

# Reliability Qualification Report

for

**16Gb LPDDR4x (x16) with Pb/Halogen Free  
(Industrial)**

Issued Date: July 19, 2024

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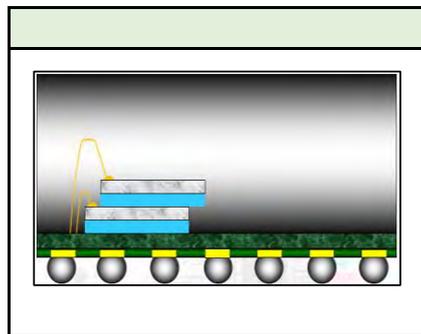
## 1. Title

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 1Channel x 2Ranks)
Product Code	: AS4C1G16MD4V-046BIN
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 $\pm 150$ 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	<b>Early Life Failure Rate (ELFR)</b> 125°C, Dynamic stress	JESD22-A108	48 hours	0 / 1800 (Passed)	1, 2
	<b>High Temperature Operating Life (HTOL)</b> 125°C, Dynamic stress	JESD22-A108	1008 hours	0 / 360 (Passed)	1, 2
<p><b>Note :</b></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	<b>Preconditioning (PC)</b> Temperature Cycling : -55°C to 125°C Bake : 125°C Soak : 30°C, 60% RH Reflow : 260°C	JESD22-A113	<b>Level 3</b> 5 cycles 24 hours 192 hours 3 cycles	0 / 225 (Passed)	1
	<b>Unbiased HAST (UHAST)</b> 110°C, 85% RH	JESD22-A118	264 hours	0 / 75 (Passed)	1, 2
	<b>Biased HAST (HAST)</b> 110°C, 85% RH, Max VDD	JESD22-A110	264 hours	0 / 75 (Passed)	1, 2
	<b>Temperature Cycling (TC)</b> -65°C to 150°C	JESD22-A104	500 cycles	0 / 75 (Passed)	1, 2
	<b>High Temperature Storage Life (HTSL)</b> 150°C	JESD22-A103	1008 hours	0 / 75 (Passed)	1
<b>Note :</b> 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

**Note :**

- 1) Electrical test is performed before and after each item.
- 2) HBM, CDM and Latch-up tests are performed at room temperature.