freescale semiconductor

# Industrial Qualification Results Summary

Objective: **AC60 Mask Rev 1M58Y Qualification**

| | | | | | |
|---|---|---|---|---|---|
| Freescale PN:<br>Part Name: | 9S08AC60<br>AC60 | Customer Name(s):<br>PN(s): | Varies | Plan or Results:<br>Revision # & Date: | Result<br>Rev A<br>24 Feb 2011 |
| Technology:<br>Package: | E025FXXQ<br>64QFP14x14(code 6057) | Design Engr: | Jim Feddeler | QUARTZ Tracking #: | 201818 |
| Fab / Assembly /<br>Final Test Sites: | FSL-CHD/FSL-KLM/FSL-TJN | Product Engr: | Chuan He Liu | | (Signature/Date shown below may be electronic) |
| Maskset#:<br>Rev#: | 1M58Y | Prod. Package Engr: | | PPE Approval (for DIM/BOM results)<br>Signature & Date: | |
| Die Size (in mm)<br>W x L x T | 2.872X2.842 | NPI PRQE: | Nancy Long | NPI PRQE Approval Signature & Date: | Nancy Long<br>Feb-24-2011 |
| Part Operating<br>Temp. Grade: | -40 to 125C | Trace/DateCode: | LotA: 8EMHA1AQ0100<br>Tracecode: QAA1051A | CAB Approval<br>Signature & Date: | 10463618M<br>Feb-25-2011 |
| | | | | Customer Approval<br>Signature & Date: | May be N/A |

***TESTS HIGHLIGHTED IN YELLOW WERE PERFORMED FOR THIS STUDY***

***This testing is performed by Freescale Reliability Lab (TJN RAL) unless otherwise noted in the Comments.***

**GROUP A - ACCELERATED ENVIRONMENTAL STRESS TESTS**

| Stress Test | Reference | Test Conditions | End Point Requirements | Minimum Sample Size | # of Lots | Total Units including spares | Results Lot ID-(#Rej/SS) NA=Not Applicable | Comments or Generic Data |
|---|---|---|---|---|---|---|---|---|
| **PC** | JESD22-<br>A113<br>J-STD-020 | **Preconditioning (PC) :**<br>PC required for SMDs only.<br>MSL 3 @ 260°C, +5/-0°C | TEST @ RHC | All surface mount devices prior to HAST, AC, TC and as required per test conditions. | | | pass | Generic data:<br>Q81736(AC60, CHD, M03J): 0/231x3 |
| **HAST** | JESD22-<br>A101<br>A110 | **Highly Accelerated Stress Test (HAST):**<br>PC before HAST (for SMDs only): Required<br>HAST = 130°C/85%RH for 96 hrs.<br>Bias = Max Vdd<br>*Timed RO of 48hrs. MAX* | TEST @ RH | 77 | 0 | 0 | pass | Generic data:<br>Q81736(AC60, CHD, M03J): 0/231 |
| **AC** | JESD22-<br>A102<br>A118 | **Autoclave (AC):**<br>PC before AC (for SMDs only): Required<br>AC = 121°C/100%RH/15 psig for 96 hrs<br>*Timed RO of 2-48hrs. MAX* | TEST @ R | 77 | 0 | 0 | pass | Generic data:<br>Q81736(AC60, CHD, M03J): 0/231 |
| **TC** | JESD22-<br>A104<br>AEC Q100-<br>Appendix 3 | **Temperature Cycle (TC):**<br>PC before TC (for SMDs only): Required<br>TC = -65°C to 150°C for 500 cycles.<br>WBP after TC on 5 devices from 1 lot; 2 bonds per corner and one mid-bond per side on each device. Record which pins were used. | TEST @ HC<br>WBP =/> 3 grams | 77 | 0 | 0 | pass | Generic data:<br>Q81736(AC60, CHD, M03J): 0/231 |
| **HTSL** | JESD22-<br>A103 | **High Temperature Storage Life (HTSL):**<br>150°C for 1000 hrs<br><br>*Timed RO = 96hrs. MAX* | TEST @ RH | 77 | 0 | 0 | pass | Refer to EDR |

**TEST GROUP B - ACCELERATED LIFETIME SIMULATION TESTS**

| Stress Test | Reference | Test Conditions | End Point Requirements | Minimum Sample Size | # of Lots | Total Units including spares | Results Lot ID-(#Rej/SS) NA=Not Applicable | Comments or Generic Data |
|---|---|---|---|---|---|---|---|---|
| **Vreg Bypassed HTOL** | JESD22-<br>A108 | **High Temperature Operating Life (HTOL):**<br>Ta = 125°C for 168 hrs for qual<br>Bias = Vdd core (unregulated)<br>(Devices incorporating NVM shall receive 'NVM endurance preconditioning'(EDR) prior to this test, and special NVM test sequencing after this test; see AEC-Q100 for details)<br>*Timed RO of 96hrs. MAX* | TEST @ RHC | 77 | 0 | 0 | pass | Generic data:<br><br>Q81736(AC60, CHD, M03J): 0/231@150C, 2.8V, 255Hrs |
| **Vreg Enabled HTOL** | JESD22-<br>A108 | **High Temperature Operating Life (HTOL):**<br>Ta = 125°C for 168 hrs<br>Bias = 6V Vdd IO (Regulated)<br>(Devices incorporating NVM shall receive 'NVM endurance preconditioning'(EDR) prior to this test, and special NVM test sequencing after this test; see AEC-Q100 for details)<br>*Timed RO of 96hrs. MAX* | TEST @ RHC | 77 | 1 | 77 | 8EMHA1AQ0100: 0/80 | Generic data:<br><br>Q81736(AC60, CHD, M03J): 0/231@150C, 6V, 168Hrs<br>Q161497(AC60, CHD, 0M58Y): 0/77@125C, 6V, 168Hrs |
| **ELFR** | AEC Q100-008 | **Early Life Failure Rate ELFR):**<br>AEC Ta = 125°C for 48 hrs or 150°C for 24 hrs<br>*Timed RO of 48 hrs MAX* | TEST @ RH | 611 | 0 | 0 | pass | Generic data:<br>Q81736(AC60, CHD, M03J): 0/2400 |
| **EDR** | AEC Q100-005 | **NVM Endurance, Data Retention, and Operational Life (EDR):**<br>(also known as NVM Endurance Preconditioning)<br><br>10K W/E Cycling @ 125oC, Vdd = 5.0V and DRB@ 175oC for 504hrs<br>*Timed RO of 48hrs. MAX* | TEST @ RHC | 77 | 0 | 0 | pass | Q81736(AC60, CHD, M03J): 0/231@10k WE@12540C@5V+DRB 175C 504Hrs |

**TEST GROUP C - PACKAGE ASSEMBLY INTEGRITY TESTS**

| Stress Test | Reference | Test Conditions | End Point Requirements | Minimum Sample Size | # of Lots | Total Units including spares | Results Lot ID-(#Rej/SS) NA=Not Applicable | Comments or Generic Data |
|---|---|---|---|---|---|---|---|---|
| **WBS** | AEC Q100-001 | **Wire Bond shear (WBS)** | Cpk = or > 1.67 | 30 bonds<br>from minimum 5 units | 1 | 5 | 8EMHA1AQ0100: 0/5, Cpk>1.67 | Performed by Assembly Site during qual lot builds |
| **WBP** | MilStd883-<br>2011 | **Wire Bond Pull (WBP):**<br>Cond. C or D | Cpk = or > 1.67 | 30 bonds<br>from minimum 5 units | 1 | 5 | 8EMHA1AQ0100: 0/5, Cpk>1.67 | Performed by Assembly Site during qual lot builds |
| **SD** | JESD22-<br>B102 | **Solderability (SD):**<br>8hr.(1 hr. for Au-plated leads) Steam age prior to test.<br>If production burn-in is done, samples must also undergo burn-in prior to SD. | >95% lead coverage of critical areas | 15 | | | | don't need for mask revision |
| **PD** | JESD22-<br>B100 | **Physical Dimensions(PD):**<br>PD per FSL 98A drawing | Cpk = or > 1.67 | 10 | | | | don't need for mask revision |
| **DIM & BOM** | | **Dimensional (DIM):**<br>PPE to verify PD results against valid 98A drawing.<br>**BOM Verification (BOM):**<br>PPE to verify qual lot ERF BOM is accurate. | | | | | DIM: not required<br>BOM: done | |
| **SBS** | AEC-Q100-010 | **Solder Ball Shear (SBS):**<br>Performed on all solder ball mounted packages e.g. PBGA, Chip Scale, Micro Lead Frame (but NOT Flip Chip).<br>Two 220°C reflow cycles before shear. | Cpk = or >1.67 | 10<br>(5 balls from a min. of 10 devices) | 0 | 0 | | For solder ball mounted packages only; NOT for Flip Chips. |
| **LI** | JESD22-<br>B105 | **Lead Integrity (LI):**<br>Not required for surface mount devices;<br>Only required for through-hole devices. | No lead breakage or cracks | 5<br>(10 leads from each of 5 parts) | 0 | 0 | | |

**TEST GROUP D - DIE FABRICATION RELIABILITY TESTS**

| Stress Test | Reference | Test Conditions | End Point Requirements | Minimum Sample Size | # of Lots | Total Units including spares | Results Lot ID-(#Rej/SS) NA=Not Applicable | Comments |
|---|---|---|---|---|---|---|---|---|
| **EM** | | **Electro Migration (EM)** | | | | | | The data, test method, calculations and internal criteria should be available to the customer upon request for new technologies. |
| **TDDB** | | **Time Dependent Dielectric Breakdown (TDDB)** | | | | | | The data, test method, calculations and internal criteria should be available to the customer upon request for new technologies. |
| **HCI** | | **Hot Carrier Injection (HCI)** | | | | | | The data, test method, calculations and internal criteria should be available to the customer upon request for new technologies. |

Technology: E025FXXQ
Package: 64QFP14x14(code 6057)
Design Engr: Jim Feddeler
QUARTZ Tracking #: 201818

## TEST GROUP E - ELECTRICAL VERIFICATION TESTS

| Stress Test | Reference | Test Conditions | End Point Requirements | Minimum Sample Size | # of Lots | Total Units including spares | Results<br>Lot ID-(#Rej/SS)<br>NA=Not Applicable | Comments or Generic Data |
|---|---|---|---|---|---|---|---|---|
| **TEST** | Freescale 48A | **Pre- and Post Functional / Parametrics (TEST):**<br>For AEC, test software shall meet requirements of AEC-Q100-007.<br>Testing performed to the limits of device specification in temperature and limit value. | 0 Fails | All | All | All | See Results Summary | This action refers to Final Testing of all qualification units.<br>Test Site TJN |
| **CCU** | Freescale 12MYS-62419B | **Control/Correlation Units (CCU):**<br>CCU required ?: ?<br>Units shall be marked to distinguish them from the qual units and must be marked in such a way as to retain marking over the test temperature. | NA | 60<br>30 units as primary units,<br>30 units as back-up units | 0 | 0 | | Use of Control/Correlation Units is OPTIONAL and is defined by the NPI PRQE. |
| **HBM** | AEC-Q100-002 / JESD22 | **ElectroStatic Discharge/**<br>**Human Body Model Classification (HBM):**<br>Test @ 500/1000/1500/2000 Volts<br>For AEC, see AEC-Q100-002 for classification levels. | TEST @ RH<br>2KV min. | 3 units per Voltage level | 1 | 12 | 8EMHA1AQ0100:<br>0/3@500V<br>0/3@1000V<br>0/3@1500V<br>0/3@2000V | Either HBM or MM is required per AEC; NPI PRQE may require both. Levels below 2000V require customer approval. |
| **MM** | AEC-Q100-003 or JESD22 | **ElectroStatic Discharge/**<br>**Machine Model Classification m(MM):**<br>Test @ 50/100/200/400 Volts<br>For AEC, see AEC-Q100-003 for classification levels. | TEST @ RH<br>200V min. | 3 units per Voltage level | 0 | 0 | | Either HBM or MM is required per AEC; NPI PRQE may require both. Levels below 200V require customer approval. |
| **CDM** | AEC-Q100-011 or JESD22 | **ElectroStatic Discharge/**<br>**Charged Device Model Classification (CDM):**<br>Test @ 250/500 Volts<br>For AEC, see AEC-Q100-011 for classification levels.<br>***Timed RO of 96hrs MAX.*** | TEST @ RH<br>All pins =/> 500V<br>Corner pins =/> 750V; | 3 units per Voltage level | 1 | 6 | 8EMHA1AQ0100:<br>0/3@250V<br>0/3@500V | Levels below 750V for corner pins and below 500V for all other pins require customer approval. |
| **LU** | JESD78<br>plus<br>AEC-Q100-004 | **Latch-up (LU):**<br>Test per JEDEC JESD78 with the AEC-Q100-004 requirements for AEC.<br>Ta= Maximum operating temperature<br>Vsupply = Maximum operating voltage | TEST @ RH | 6 | 1 | 6 | 8EMHA1AQ0100: 0/6 | |
| **ED** | AEC-Q100-009, Freescale 48A spec | **Electrical Distribution (ED)** | TEST @ RHC | 5 | 1 | 5 | 8EMHA1AQ0100: done | |
| **FG** | For AEC, AEC-Q100-007 | **Fault Grading (FG)** | FG shall be = or > 90% for qual units | | | | FG%>98% | Production Test requirement:<br>98% w/o Iddq<br>95% w/Iddq<br>100% TYPE2 faults detection |
| **CHAR** | For AEC, AEC-Q003 | **Characterization (CHAR):**<br>Ony performed on new technologies and part families per AEC Q003. | | | | | | |
| **GL** | For AEC, AEC-Q100-006 | **Electro-Thermally Induced Gate Leakage (GL):**<br>155°C, 2.0 min, +400/-400 V<br>*Timed RO of 96 hrs MAX.*<br>*For all failures, perform unbiased bake (4hrs/125°C, or 2hrs/150°C) and retest; recovered units are GL failures.* | TEST @ R | 6 | 0 | 0 | | AEC Requirement. Not required for Commercial/Industrial. |
| **EMC** | SAE J1752/3 - Radiated Emissions | **Electromagnetic Compatibility (EMC)**<br>(see AEC Q100 Appendix 5 for test applicability; done on case-by-case basis per customer/Freescale agreement) | <40dBuV<br>150KHz - 1GHz | 1 | 0 | 0 | | Done on 0M58Y |

AC60 BOM: 9200HF10M mold compound, CRM-1064MB die attach, 1mil Au wire

Package Generic data

| Quartz # | Mask Set | Product-Qual Description / Part Number(s) | Assembly Site | Package | Mold Compound | Die Attach | CAB Number | CAB Date |
|---|---|---|---|---|---|---|---|---|
| 81736 | 0M03J | PC9S08AC60CFUE | KLM | 64QFP14x14 | Hitachi 9200HF10M | CRM1064MB | 2007 41 39573 | Nov-2007 |

Previous Revision History

| Quartz # | Mask Set | Product-Qual Description / Part Number(s) | Die Fab Facility & Process ID: | Die size(mm) | CAB Number | CAB Date |
|---|---|---|---|---|---|---|
| 81736 | 0M03J | S08AC60 | CHD/E025FXXQ | 2.850X2.820 | 2007 41 39573 | Nov-2007 |
| 135443 | 3M03J | S08AC60 | CHD/E025FXXQ | 2.850X2.820 | 08502544M | Sep-2009 |
| 161497 | 0M58Y | S08AC60 | CHD/E025FXXQ | 2.872X2.842 | 09110672M | Jan-2010 |

| Revision | Date | Comments | Author |
|---|---|---|---|
| Rev O | Nov-20-2010 | Initiate Plan | Nancy Long |
| Rev A | Feb-24-2011 | Update result | Nancy Long |