

## Qualification and Reliability Report

 Series:           E13C7          

| Qualification Tests                                     |  |      |      |      |
|---|--|------|------|------|
| Test  | Method/Condition   | Test | Pass | Fail |
| Aging   | Biased, Nominal V <sub>DD</sub> , Temperature = 85°C, Duration = 30 days | 100  | 100  | 0    |
| Autoclave   | JESD22-A102, 121°C, 100% RH, 15 PSIG, 96 hours                           | 100  | 100  | 0    |
| ESD Susceptibility                                      | MIL-STD-883, Method 3015, Class 1, HBM = 1,500V                          | 10   | 10   | 0    |
| Flammability  | UL94-V0  | 10   | 10   | 0    |
| Hermeticity – Fine Leak                                 | MIL-STD-883, Method 1014, Condition A                                    | 100  | 100  | 0    |
| Hermeticity – Gross Leak                                | MIL-STD-883, Method 1014, Condition C                                    | 100  | 100  | 0    |
| High Temperature Operating Life                         | MIL-STD-883, Method 1005, Condition B, Biased, 125°C, 1,000 hours        | 100  | 100  | 0    |
| High Temperature Storage                                | MIL-STD-883, Method 1008, Condition C, 125°C, 168 hours                  | 100  | 100  | 0    |
| Highly Accelerated Temperature and Humidity Stress Test | JESD22-A110, Biased, 130°C, 85% RH, 96 hours                             | 100  | 100  | 0    |
| Latchup   | JESD17, 200mA @ 25°C   | 10   | 10   | 0    |
| Mechanical Dimensions                                   | Per Datasheet  | 25   | 25   | 0    |
| Mechanical Shock  | MIL-STD-883, Method 2002, Condition B, 1,500G's, 0.5msec, ½ sine         | 100  | 100  | 0    |
| Moisture Sensitivity Level                              | J-STD-020, MSL = 1, 260°C  | 100  | 100  | 0    |
| Resistance to Soldering Heat                            | MIL-STD-202, Method 210, Condition K                                     | 100  | 100  | 0    |
| Resistance to Solvents                                  | MIL-STD-202, Method 215  | 100  | 100  | 0    |
| Solderability   | MIL-STD-883, Method 2003   | 100  | 100  | 0    |
| Temperature Cycle                                       | MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 cycles        | 100  | 100  | 0    |
| Vibration   | MIL-STD-883, Method 2007, Condition A, 20G's                             | 100  | 100  | 0    |

| Reliability Tests |  |       |       |      |
|-------------------|--|-------|-------|------|
| Test              | Method/Condition   | Test  | Pass  | Fail |
| Vibration         | MIL-STD-883, Method 2007, 20 G's   | 8,215 | 8,215 | 0    |
| Mechanical Shock  | MIL-STD-883, Method 2002, Condition B, 1,500G's, 0.5msec, ½ sine           | 8,215 | 8,215 | 0    |
| Temperature Cycle | MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 cycles          | 8,215 | 8,215 | 0    |
| Aging             | Biased, Nominal V <sub>DD</sub> , Temperature = 85°C, Duration = 720 hours | 8,215 | 8,215 | 0    |

| Reliability Data    |                                   |                         |
|---------------------|-----------------------------------|-------------------------|
| Characteristic      | Constant                          | Value                   |
| Number of Units     | <i>N</i>                          | 8,215                   |
| Hours Tested        | <i>t</i>                          | 720                     |
| Activation Voltage  | <i>Ea</i>                         | 0.4eV                   |
| Boltzman's Constant | <i>k</i>                          | 8.62 x 10 <sup>-5</sup> |
| Aging Temperature   | <i>T1</i>                         | 85°C                    |
| Ambient Temperature | <i>T2</i>                         | 25°C                    |
| Confidence Level    | <i>X</i> <sup>2</sup> (CL, 2 dof) | 90%                     |

| Reliability Calculations    |                                      |
|-----------------------------|--------------------------------------|
| Parameter                   | Value                                |
| Failures in Time (FIT)      | 29 units / 1 x 10 <sup>9</sup> Hours |
| Mean Time To Failure (MTTF) | 34,925,000 hours / Failure           |

$$FIT = \frac{(\chi^2 / 2) \cdot 1,000,000,000}{\sum \left[ f_i \cdot t_i \cdot e^{\frac{Ea}{k} \left( \frac{1}{T1+273} - \frac{1}{T2+273} \right)} \right] + \left[ N \cdot t \cdot e^{\frac{Ea}{k} \left( \frac{1}{T1+273} - \frac{1}{T2+273} \right)} \right]}$$

$$MTTF = 1,000,000,000 / FIT$$