

Reliability Qualification Report

for

**16Gb LPDDR4x (x32) with Pb/Halogen Free
(Industrial)**

Issued Date: May 06, 2024

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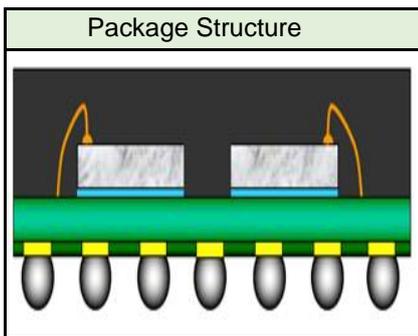
1. Title

This report describes the reliability and qualification data of Alliance product listed below.

The qualification and reliability tests have been completed successfully based on Alliance standard.

2. Product and Package Information

Product Description	: 16Gb LPDDR4x (64Mb x 16DQ x 8Banks x 2Channels)
Product Code	: AS4C512M32MD4V-046BIN AS4C512M32MD4V-053BIN
Operating Temperature	: -40°C to +95°C
Operating Voltage	: VDD1 1.70~1.95V, VDD2 1.03~1.17V, VDDQ 0.57~0.65V
Package Type	: FBGA 200B (10.0 x 15.0mm, 1.0T)
Solder Ball Type	: SAC305
Solder Ball Composition	: Sn balance, 3.0% Ag, 0.5% Cu
Flammability	: UL-V0



3. Result Summary

Lifetime Simulation Tests	: Passed ELFR & HTOL
Environment Stress Tests	: Passed All Tests
ESD & Latch-up	: Passed HBM 1000V, CDM 500V & Latch-up $\pm 150\text{mA}$

4. Accelerated Lifetime Simulation Tests

Group	Test Item / Conditions	Test Method	Duration or Level	Result	Notes
				Failed Q'ty / Tested Q'ty	
Accelerated Lifetime Simulation Tests	Early Life Failure Rate (ELFR) 125°C, Dynamic stress	JESD22-A108	48 hours	0 / 1800 (Passed)	1, 2
	High Temp. Operating Life (HTOL) 125°C, Dynamic stress	JESD22-A108	1000 hours	0 / 360 (Passed)	1, 2
<p>Note :</p> <p>1) Electrical test is performed before and after each item.</p> <p>2) "Dynamic stress" means continuous memory operation like read or write function.</p>					

* Failure Rate Estimation

Estimation Condition :

User Operating Temperature : 55°C
 Confidence Level : 60%

$$AF_{OVERALL} = AF_T * AF_V = 22.4 * 11.02 = 246.8$$

Early Life (Ea = 0.5 eV, β = 8) : 43.0 FITs (MTTF : 2,657 years)
 Inherent Life (Ea = 0.5 eV, β = 8) : 10.2 FITs (MTTF : 11,160 years)

5. Accelerated Environment Stress Tests

Group	Test Item / Conditions	Test Method	Duration or Level	Result	Notes
				Failed Q'ty / Tested Q'ty	
Accelerated Environment Stress Tests	Preconditioning Temperature Cycling : -55°C to 125°C Bake : 125°C Soak : 30°C, 60% RH Reflow : 260°C	JESD22-A113	Level 3 5 cycles 24 hours 192 hours 3 cycles	0 / 225 (Passed)	1
	Unbiased HAST (UHAST) 110°C, 85% RH	JESD22-A118	264 hours	0 / 75 (Passed)	1, 2
	Biased HAST (HAST) 110°C, 85% RH, Max VDD	JESD22-A110	264 hours	0 / 75 (Passed)	1, 2
	Temperature Cycling (TC) -65°C to 150°C	JESD22-A104	500 cycles	0 / 75 (Passed)	1, 2
	High Temperature Storage Life (HTSL) 150°C	JESD22-A103	1000 hours	0 / 75 (Passed)	1
Note : 1) Electrical test is performed before and after each item. 2) Preconditioning is performed before the test.					

6. Electrical Verification Tests (Electrostatic Discharge & Latch-up)

Group	Test Item / Conditions	Test Method	Duration or Level	Result	Notes
				Failed Q'ty / Tested Q'ty	
Electrical Verification Tests	ESD Human Body Model (HBM)	JS-001-2017	1000V	0 / 15 (Passed)	1, 2
	ESD Charged Device Model (CDM)	JESD22-C101	500V	0 / 3 (Passed)	1, 2
	Latch-Up (LU Overvoltage)	JESD78	> 2.93V	0 / 3 (Passed)	1, 2
	Latch-Up (LU I-test)	JESD78	±150mA	0 / 6 (Passed)	1, 2
<p>Note :</p> <p>1) Electrical test is performed before and after each item.</p> <p>2) HBM, CDM and Latch-up tests are performed at room temperature.</p>					