

Reliability Qualification Report

for

DDRIII L SDRAM with Pb/Halogen Free

(256Mx8, 38nm SDRAM AS4C256M8D3LB-12BCN)

Issued Date: May 02, 2018

Test Item	Test Condition	Test Time
PCT	121°C, 100%R.H., 2.0atm	96Hrs

3.3.2.5. Highly-Accelerated Temperature and Humidity Stress Test

The highly-accelerated temperature and humidity stress test is performed for the purpose of evaluating the reliability of nonhermetic packaged solid-state device in an environment with high humidity. It employs severe condition of temperature, humidity, and bias that accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductor that pass through it. The stress conditions of the HAST are 130°C, 85% relativity humidity, 2.3atm pressure, and 1.45V maximum operating voltage. Samples of surface mount devices are subjected to preconditioning and a final electrical test prior to the highly-accelerated temperature and humidity stress test.

Test Item	Test Condition	Test Time
HAST	130°C, 85%R.H., 2.3atm, 1.45V	96Hrs

3.3.3. Test Criteria and Result

Table 4 shows the test results and reference standard of environmental test. The test status and results of AS4C256M8D3LB-12BCN are also pre-sented in the table. All pass from these test results mean that Alliance's SDRAM products are much more durable in most of their service environment.

Test Item	Reference Standard	A/R Criteria	Failure/S.S.	Status	Failure Mode
Moisture Sensitivity	J-STD-020	0/1	0/228	PASS	N/A
HTST	JESD22-A103	0/1	0/76	PASS	N/A
TCT*	JESD22-A104	0/1	0/76	PASS	N/A
PCT*	JESD22-A102	0/1	0/76	PASS	N/A
HAST*	JESD22-A110	0/1	0/76	PASS	N/A

* Sampling from Moisture Sensitivity

Table 4. Environmental Test Criteria and Result

3.4. ESD Test

Electrical discharge into semiconductor product is one of the leading causes of device failure in the customer's manufacturing process. Alliance performs the ESD test to ensure that the performance of AS4C256M8D3LB-12BCN will not be degraded to an unacceptable level by exposure to a succession of electro-static discharge. The test methods and test results are shown in Table 5.

Test Item	Test Method				Result (F/S.S)
	Reference Standard	Test Condition	Criteria	Sample	
H.B.M.	JESD22-A114	R=1.5KΩ, C=100pF	≥±2KV	3ea	0/3
M.M.	JESD22-A115	R=0KΩ, C=200pF	≥±200V	3ea	0/3
C.D.M.	JESD22-C101	Non-Socket Mode	≥±500V	3ea	0/3

Table 5. ESD Test Condition and Result

3.5. Latch-Up Test

CMOS products can be prone to over-voltage exceeding the maximum device rating if the parasitic p-n-p-n SCRs (Silicon-controlled rectifier) are improperly biased. When the SCR turns on, it draws excessive current and causes products being damaged by thermal runaway. The Table 6 shows the latch-up test method and the test result of no failure.

Test Item	Test Method			Result (F/S.S)
	Reference Standard	Test Condition & Criteria	Sample	
Latch-Up	JESD78	$V_{tr}(+) \geq 1.5 * V_{cc}$ $V_{tr}(-) \leq -0.5 * V_{cc}$ $I_{tr}(+) \geq 100mA$ $I_{tr}(-) \leq -100mA$	6ea	0/6

Table 6. Latch-Up test Condition and Result

4. CONCLUSION

Reliability test is to ensure the ability of a product in order to perform a required function under specific conditions for a certain period of time. Through those tests, the devices of potential failure can be screened out before shipping to the customer. At the same time, the test results are fed back to process, design and other related departments for improving product quality and reliability.

According to the life time test data, *the short-term 48Hrs failure rate (= the normal operation 0-1 year) of AS4C256M8D3LB-12BCN is equal to 0 DPM at $T_a=55^{\circ}C$ and $V_{cc}=1.35V$ with 60% confidence level AND the long-term 1000Hrs failure rate (= the normal operation 1-10 year) of AS4C256M8D3LB-12BCN is equal to 15 FIT at $T_a=55^{\circ}C$ and $V_{cc}=1.35V$ with 60% confidence level.* The results of environmental test, ESD test and latch-up test also ensure that AS4C256M8D3LB-12BCN is manufactured under a precise control of quality work by Alliance and its subcontractors. ***Thus, this experiment based on the Alliance reliability test standard for above test items can all pass.***

With the extensive research and development activities and the cooperation of all departments, Alliance continuously sets and maintains higher standard of quality and reliability to satisfy the future demand of its customers.