# Automotive AEC-Q100 Grade2 Compliance

## Reliability Qualification Report

## For

## LPDDR4 SDRAM

(25nm,2Gb/4Gb/8Gb, x16, x32, BGA200)

A2 Grade （Tc: -40ºC~105ºC）

# Part List

| Part Number | Density | Organization | Vdd1/Vdd2/Vddq (V) | Package | Dim (mm) | Speed (Mhz) | Temperature |
|---|---|---|---|---|---|---|---|
| **AS4C128M16MD4-062BAN** | 2Gb | 128Mb X16 | 1.8/1.1/1.1 | BGA200 | 10x14.5 | 1600 | -40°C to 105° C |
| **AS4C64M32MD4-062BAN** | 2Gb | 64Mb X32 | 1.8/1.1/1.1 | BGA200 | 10x14.5 | 1600 | -40°C to 105°C |
| **AS4C256M16MD4-062BAN** | 4Gb | 256Mb X16 | 1.8/1.1/1.1 | BGA200 | 10x14.5 | 1600 | -40°C to 105°C |
| **AS4C128M32MD4-062BAN** | 4Gb | 128Mb X32 | 1.8/1.1/1.1 | BGA200 | 10x14.5 | 1600 | -40°C to 105°C |
| **AS4C256M32MD4-062BAN** | 8Gb | 256Mb X32 | 1.8/1.1/1.1 | BGA200 | 10x14.5 | 1600 | -40°C to 105°C |

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# Information

| Product | 2Gb, 4Gb & 8Gb - x16 & x32 | |
|---|---|---|
| Batch Number | MLE367, MLD751, MLE 365 | |
| Target Quality | A2 Grade (Tc : -40C ~ 105C) | |
| Die Fabrication | Wafer Foundry | PowerChip |
| | Technology | 25nm |
| | Die Metallization & Levels | Al-Cu, 3 Levels |
| | Substrate Material | 12inches Si Wafer |
| Package Assembly & Testing | Package Type | VFBGA 200B |
| | Bond Wire | Au 2N 0.7mil, by TANAKA |
| | Mold Compound | 9740HF, HITACHI |
| | Die Attach Materials | EM760, NITTO |
| | Solder Ball Materials | SAC305, SENJU |

# Reliability Process

| Test Items | Reference | Test Conditions | Sample Size | Results |
|---|---|---|---|---|
| Hot Carrier Injection (HCI) | JESD28 & 60 | Ta=25ºC; | 15 per device | AC t0.01%> 10 years; Pass; |
| Time Dependent Dielectric Breakdown (TDDB) | JESD35 | Ta=90ºC; | 60 per device | t0.01%> 10 years; Pass; |
| Negative Bias Temperature Instability (NBTI) | JESD90 | Ta=90ºC; | 15 per device | t0.01%> 10 years; Pass; |
| Electro migration (EM) | JESD61 | Ta=200ºC;<br>M1, M2, M3, 2TH, 3TH; | 12 per structure | t0.01%> 10 years; Pass; |
| Stress Migration | JESD87 | Ta=225ºC;<br>M1, M2, M3, 2TH, 3TH; | ≥30ea | No Failure @1000hrs ((10% resistance change)) |

# Accelerated Life Test

| Product | Stress | Spec | Test Condition | SS | Stress duration | Results |
|---|---|---|---|---|---|---|
| 4G(x32)[1] | HTOL | JESD22-A108 | Vdd1 = 2.0V<br>Vdd2/q=1.21V<br>Ta = 125C | 3 Lot<br>(80pcs/lot) | 500hrs<br>1000hrs | Pass<br>(0 Failures) |
| | ELFR | AEC-Q100-008 | Vdd1=2.1V<br>Vdd2/q=1.21V<br>Ta=125C | 3 Lot<br>(80pcs/lot) | 48hrs | Pass<br>(0 Failures) |
| 8G(x32) | HTOL | JESD22-A108 | Vdd1 = 2.0V<br>Vdd2/q=1.21V<br>Ta = 125C | 3 Lot<br>(80pcs/lot) | 500hrs<br>1000hrs | Pass<br>(0 Failures) |
| | ELFR | AEC-Q100-008 | Vdd1=2.1V<br>Vdd2/q=1.21V<br>Ta=125C | 3 Lot<br>(80pcs/lot) | 48hrs | Pass<br>(0 Failures) |

Note.1) 2G(x16), 2G(x32) & 4G(x16) are Qualified by Similarity

## Accelerated Environmental Test

| Product | Stress | Spec | Test Condition | SS | Stress duration | Results |
|---|---|---|---|---|---|---|
| 4G(x32)[2] | HTS[1] | JESD22-A103 | Ta=150C | 3 Lots (45pcs/lot) | 500hrs 1000hrs | Pass (0 Failures) |
| | TCT[1] | JESD22-A104 | -65C/150C | 3 Lots (77pcs/lot) | 500x | Pass (0 Failures) |
| | bHAST[1] | JESD22-A110 | 130C/85% R.H; Vdd1=1.95V, Vdd2/q=1.17V | 3 Lots (77pcs/lot) | 96hrs | Pass (0 Failures) |
| 8G(x32)[2] | HTS[1] | JESD22-A103 | Ta=150C | 3 Lots (45pcs/lot) | 500hrs 1000hrs | Pass (0 Failures) |
| | TCT[1] | JESD22-A104 | -65C/150C | 3 Lots (77pcs/lot) | 500x | Pass (0 Failures) |
| | bHAST[1] | JESD22-A110 | 130C/85% R.H; Vdd1=1.95V, Vdd2/q=1.17V | 3 Lots (77pcs/lot) | 96hrs | Pass (0 Failures) |

Note.1) Stress tests done after Pre-Conditioning (Bake:150C/24hrs, Soak: 60C/60%RH/40hrs, Reflow:3x260C)
Note.2) 2G(x16), 2G(x32), 4G(x16) is Qualified by Similarity

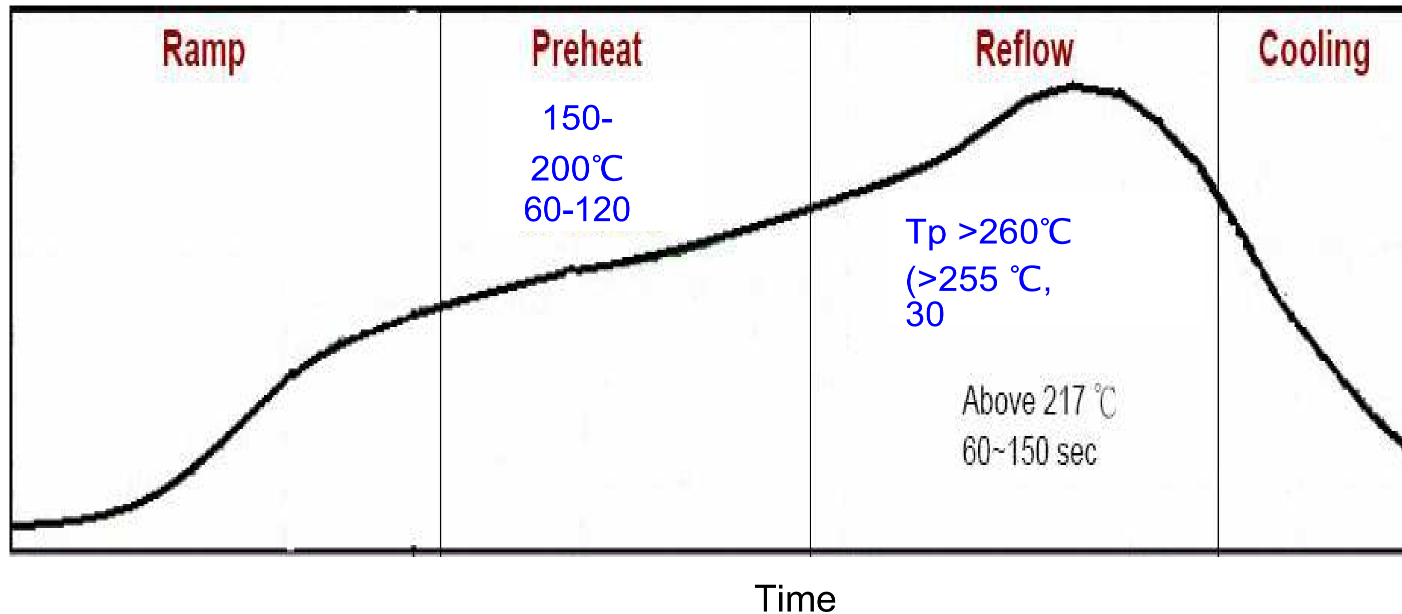
# ESD Stress

| Product | Test Item | Spec | Test Condition | ESD Voltage | Sample Size | Results |
|---|---|---|---|---|---|---|
| 2G(x16) | HBM | AEC-Q100-002D | +/-2000V | +/-2000V | 15 | Pass (0 Failures) |
| | CDM | AEC-Q100-011-D | +/-750V | +/-750V | 3 | Pass (0 Failures) |
| 4G(x16) | HBM | AEC-Q100-002D | +/-2000V | +/-2000V | 15 | Pass (0 Failures) |
| | CDM | AEC-Q100-011-D | +/-750V | +/-750V | 3 | Pass (0 Failures) |
| 4G(x32) | HBM | AEC-Q100-002D | +/-2000V | +/-2000V | 15 | Pass (0 Failures) |
| | CDM | AEC-Q100-011-D | +/-750V | +/-750V | 3 | Pass (0 Failures) |
| 8G(x32) | HBM | AEC-Q100-002D | +/-2000V | +/-2000V | 15 | Pass (0 Failures) |
| | CDM | AEC-Q100-011-D | +/-750V | +/-750V | 3 | Pass (0 Failures) |

# Latch – Up Stress

| Product | Test Item | Spec | Test Condition | Sample Size | Results |
|---|---|---|---|---|---|
| 2G(x16) | Over Voltage Test | AEC-Q100-004 | 1.5xVdd_Max; Temperature 125C | 3 | Pass (0 Failures) |
| | I-Test | | +/-100/200mA Temperature 125C | 3 | Pass (0 Failures) |
| 4G(x16) | Over Voltage Test | AEC-Q100-004 | 1.5xVdd_Max; Temperature 125C | 3 | Pass (0 Failures) |
| | I-Test | | +/-100/200mA Temperature 125C | 3 | Pass (0 Failures) |
| 4G(x32) | Over Voltage Test | AEC-Q100-004 | 1.5xVdd_Max; Temperature 125C | 3 | Pass (0 Failures) |
| | I-Test | | +/-100/200mA Temperature 125C | 3 | Pass (0 Failures) |
| 8G(x32) | Over Voltage Test | AEC-Q100-004 | 1.5xVdd_Max; Temperature 125C | 3 | Pass (0 Failures) |
| | I-Test | | +/-100/200mA Temperature 125C | 3 | Pass (0 Failures) |

## Temperature Profile of IR Reflow




1. The IR reflow profile follows the IPC/JEDEC J-STD-020D.1.
2. Ramp up rate: 3 ℃/sec max., Ramp down rate: 6 ℃/sec max..
3. The maximum temperature should be limited to 260 ℃.
4. Time above liquidus temperature (217 ℃) should be 60~150 sec.
5. The re-flow should not be repeated for more than 3 times.
6. Time 25 °C to peak temperature should be 8 minutes maximum.