# S29AL008J

## CS Q99814, Q99814a, Q99814b, Q99814c

**Qualification of: S29AL008J, 8 Megabit (1 M x 8-Bit/512K x 16-Bit) CMOS 3.0 Volt-Only Boot Sector Flash Memory in TS048, VBK048, LAE064 and SSOP56 packages**

## Reliability Qualification Summary

**CONFIDENTIAL**

NOTICE: The material in this report is confidential. It is prepared to assist in the qualification of our product. It is declassified for the internal use of our customers only, and may be modified to meet the needs of specific customers. It also serves as a record of full qualification according to JESD47 and AEC-Q100 Grade 1 requirements.

Additionally, the package details (material set, assembly location, etc.) are specific to the qual vehicle used for the qualification. Alternate material sets and assembly locations may be qualified for the product. Production material can be assembled with any qualified material set and at any qualified assembly location. Tests are performed in accordance with AEC-Q100 and relevant JEDEC specifications.

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# I.A. Product Information

**Product Description:** S29AL008J
8 Megabit (1 M x 8-Bit/512K x 16-Bit)
CMOS 3.0 Volt-Only Boot Sector Flash Memory

| | | | |
|---|---|---|---|
| **Package:** | TS048 | **Qualification:** | Q99814 |
| **Description:** | (18.4 x 12.0 x 1.0mm) 48 Lead, Thin Small Outline Package (TSOP) | | |
| **Theta Ja:** | 40 °C/W | **Psi Jt:** | 17 °C/W |
| **Assembly Location:** | Spansion Kuala Lumpur | **Molding Compound:** | RoHS Compliant Epoxy Resin |
| **Substrate/Leadframe:** | Laminate Substrate | **Die Attachment:** | Paste |
| **Lead Finish:** | 100% Matte Sn Plating | **Bond Wire:** | Gold |
| **Comments:** | | | |

| | | | |
|---|---|---|---|
| **Est. Field Temperature:** | 55 °C | **Life Test Temperature:** | 150 °C |
| **Est. DC Field Current:** | 20 mA | **Life Test Dynamic Current:** | 7 mA |
| **Est. Field Voltage:** | 3.0 V | **Life Test Voltage:** | 3.6 V |
| **Est. Field Power Dissipation:** | 60 mWatts | **Est. Stress Power Dissipation:** | 25.2 mWatts |
| **Est. Field Tj:** | 57.4 °C | **Est. Stress Tj:** | 151.0 °C |

| | | | |
|---|---|---|---|
| **Die:** | 98H21B | **Die Size:** | 4.30 x 1.96 mm |
| **Process:** | CS69SS (110nm) | **Fab:** | Spansion Fab25 |
| **Type:** | Floating Gate | **Density:** | 8M |

# I.B. Product Information

**Product Description:** S29AL008J
8 Megabit (1 M x 8-Bit/512K x 16-Bit)
CMOS 3.0 Volt-only Boot Sector Flash Memory

| | | | |
|---|---|---|---|
| **Package:** | LAE064 | **Qualification:** | Q99814a |
| **Description:** | (9 x 9 x 1.4mm) 64 Ball, Fortified Ball Grid Array Package (fFBGA) | | |
| **Theta Ja:** | 39 °C/W | **Psi Jt:** | 11 °C/W |
| **Assembly Location:** | Spansion Thailand | **Molding Compound:** | RoHS Compliant Epoxy Resin |
| **Substrate/Leadframe:** | Laminate Substrate | **Die Attachment:** | Paste |
| **Lead Finish:** | 96.5Sn3.0Ag0.5Cu Spheres | **Bond Wire:** | Gold |
| **Comments:** | | | |

| | | | |
|---|---|---|---|
| **Est. Field Temperature:** | 55 °C | **Life Test Temperature:** | 150 °C |
| **Est. DC Field Current:** | 20 mA | **Life Test Dynamic Current:** | 7 mA |
| **Est. Field Voltage:** | 3.0 V | **Life Test Voltage:** | 3.6 V |
| **Est. Field Power Dissipation:** | 60 mWatts | **Est. Stress Power Dissipation:** | 25.2 mWatts |
| **Est. Field Tj:** | 57.3 °C | **Est. Stress Tj:** | 150.9 °C |

| | | | |
|---|---|---|---|
| **Die:** | 98H21B | **Die Size:** | 4.30 x 1.96 mm |
| **Process:** | CS69SS (110nm) | **Fab:** | Spansion Fab25 |
| **Type:** | Floating Gate | **Density:** | 8M |

# I.C. Product Information

| | |
|---|---|
| **Product Description:** | S29AL008J<br>8 Megabit (1 M x 8-Bit/512K x 16-Bit)<br>CMOS 3.0 Volt-only Boot Sector Flash Memory |

| | | | |
|---|---|---|---|
| **Package:** | VBK048 | **Qualification:** | Q99814b |
| **Description:** | (8.15 x 6.15 x 1.0mm) 48 Ball, Very Thin Fine Pitch Ball Grid Array Package (FBGA) | | |
| **Theta Ja:** | 39 °C/W | **Psi Jt:** | 11 °C/W |
| **Assembly Location:** | Spansion Thailand | **Molding Compound:** | RoHS Compliant Epoxy Resin |
| **Substrate/Leadframe:** | Laminate Substrate | **Die Attachment:** | Paste |
| **Lead Finish:** | 96.5Sn3.0Ag0.5Cu Spheres | **Bond Wire:** | Gold |
| **Comments:** | | | |

| | | | |
|---|---|---|---|
| **Est. Field Temperature:** | 55 °C | **Life Test Temperature:** | 150 °C |
| **Est. DC Field Current:** | 20 mA | **Life Test Dynamic Current:** | 7 mA |
| **Est. Field Voltage:** | 3.0 V | **Life Test Voltage:** | 3.6 V |
| **Est. Field Power Dissipation:** | 60 mWatts | **Est. Stress Power Dissipation:** | 25.2 mWatts |
| **Est. Field Tj:** | 57.3 °C | **Est. Stress Tj:** | 150.9 °C |

| | | | |
|---|---|---|---|
| **Die:** | 98H21B | **Die Size:** | 4.30 x 1.96 mm |
| **Process:** | CS69SS (110nm) | **Fab:** | Spansion Fab25 |
| **Type:** | Floating Gate | **Density:** | 8M |

# I.D. Product Information

**Product Description:** S29AL008J
8 Megabit (1 M x 8-Bit/512K x 16-Bit)
CMOS 3.0 Volt-only Boot Sector Flash Memory.

| | | | |
|---|---|---|---|
| **Package:** | SSO056 | **Qualification:** | Q99814c |
| **Description:** | (23.7 x 13.3 x 2.0mm) 56 Lead, Shrink Small Outline Package (SSOP) | | |
| **Theta Ja:** | 72 °C/W | **Psi Jt:** | 16 °C/W |
| **Assembly Location:** | Spansion Kuala Lumpur | **Molding Compound:** | RoHS Compliant Epoxy Resin |
| **Substrate/Leadframe:** | Laminate Substrate | **Die Attachment:** | Paste |
| **Lead Finish:** | 100% Matte Sn Plating | **Bond Wire:** | Gold |
| **Comments:** | | | |

| | | | |
|---|---|---|---|
| **Est. Field Temperature:** | 55 °C | **Life Test Temperature:** | 150 °C |
| **Est. DC Field Current:** | 20 mA | **Life Test Dynamic Current:** | 7 mA |
| **Est. Field Voltage:** | 3.0 V | **Life Test Voltage:** | 3.6 V |
| **Est. Field Power Dissipation:** | 60 mWatts | **Est. Stress Power Dissipation:** | 25.2 mWatts |
| **Est. Field Tj:** | 59.3 °C | **Est. Stress Tj:** | 151.8 °C |

| | | | |
|---|---|---|---|
| **Die:** | 98H21B | **Die Size:** | 4.30 x 1.96 mm |
| **Process:** | CS69SS (110nm) | **Fab:** | Spansion Fab25 |
| **Type:** | Floating Gate | **Density:** | 8M |

# II. CS69SS/LSS Life Test Failure Rate Calculation

### HTOL Stress Temperature - 150 °C

| Failure Mechanism | Read Points / Test Results | | | | Modeling Parameters @ 55°C | | | | | Avg. Failure Rate FITS @55°C, 60% Conf. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 hrs | 168 hrs | 1000 hrs | 2000 hrs | Ea eV | TAF | VAF | OAF | MTTF (yrs) | Early Life | Inherent Life |
| **PLASTIC** | | | | | | | | | | | |
| Sample Size | 11200 | 11334 | 2370 | 160 | | | | | | | |
| Zero fails, Process ave. Ea | 0 * | 0 | 0 | 0 | 0.66 | 166 | 1 | 166 | | 20 | 1 |
| **Totals** | **0** | **0** | **0** | **0** | | | | | **114155** | **20** | **1** |

* Contributes to early life FITS

### Data Retention Bake - 150 °C

| Reliability Stress | Number of Rejects | Sample Size | Failure Rate % | Failure Mechanism |
|---|---|---|---|---|
| 500 hrs | 0 | 3400 | 0.00 | No Failures |
| 1000 hrs | 0 | 3900 | 0.00 | No Failures |
| 2000 hrs | 0 | 2000 | 0.00 | No Failures |

## III. Summary of Stress Test Results

| Stress Test | Stress Condition | Package Type | Sample Size | Num. of Lots | Num. of Fails | Failure Rate % | Comments |
|---|---|---|---|---|---|---|---|
| **Data From Qualification Q99814:** | | | | | | | |
| **HTOL (EL)** | (3.6V, 150°C) | TS048 [1] | 77 | 1 | 0 | 0.00 | 168 hours |
| **ESD CDM** | N/A | TS048 [1] | 15 | 1 | Passed 1.0kV | | |
| **ESD HBM** | (100pF, 1500 Ohms) | TS048 [1] | 60 | 1 | Passed 2.0kV | | |
| **Latch Up** | (125°C, +/- 100mA) | TS048 [1] | 6 | 1 | Passed | | |
| **Endurance (10k)** | (125°C, 3.6V) | TS048 [1] | 64 | 1 | 0 | 0.00 | 10k cycles |
| **Endurance (100k)** | (125°C, 3.6V) | TS048 [1] | 64 | 1 | 0 | 0.00 | 100k cycles |

## Generic Reference Data:

| Test | Condition | Package | Sample Size | Lots | Fails | | Duration |
|---|---|---|---|---|---|---|---|
| **HTOL (EL)** | (3.6V, 150°C) | TS048 [2] | 2400 | 3 | 0 | 0.00 | 24 hours |
| | (3.6V, 150°C) | TS048 [2] | 1208 | 7 | 0 | 0.00 | 168 hours |
| **HTOL (IL)** | (3.6V, 150°C) | TS048 [2] | 900 | 3 | 0 | 0.00 | 408 hours |
| **Data Retention Bake** | (150°C) | TS048 [2] | 300 | 3 | 0 | 0.00 | 48 hours |
| | (25°C) | TS048 [2] | 3926 | 3 | 0 | 0.00 | 24 hours |
| **ESD CDM** | N/A | VBK048 [3] | 15 | 1 | Passed 1.0kV | | |
| | N/A | SSO056 [4] | 15 | 1 | Passed 1.0kV | | |
| | N/A | LAE064 [5] | 15 | 1 | Passed 1.0kV | | |
| **Preconditioning** | (PC1/260°C, +0°C/-5°C) | TS048 [2] | 693 | 3 | Passed Jedec L3 / Jeita Rank E | | |
| | (PC2/260°C, +0°C/-5°C) | VBK048 [3] | 231 | 1 | Passed Jedec L3 / Jeita Rank E | | |
| | (PC2/260°C, +0°C/-5°C) | SSO056 [4] | 230 | 1 | Passed Jedec L3 / Jeita Rank E | | |
| | (PC1/260°C, +0°C/-5°C) | LAE064 [5] | 231 | 1 | Passed Jedec L3 / Jeita Rank E | | |
| **Precon+Temp Cycle** | (PC1/260°C, -40°C/150°C) | TS048 [2] | 231 | 3 | 0 | 0.00 | 1000 cycles |
| | (PC1/260°C, -40°C/150°C) | VBK048 [3] | 77 | 1 | 0 | 0.00 | 1000 cycles |
| | (PC1/260°C, -40°C/150°C) | SSO056 [4] | 77 | 1 | 0 | 0.00 | 1000 cycles |
| | (PC1/260°C, -40°C/150°C) | LAE064 [5] | 77 | 1 | 0 | 0.00 | 1000 cycles |
| **Precon+HAST** | (PC1/260°C, Biased, 130°C/85% RH) | TS048 [2] | 231 | 3 | 0 | 0.00 | 96 hours |
| | (PC1/260°C, Biased, 110°C/85% RH) | VBK048 [3] | 77 | 1 | 0 | 0.00 | 264 hours |
| | (PC1/260°C, Biased, 130°C/85% RH) | SSO056 [4] | 76 | 1 | 0 | 0.00 | 96 hours |
| | (PC1/260°C, 3.6V Bias, 110°C/85% RH) | LAE064 [5] | 77 | 1 | 0 | 0.00 | 264 hours |
| **Precon+Steam Pressure** | (PC1/260°C, 121°C/100%RH/15PSIG) | VBK048 [3] | 77 | 1 | 0 | 0.00 | 168 hours |
| **Precon+uHAST** | (PC1/260°C, Unbiased, 130°C/85% RH) | TS048 [2] | 231 | 3 | 0 | 0.00 | 96 hours |
| | (PC1/260°C, Unbiased, 130°C/85% RH) | SSO056 [4] | 77 | 1 | 0 | 0.00 | 96 hours |
| | (PC1/260°C, Unbiased, 130°C/85% RH) | LAE064 [5] | 77 | 1 | 0 | 0.00 | 96 hours |

**Notes / Justification:**

1) Results from Qual Q99814, S29AL008J, 8M CS69SS (110nm) Floating Gate in 48 Lead TSOP (18.4 x 12 x 1mm)
2) Results from Qual Q99801, S29AL016J in 48 Lead TSOP (18.4 x 12 x 1mm) - Same package, Same Fab and Flash Technology
3) Results from Qual 81282, S29AS016J in 48 Ball vFBGA (8.15 x 6.15 x 1mm) - Same Package, Similar Technology
4) Results from Qual Q99467, S29AL016J in 56 Lead SSOP (23.7 x 13.3 x 2mm) - Same Package and Flash Technology
5) Results from Qual Q06646, S29GL01GR in 64 Ball fFBGA (9 x 9 x 1.4mm) - Same package with larger Die Size

**Preconditioning Flows:** PC1 (Exceeds JEDEC L3 and JEITA Rank E): Bake 125°C, 24hr => Soak @ 30°C/70%RH, 216hr => 3x Reflow

PC2 (JEDEC L3): Bake 125°C, 24hr => Soak @ 30°C/60%RH, 192hr => 3x Reflow

# IV. Revision History

| Section | Description |
| --- | --- |
| **Revision A - 6/1/2011** | |
| | Initial Release. |
| **Revision B - 6/1/2011** | |
| Section III:Summary of Stress Test Results | Added 168hrs HTOL Reference data |

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