150C | 500 | 300 | 0 | 150000 |
| | | 1000 | 308 | 0 | 308000 |
| QSOP | -65C to +150C | 100 | 100 | 0 | 10000 |
| | | 500 | 100 | 0 | 50000 |
| | | 100 | 22 | 0 | 2200 |
| | JESD22-A104-B | 500 | 45 | 0 | 22500 |
| | -65C to 175C | 500 | 231 | 0 | 115500 |
| SC70 | -65C to +150C | 100 | 50 | 0 | 5000 |
| SOIC (NB) | -65C to +150C | 100 | 1050 | 0 | 105000 |
| | | 250 | 25 | 0 | 6250 |
| | | 500 | 50 | 0 | 25000 |
| SOIC (WB) | -65C to +150C | 100 | 300 | 0 | 30000 |
| | | 500 | 50 | 0 | 25000 |
| SOT 23 | -65C to +150C | 100 | 50 | 0 | 5000 |

| | | | | | |
|---|---|---|---|---|---|
| SSOP | -65C to +150C | 100 | 101 | 0 | 10100 |
| TO 220 | -65C to +150C | 100 | 100 | 0 | 10000 |
| TSOT | -65C to +150C | 100 | 100 | 0 | 10000 |
| TSOT 23 | -65C to +150C | 100 | 149 | 0 | 14900 |
| TSSOP | -55C to +150C | 2000 | 77 | 0 | 154000 |
| | -65C to +150C | 100 | 300 | 0 | 30000 |
| | -65C to +175C | 500 | 231 | 0 | 115500 |
| UDFN | -65C to +150C | 100 | 50 | 0 | 5000 |
| WLCSP | -40C to +125C | 500 | 100 | 0 | 50000 |
| | -65C to +150C | 500 | 50 | 0 | 25000 |
| **Total =** | | | **7938** | **0** | **2473650** |

**Table 6.1.9: Temperature Humidity Bias (THB)**

| Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|
| DFN | 85C/85RH | 2000 | 198 | 0 | 198000 |
| LGA | 85C/85RH | 2025 | 50 | 0 | 101250 |
| Module | 85C/85RH | 1000 | 50 | 0 | 50000 |
| QFN | 130C/85RH | 116 | 75 | 0 | 8700 |
| | 85C/85RH | 1000 | 50 | 0 | 50000 |
| QFN (FC) | 130C/85RH | 96 | 25 | 0 | 2400 |
| | 85C/85RH | 3000 | 150 | 0 | 150000 |
| QSOP | 85C/85RH | 1000 | 281 | 0 | 281000 |
| SOIC (WB) | 85C/85RH | 1000 | 50 | 0 | 50000 |
| SOT | 85C/85RH | 160 | 77 | 0 | 12320 |
| TO | 85C/85RH | 1000 | 50 | 0 | 50000 |
| WLCSP | 85C/85RH | 1000 | 50 | 0 | 50000 |
| TSSOP | 85C/85RH | 1000 | 231 | 0 | 231000 |
| **Total =** | | | **1337** | **0** | **1234670** |

## 6.2 Package Reliability (By Product)

**Table 6.2.1: Power Temp Cycles (PTC)**

| Product | Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|---|
| LX24XX | LD68-2 | -40 to 125C | 1000 | 50 | 0 | 50000 |
| LX96XX | QFN1515-MCP | -40 to 85C | 1000 | 25 | 0 | 25000 |
| LXM24XX | LG-2 | -65 to 150C | 2000 | 50 | 0 | 100000 |
| | Module | -65 to 150C | 1000 | 50 | 0 | 50000 |
| NX95XX | LQ55-32 | -65 to 150C | 1000 | 50 | 0 | 50000 |
| **Total =** | | | | **225** | **0** | **275000** |

**Table 6.2.2: High Temperature Storage Life (HTSL)**

| Product | Package | Condition | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LX22XX | DB-36 | 150 | 1000 | 50 | 0 | 50000 |
| LX24XX | LD68-2 | 130 | 1000 | 75 | 0 | 75000 |
| | | 150 | 1000 | 45 | 0 | 45000 |
| LX27XXX | D-16 | 150 | 1000 | 50 | 0 | 50000 |
| LX27XXX | DW-24 | 150 | 1000 | 50 | 0 | 50000 |
| LX27XXX | D-14 | 150 | 1000 | 25 | 0 | 25000 |
| LX71XX | LD335-12 | 150 | 100 | 25 | 0 | 2500 |
| | | | 1000 | 125 | 0 | 125000 |
| LX71XX | CSP216-20 | 150 | 1000 | 50 | 0 | 50000 |
| LX71XX | LD22-8 | 150 | 1000 | 100 | 0 | 100000 |
| LX71XX | LD335-12 | 150 | 1000 | 50 | 0 | 50000 |
| LX71XX | LD33-10 | 150 | 1000 | 50 | 0 | 50000 |
| LX71XX | LQ22-12 | 150 | 1000 | 100 | 0 | 100000 |
| LX71XX | LQ22-12 | 150 | 1000 | 50 | 0 | 50000 |
| LX73XX | LQ44-24 | 150 | 1000 | 50 | 0 | 50000 |
| LX73XX | LQ44-24 | 150 | 1000 | 45 | 0 | 45000 |
| LX82XX | LD33-10 | 150 | 1000 | 179 | 0 | 179000 |
| LX82XX | LQ32-12 | 150 | 1000 | 177 | 0 | 177000 |
| LX82XX | LQ 3.5x4.5-24 vQFN-Fcol | 150 | 1000 | 77 | 0 | 77000 |
| LX82XX | LD32-8 | 150 | 1000 | 50 | 0 | 50000 |
| LX96XX | QFN1515-MCP | 150 | 1000 | 75 | 0 | 75000 |
| LXM24XX | LG-2 | 150 | 1000 | 50 | 0 | 50000 |
| AA6XX | Microphone Carrier Board | 150 | 1000 | 45 | 0 | 45000 |
| LX33XX | 14-pin TSSOP (RoHS) | 175 | 1000 | 122 | 0 | 122000 |
| **Total =** | | | | **1715** | **0** | **1692500** |

**Table 6.2.3: UnBiased Highly Accelerated Stress Test (UHAST)**

| Product | Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LX19XX | PL-8 | 110C/85RH | 264 | 50 | 0 | 13200 |
| LX27XXX | D-14 | 110C/85RH | 96 | 25 | 0 | 2400 |
| AA6XX | 16 pin QSOP (RoHS) | 130C/85RH | 96 | 46 | 0 | 4416 |
| LX33XX | 14-pin TSSOP (RoHS) | 130C/85RH | 96 | 77 | 0 | 7392 |
| **Total =** | | | | **198** | **0** | **27408** |

**Table 6.2.4: Highly Accelerated Stress Test (HAST)**

| Product | Package | Condition | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LX24XX | LD68-2 | 130C/85RH | 96 | 100 | 0 | 9600 |
| LX33XX | 14-pin TSSOP (RoHS) | 130C/85RH | 96 | 77 | 0 | 7392 |
| LX82XX | LD33-10 | 130C/85RH | 96 | 75 | 0 | 7200 |
| LX82XX | LQ32-12 | 130C/85RH | 96 | 175 | 0 | 16800 |
| LX82XX | LQ 3.5x4.5-24 vQFN-Fcol | 130C/85RH | 96 | 100 | 0 | 9600 |
| **Total =** | | | | **527** | **0** | **50592** |

**Table 6.2.5: High Temperature Reverse Bias (HTRB)**

| Product | Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LXM24XX | LG-2 | 150 | 1000 | 50 | 0 | 50000 |
| | Module | 150 | 1000 | 50 | 0 | 50000 |
| LX24XX | LD68-2 | 132 | 2000 | 154 | 0 | 308000 |
| **Total =** | | | | **254** | **0** | **408000** |

**Table 6.2.6: Thermal Shock (TS)**

| Product | Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|---|
| LX19XX | DU-8 | -40C to +100C | 100 | 150 | 0 | 15000 |
| LX71XX | LU-6 | -55C to +125C | 100 | 50 | 0 | 5000 |
| | SG-5 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX13XXX | LQ54-34 | -55C to +125C | 100 | 197 | 0 | 19700 |
| LX13XXX | LQ54-34 | -55C to +125C | 1000 | 50 | 0 | 50000 |
| LX13XXX | LD33-10 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX16XX | LQ57-38 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX16XX | PW-24 | -55C to +125C | 100 | 98 | 0 | 9800 |
| LX16XX | PW-20 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX16XX | DB-20 | -55C to +125C | 100 | 100 | 0 | 10000 |
| | DW-20 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX19XX | BC | -40C to +100C | 100 | 46 | 0 | 4600 |
| LX19XX | DU-8 | -40C to +100C | 100 | 50 | 0 | 5000 |
| | DU-8-C | -40C to +100C | 100 | 200 | 0 | 20000 |
| LX19XX | DU-10 | -55C to +125C | 100 | 50 | 0 | 5000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LX19XX | LQ44-24 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX22XX | DB-36 | -55C to +125C | 1000 | 100 | 0 | 100000 |
| | LQ57-38 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX23XXX | LQ55-32 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX23XXX | DB-48 | -55C to +125C | 100 | 50 | 0 | 5000 |
| | LQ77-48 | -55C to +125C | 100 | 100 | 0 | 10000 |
| LX23XXX | DB-36 | -55C to +125C | 100 | 48 | 0 | 4800 |
| | LQ66-36 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX24XX | LG-2 | -55C to +125C | 1000 | 50 | 0 | 50000 |
| LX24XX | LD68-2 | -55C to +125C | 1000 | 77 | 0 | 77000 |
| LX24XXX | LQ88-56 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX27XX | LQ33-16 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX27XXX | D-16 | -55C to +125C | 100 | 100 | 0 | 10000 |
| LX27XXX | DW-24 | -55C to +125C | 1000 | 50 | 0 | 50000 |
| LX43XX | SC-3 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX65XX | DW-28 | -55C to +125C | 100 | 50 | 0 | 5000 |
| | PW-28 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX65XX | D-16 | -55C to +125C | 100 | 300 | 0 | 30000 |
| LX65XX | DW-20 | -55C to +125C | 100 | 100 | 0 | 10000 |
| LX65XX | D-16 | -55C to +125C | 100 | 250 | 0 | 25000 |
| | PW-16 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX65XX | D-16 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX65XX | D-14 | -55C to +125C | 100 | 150 | 0 | 15000 |
| LX65XX | D-14 | -55C to +125C | 100 | 200 | 0 | 20000 |
| LX71XX | LD335-12 | -55C to +125C | 100 | 200 | 0 | 20000 |
| | LQ33-12 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX71XX | LD335-12 | -55C to +125C | 100 | 50 | 0 | 5000 |
| | | | 1000 | 200 | 0 | 200000 |
| LX71XX | LD22-8 | -55C to +125C | 1000 | 300 | 0 | 300000 |
| LX71XX | LD335-12 | -55C to +125C | 100 | 100 | 0 | 10000 |
| | | | 1000 | 150 | 0 | 150000 |
| LX71XX | LD33-10 | -55C to +125C | 1000 | 50 | 0 | 50000 |
| LX71XX | LQ22-12 | -55C to +125C | 1000 | 199 | 0 | 199000 |
| LX72XX | SM-6 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX73XX | LQ33-20 | -55C to +125C | 100 | 150 | 0 | 15000 |
| LX73XX | LQ44-24 | -55C to +125C | 1000 | 149 | 0 | 149000 |
| LX82XX | SE-5 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LX8XX | SE-5 | -55C to +125C | 100 | 50 | 0 | 5000 |
| LXM24XX | LG-2 | -55C to +125C | 2000 | 150 | 0 | 300000 |
| | Module | -55C to +125C | 1000 | 50 | 0 | 50000 |
| NX24XX | LQ44-24 | -55C to +125C | 100 | 48 | 0 | 4800 |
| NX41XX | SE-5 | -55C to +125C | 100 | 50 | 0 | 5000 |
| NX95XX | LQ55-32 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SG15XX | N-16 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SG15XX | N-18 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SG28XX | Q-20 | -55C to +125C | 100 | 50 | 0 | 5000 |
| SG29XXX | P-5 | -55C to +125C | 100 | 100 | 0 | 10000 |
| SG34XX | M-8 | -55C to +125C | 100 | 50 | 0 | 5000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SG35XX | N-18 | -55C to +125C | 100 | 50 | 0 | 5000 |
| AAHS2XX | 20 pin ceramic SOIC | -55C to +125C | 15 | 15 | 0 | 225 |
| AA6XX | 24L 4x4x0.5 QFN (RoHS) | -55C to +125C | 100 | 50 | 0 | 5000 |
| **Total =** | | | | **5877** | **0** | **2153925** |

**Table 6.2.7: Auto Clave (AC)**

| Product | Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| 71XX | LU-6 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| | SG-5 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX13XXX | LQ54-34 | 121C, 15 psig | 96 | 200 | 0 | 19200 |
| LX13XXX | LQ54-34 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX13XXX | LD33-10 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX16XX | LQ57-38 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX16XX | PW-24 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| LX16XX | PW-20 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX16XX | DB-20 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| | DW-20 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX19XX | LD33-8 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX19XX | DU-10 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX19XX | LQ44-24 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX22XX | DB-36 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| | LQ57-38 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX23XXX | LQ55-32 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX23XXX | DB-48 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| | LQ77-48 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| LX23XXX | DB-36 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| | LQ66-36 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX24XXX | LQ88-56 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX27XX | LQ33-16 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX27XXX | D-16 | 121C, 15 psig | 96 | 150 | 0 | 14400 |
| LX27XXX | DW-24 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX43XX | SC-3 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX65XX | DW-28 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| | PW-28 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX65XX | D-16 | 121C, 15 psig | 96 | 249 | 0 | 23904 |
| LX65XX | DW-20 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| LX65XX | D-16 | 121C, 15 psig | 96 | 250 | 0 | 24000 |
| | PW-16 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX65XX | D-16 | 121C, 15 psig | 96 | 49 | 0 | 4704 |
| LX65XX | D-14 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| | | 130C, 85%RH | 96 | 50 | 0 | 4800 |
| LX65XX | D-14 | 121C, 15 psig | 96 | 200 | 0 | 19200 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LX71XX | LD335-12 | 121C, 15 psig | 96 | 200 | 0 | 19200 |
| | LQ33-12 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX71XX | LD335-12 | 121C, 15 psig | 96 | 249 | 0 | 23904 |
| LX71XX | LD22-8 | 121C, 15 psig | 96 | 300 | 0 | 28800 |
| LX71XX | LD335-12 | 121C, 15 psig | 96 | 249 | 0 | 23904 |
| LX71XX | LD33-10 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX71XX | LQ22-12 | 121C, 15 psig | 96 | 200 | 0 | 19200 |
| LX71XX | LQ22-12 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX72XX | SM-6 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX73XX | LQ33-20 | 121C, 15 psig | 96 | 150 | 0 | 14400 |
| LX73XX | LQ44-24 | 121C, 15 psig | 96 | 149 | 0 | 14304 |
| LX82XX | SE-5 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| LX82XX | SE-5 | 121C, 15 psig | 96 | 49 | 0 | 4704 |
| LX82XX | LD32-8 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| NX24XX | LQ44-24 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| NX41XX | SE-5 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| NX95XX | LQ55-32 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SG15XX | N-16 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SG15XX | N-18 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SG28XX | Q-20 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SG29XXX | P-5 | 121C, 15 psig | 96 | 100 | 0 | 9600 |
| SG34XX | M-8 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| SG35XX | N-18 | 121C, 15 psig | 96 | 50 | 0 | 4800 |
| AA55X | 4LD SOT143 | 121C | 96 | 77 | 0 | 7392 |
| AA6XX | 24L 4x4x0.5 QFN (RoHS) | 121C | 96 | 50 | 0 | 4800 |
| AA594C | 16 pin QSOP (RoHS) | 121C | 96 | 11 | 0 | 1056 |
| AA594D | 16 pin QSOP (RoHS) | 121C | 96 | 11 | 0 | 1056 |
| LX33XX | 14-pin TSSOP (RoHS) | 121C, 15 psig | 96 | 231 | 0 | 22176 |
| **Total =** | | | | **5574** | **0** | **535104** |

**Table 6.2.8: Temperature Cycles (TC)**

| Product | Package | Conditions | Cycles | Units | Failures | Device Cycles |
|---|---|---|---|---|---|---|
| AA594C | 16 pin QSOP (RoHS) | -65 to 150C | 100 | 11 | 0 | 1100 |
| AA594D | 16 pin QSOP (RoHS) | -65 to 150C | 100 | 11 | 0 | 1100 |
| AA6XX | 24L 4x4x0.5 QFN (RoHS) | -65 to 150C | 100 | 50 | 0 | 5000 |
| AA6XX | 16 pin QSOP (RoHS) | JESD22-A104-B Condition C | 500 | 45 | 0 | 22500 |
| AAHS2XX | 20 pin ceramic SOIC | method 1010, condition C | 100 | 15 | 0 | 1500 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LX33XX | 14-pin TSSOP (RoHS) | -55C to +150C | 2000 | 77 | 0 | 154000 |
| | | -65C to +175C | 500 | 231 | 0 | 115500 |
| LX19XX | DU-8 | -40C to +100C | 100 | 150 | 0 | 15000 |
| LX71XX | LU-6 | -65C to +150C | 100 | 50 | 0 | 5000 |
| | SG-5 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX13XXX | LQ54-34 | -65C to +150C | 100 | 149 | 0 | 14900 |
| LX13XXX | LQ54-34 | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX13XXX | LD33-10 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX16XX | LQ57-38 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX16XX | PW-24 | -65C to +150C | 100 | 100 | 0 | 10000 |
| LX16XX | PW-20 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX16XX | DB-20 | -65C to +150C | 100 | 101 | 0 | 10100 |
| | DW-20 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX19XX | LD33-8 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX19XX | BC | -40C to +100C | 100 | 49 | 0 | 4900 |
| LX19XX | DU-8 | -40C to +100C | 100 | 50 | 0 | 5000 |
| | DU-8-C | -40C to +100C | 100 | 200 | 0 | 20000 |
| LX19XX | DU-10 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX19XX | LQ44-24 | -65C to +150C | 100 | 49 | 0 | 4900 |
| LX22XX | DB-36 | -65C to +150C | 500 | 100 | 0 | 50000 |
| | LQ57-38 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX23XXX | LQ55-32 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX23XXX | DB-48 | -65C to +150C | 100 | 50 | 0 | 5000 |
| | LQ77-48 | -65C to +150C | 100 | 100 | 0 | 10000 |
| LX23XXX | DB-36 | -65C to +150C | 100 | 50 | 0 | 5000 |
| | LQ66-36 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX24XX | LG-2 | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX24XX | LD68-2 | -65C to +150C | 500 | 154 | 0 | 77000 |
| LX24XXX | LQ88-56 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX27XX | LQ33-16 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX27XXX | D-16 | -65C to +150C | 100 | 100 | 0 | 10000 |
| | | | 500 | 50 | 0 | 25000 |
| LX27XXX | DW-24 | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX27XXX | D-14 | -65C to +150C | 250 | 25 | 0 | 6250 |
| LX43XX | SC-3 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX65XX | DW-28 | -65C to +150C | 100 | 50 | 0 | 5000 |
| | PW-28 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX65XX | D-16 | -65C to +150C | 100 | 300 | 0 | 30000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LX65XX | DW-20 | -65C to +150C | 100 | 100 | 0 | 10000 |
| LX65XX | D-16 | -65C to +150C | 100 | 250 | 0 | 25000 |
| | PW-16 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX65XX | D-16 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX65XX | D-14 | -65C to +150C | 100 | 150 | 0 | 15000 |
| LX65XX | D-14 | -65C to +150C | 100 | 200 | 0 | 20000 |
| LX71XX | LD335-12 | -65C to +150C | 100 | 200 | 0 | 20000 |
| | LQ33-12 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX71XX | LD335-12 | -65C to +150C | 100 | 50 | 0 | 5000 |
| | | | 500 | 200 | 0 | 100000 |
| LX71XX | CSP216-20 | -40C to +125C | 500 | 100 | 0 | 50000 |
| | | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX71XX | LD22-8 | -65C to +150C | 500 | 301 | 0 | 150500 |
| LX71XX | LD335-12 | -65C to +150C | 100 | 100 | 0 | 10000 |
| | | | 500 | 149 | 0 | 74500 |
| LX71XX | LD33-10 | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX71XX | LQ22-12 | -65C to +150C | 500 | 200 | 0 | 100000 |
| LX71XX | LQ22-12 | -65C to +150C | 500 | 50 | 0 | 25000 |
| LX72XX | SM-6 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX73XX | LQ33-20 | -65C to +150C | 100 | 150 | 0 | 15000 |
| LX73XX | LQ44-24 | -65C to +150C | 500 | 149 | 0 | 74500 |
| LX73XX | LQ44-24 | -55C to + 125C | 700 | 75 | 0 | 52500 |
| LX82XX | LD33-10 | -65C to +150C | 1000 | 154 | 0 | 154000 |
| LX82XX | SE-5 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX82XX | SE-5 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX82XX | LQ32-12 | -65C to +150C | 500 | 50 | 0 | 25000 |
| | | | 1000 | 154 | 0 | 154000 |
| LX82XX | LQ 3.5x4.5-24 vQFN-Fcol | -65C to +150C | 1000 | 154 | 0 | 154000 |
| LX82XX | LD32-8 | -65C to +150C | 100 | 50 | 0 | 5000 |
| LX96XX | QFN1515-MCP | -65C to +150C | 500 | 75 | 0 | 37500 |
| LXM24XX | LG-2 | -65C to +150C | 1000 | 150 | 0 | 150000 |
| | Module | -65C to +150C | 500 | 50 | 0 | 25000 |
| NX24XX | LQ44-24 | -65C to +150C | 100 | 50 | 0 | 5000 |
| NX41XX | SE-5 | -65C to +150C | 100 | 49 | 0 | 4900 |
| NX95XX | LQ55-32 | -65C to +150C | 100 | 50 | 0 | 5000 |
| SG15XX | N-16 | -65C to +150C | 100 | 50 | 0 | 5000 |
| SG15XX | N-18 | -65C to +150C | 100 | 50 | 0 | 5000 |
| SG28XX | Q-20 | -65C to +150C | 100 | 50 | 0 | 5000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SG29XXX | P-5 | -65C to +150C | 100 | 100 | 0 | 10000 |
| SG34XX | M-8 | -65C to +150C | 100 | 50 | 0 | 5000 |
| SG35XX | N-18 | -65C to +150C | 100 | 50 | 0 | 5000 |
| **Total =** | | | | **7327** | **0** | **2340150** |

**Table 6.2.9: Temperature Humidity Bias (THB)**

| Product | Package | Conditions | Hours | Units | Failures | Device Hours |
|---|---|---|---|---|---|---|
| LX22XX | DB-36 | 85C/85RH | 1000 | 50 | 0 | 50000 |
| LX27XXX | DW-24 | 85C/85RH | 1000 | 50 | 0 | 50000 |
| LX71XX | LD335-12 | 85C/85RH | 2000 | 100 | 0 | 100000 |
| LX71XX | CSP216-20 | 85C/85RH | 1000 | 50 | 0 | 50000 |
| LX71XX | LD22-8 | 85C/85RH | 2000 | 98 | 0 | 98000 |
| LX71XX | LQ22-12 | 85C/85RH | 2000 | 100 | 0 | 100000 |
| LX71XX | LQ22-12 | 85C/85RH | 1000 | 50 | 0 | 50000 |
| LX73XX | LQ44-24 | 85C/85RH | 1000 | 50 | 0 | 50000 |
| LX82XX | LQ32-12 | 130C/85RH | 96 | 25 | 0 | 2400 |
| LX96XX | QFN1515-MCP | 130C/85RH | 116 | 75 | 0 | 8700 |
| LXM24XX | LG-2 | 85C/85RH | 2025 | 50 | 0 | 101250 |
| | Module | 85C/85RH | 1000 | 50 | 0 | 50000 |
| AA550 | 4LD SOT143 | 85C/85RH | 160 | 77 | 0 | 12320 |
| LX3301 | 14-pin TSSOP (RoHS) | 85C/85RH | 1000 | 231 | 0 | 231000 |
| **Total =** | | | | **1056** | **0** | **953670** |

## Revision History

<table>
<tr><th>ECO/Change</th><th>Revision</th><th>Description of change</th><th>Date of Revision</th></tr>
<tr><td>01897</td><td>A</td><td>Initial Release (covering qualification data since January 2008 till August 2015)</td><td>10/23/2015</td></tr>
<tr><td>01939</td><td>B</td><td>Updated tables (4.0.1, 4.1.1, 6.1.2, 6.1.7, 6.1.8, 6.1.9, 6.2.2, 6.2.7, 6.2.8, 6.2.9) based on additional qualification data (from September 2015 thru December 2015)</td><td>12/17/2015</td></tr>
<tr><td>PD-000124027</td><td>C</td><td>Updated tables HTOL Table 4.0.1 with qualification data from March RTP and split 0.6um and 1.0um product from previous data.</td><td>4/01/2016</td></tr>
<tr><td>PD-000157984</td><td>D</td><td>Added in Section 2.0 Product Portfolio – Hi Rel Product/Product AA7XX/AA7XX<br>Updated qualification data in Table 4.0.1: High Temperature Operational Life Test/Burn In (HTOL/BI)
<table>
<tr><th>Foundry Process</th><th>Total Units</th><th>Failures</th><th>Total Device Hours</th><th>FIT Rate</th></tr>
<tr><td>0.18um (Global Foundries)</td><td>820</td><td>0</td><td>2069801</td><td>5.6799</td></tr>
<tr><td>0.6um (XFAB)</td><td>1952</td><td>0</td><td>1698937</td><td>6.9197</td></tr>
<tr><td>1.0um (XFAB)</td><td>519</td><td>0</td><td>1193000</td><td>9.8543</td></tr>
</table>
Updated ESD Summary Table 4.1.1 to include LX8204 ESD ratings
<table>
<tr><td>0.18um Global Foundries</td><td>LX24XX</td><td>1500V</td><td>2000V</td><td></td></tr>
</table>
Updated the following tables for LX8204 package reliability data<br>Table 6.1.2: High Temperature Storage Life (HTSL)<br>Table 6.1.4: Highly Accelerated Stress Test (HAST)<br>Table 6.1.8: Temperature Cycles (TC)<br>Table 6.2.2: High Temperature Storage Life (HTSL)<br>Table 6.2.4: Highly Accelerated Stress Test (HAST)<br>Table 6.2.8: Temperature Cycles (TC)</td><td>6/27/2016</td></tr>
<tr><td>PD-000161627</td><td>E</td><td>Updated the following tables for LX3302QPW, LX7165-X5 V2R1, LX8237 V3R1 and LX8237 V3R2 reliability test data:<br>Table 4.0.1: High Temperature Operational Life Test/Burn In (HTOL/BI)<br>Table 4.1.1: ESD Summary (Data from HBM, CDM & MM models as applicable)<br>Table 5.1: Program/Erase Endurance Cycling – High temperature<br>Table 5.2: Program/Erase Endurance Cycling – Low temperature<br>Table 5.3: Low Temperature Data Retention<br>Table 5.4: High Temperature Storage<br>Table 6.1.2: High Temperature Storage Life (HTSL)<br>Table 6.1.3: UnBiased Highly Accelerated Stress Test (UHAST)<br>Table 6.1.4: Highly Accelerated Stress Test (HAST)<br>Table 6.1.8: Temperature Cycles (TC)<br>Table 6.2.2: High Temperature Storage Life (HTSL)<br>Table 6.2.3: UnBiased Highly Accelerated Stress Test (UHAST)<br>Table 6.2.4: Highly Accelerated Stress Test (HAST)<br>Table 6.2.8: Temperature Cycles (TC)</td><td>10/24/16</td></tr>
</table>