Qualification & Reliability Report

DDR4 SDRAM 8Gb

x8: 78b TFBGA
AS4C1G8D4B-62BCN

x16: 96b TFBGA
AS4C512M16D4B-62BCN

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Qualification Results

Qualification Results — 8Gb DDR4 SDRAM

Table 1: Process: 1α nm — Fabrication

	Test Procedure / Conditions	Test Method Referenced	Duration or Level	Results		Notes
				# Lots	Failed / Tested	
Reliability Level Tests	**HIGH TEMPERATURE OPERATING LIFE** *Stress Conditions*: 125°C, 1.3V internal voltage *Typical Operating Conditions*: 50°C, 1.0V internal voltage at 1.2V external Vdd): 16 FITs Ea=0.5eV; ß=7; $AF_{OVERALL}$=241; Pn=0.916; Device Hrs=2.328 x 10^5	JESD22-A108	168 hrs 504 hrs 1008 hrs	3	0 / 231 0 / 231 0 / 231	1,2
	EARLY LIFE FAILURE RATE *Stress Conditions*: 125°C, 1.3V internal voltage *Typical Operating Conditions*: 50°C, 1.0V internal voltage at 1.2V external Vdd): 21 FITs Ea=0.5eV; ß=7; $AF_{OVERALL}$=241; Pn=0.916; Device Hrs=1.8 x 10^5	JESD22-A108	36 hrs	3	0 / 5000	1,2
	LOW TEMPERATURE OPERATING LIFE -10°C, 1.3V internal voltage	JESD22-A108	168 hrs 504 hrs 1008 hrs	3	0 / 231 0 / 231 0 / 231	1,2
	HIGH TEMPERATURE STORAGE LIFE 150°C, no bias.	JESD22-A103	504 hrs 1008 hrs	3	0 / 231 0 / 231	1,2
Characterization Tests	**ELECTROSTATIC DISCHARGE** **Human Body Model** **Charged Device Model**	JS-001 JS-002	2,000V 500V	3 3	0 / 3 0 / 3	1
	LATCH-UP (105°C) **$I_{Trigger}$** **Overvoltage V_{SUPPLY}**	JESD78	100mA VDD/VDDQ = 1.9V VPP = 4.2V	3 3	0 / 6 0 / 6	1
Wafer Level Tests	**TIME DEPENDENT DIELECTRIC BREAKDOWN** (TDDB)	JESD35A, JESD35-2, JESD92	>10 years	3	Pass	
	ELECTROMIGRATION (EM)	JESD63, JESD61A, JESD202A, JESD87	>10 years	3	Pass	
	CHANNEL HOT CARRIER (CHC)	JESD28, JESD60A	>10 years	3	Pass	
	NEGATIVE BIAS TEMPERATURE INSTABILITY (NBTI)	JESD90	>10 years	3	Pass	

(1) Alliance primarily references JEDEC standard JESD47 when conducting reliability tests for the qualification of new product. In some tests, other industry standards may be referenced. Note that many tests are carried beyond the minimum recommended by JEDEC. This is to verify that margin exists with respect to intrinsic reliability.

(2) Preconditioning (without soak): per JEDEC J-STD-020D. Test is performed with 260°C peak reflow.

Qualification Results — 8Gb DDR4 SDRAM (continued)

Table 2: Package: SDP-78b TFBGA

	Test Procedure / Conditions	Test Method Referenced	Duration or Level	Results # Lots	Results Failed / Tested	Notes
Reliability Level Tests	**HIGHLY ACCELERATED STRESS TEST** 110°C, 85% RH, 1.26V on alternating balls.	JESD22-A110	264 hrs	3	0 / 231	1,2
	TEMPERATURE CYCLE -55°C for 15 min., + 125°C for 15 min., air to air.	JESD22-A104	500 cycles 750 cycles 1000 cycles	3	0 / 231 0 / 231 0 / 231	1,2
	HIGH TEMPERATURE STORAGE LIFE 150°C, no bias.	JESD22-A103	504 hrs 1008 hrs	3	0 / 231 0 / 231	1,3
Characterization Tests	**MOISTURE SENSITIVITY LEVEL** Peak Reflow Temp = 260°C	J-STD-020	minimum Level 3	3	Pass	1
	SOLDERABILITY 245°C peak reflow temperature, FR4 substrate, ROL0 SnAgCu solder paste.	J-STD-002D		3	0 / 15	1
	BOND INTEGRITY **Wire Bond Shear** minimum gmf **Wire Bond Pull Strength** minimum gmf	JESD22-B116 Internal Alliance specs		3 3	10.78 gmf 2.96 gmf	1
	SOLDER BALL SHEAR 240°C peak reflow temperature, 1x reflow, minimum gmf	JESD22-B117		3	823.55 gmf	1

(1) Alliance primarily references JEDEC standard JESD47 when conducting reliability tests for the qualification of new product. In some tests, other industry standards may be referenced. Note that many tests are carried beyond the minimum recommended by JEDEC. This is to verify that margin exists with respect to intrinsic reliability.
(2) Preconditioning (with soak): per JEDEC J-STD-020D at rated moisture sensitivity level. Test is performed with 260°C peak reflow.
(3) Preconditioning (without soak): per JEDEC J-STD-020D. Test is performed with 260°C peak reflow.
(4) Data leveraged from similar package.

Qualification Results — 8Gb DDR4 SDRAM (continued)

Table 3: Package: SDP-96b TFBGA

	Test Procedure / Conditions	Test Method Referenced	Duration or Level	Results		Notes
				# Lots	Failed / Tested	
Reliability Level Tests	**HIGHLY ACCELERATED STRESS TEST** 110°C, 85% RH, 1.26V on alternating balls.	JESD22-A110	264 hrs	3	0 / 231	1,2
	TEMPERATURE CYCLE -55°C for 15 min., + 125°C for 15 min., air to air.	JESD22-A104	500 cycles 750 cycles 1000 cycles	3	0 / 231 0 / 231 0 / 231	1,2
	HIGH TEMPERATURE STORAGE LIFE 150°C, no bias.	JESD22-A103	504 hrs 1008 hrs	3	0 / 231 0 / 231	1,3
Characterization Tests	**MOISTURE SENSITIVITY LEVEL** Peak Reflow Temp = 260°C	J-STD-020	minimum Level 3	3	Pass	1
	SOLDERABILITY 245°C peak reflow temperature, FR4 substrate, ROL0 SnAgCu solder paste.	J-STD-002D		3	0 / 15	1
	BOND INTEGRITY **Wire Bond Shear** minimum gmf **Wire Bond Pull Strength** minimum gmf	JESD22-B116 Internal Alliance specs		3 3	9.99 gmf 2.91 gmf	1
	SOLDER BALL SHEAR 240°C peak reflow temperature, 1x reflow, minimum gmf	JESD22-B117		3	802.98 gmf	1

(1) Alliance primarily references JEDEC standard JESD47 when conducting reliability tests for the qualification of new product. In some tests, other industry standards may be referenced. Note that many tests are carried beyond the minimum recommended by JEDEC. This is to verify that margin exists with respect to intrinsic reliability.
(2) Preconditioning (with soak): per JEDEC J-STD-020D at rated moisture sensitivity level. Test is performed with 260°C peak reflow.
(3) Preconditioning (without soak): per JEDEC J-STD-020D. Test is performed with 260°C peak reflow.
(4) Data leveraged from similar package.