

Reliability Qualification Report

for

LPDDR1 SDRAM with Pb/Halogen Free

(45nm 512M LPDDR1 AS4C32M16MD1A-5BCN)

Test Item	Test Conditions	Test Results	Sample Size	# of Fail	Criteria
EFR	125°C / 1.1 * Max Vdd	Pass @ 48Hrs	2300ea	0	Acc/Rej = 1/2
HTOL	125°C / 1.1 * Max Vdd	Pass @ 504Hrs	231ea	0	Acc/Rej = 1/2

EFR : Early Failure Rate

HTOL : High Temperature Operating Life

Test Item	Test Conditions	Test Results	Sample Size	# of Fail	Criteria
HTS	150°C	Pass @ 1008Hrs	75ea	0	Acc/Rej = 0/1
LTS	-50°C	Pass @ 1008Hrs	75ea	0	Acc/Rej = 0/1
TCT (*)	-50°C / 125°C	Pass @ 1000Cycles	75ea	0	Acc/Rej = 0/1
PCT (*)	121°C / 100%RH / 2ATM	Pass @ 168Hrs	75ea	0	Acc/Rej = 0/1
T/H (*)	85°C / 85%RH	Pass @ 504Hrs	75ea	0	Acc/Rej = 0/1
MSL	30°C / 60%	Pass @ 192hrs	45ea	0	Acc/Rej = 0/1

☞ Note(*) : Pre-Conditioning should be performed before THB, T/C and PCT

Test Item	Test Conditions	Sample Size	Test Result		Spec	Criteria
Electrostatic Discharge	JESD22-A114	9ea	HBM : $\pm 2000V$	PASS	> 2000V	Acc/Rej = 0/1
	JESD22-A115	9ea	MM : $\pm 200V$	PASS	> 200V	
	JESD22-C101	3ea	CDM : 1000V	PASS	> 1000V	
Latch-up	JESD 78	9ea	Power : > 3V	PASS	> 200mA	
			Current Injection : $\pm 200mA$	PASS		

Test Item	Condition	Duration	S/S	Ea	β	Result	Remark
EFR	125°C / 1.1 * Max Vdd	48 hrs	2300ea	0.5	6.9	93.0 FIT	60% confidence Level
HTOL	125°C / 1.1 * Max Vdd	504 hrs	231ea			88.2 FIT	

The method of determining a product's failure rate is through the use of accelerated high temperature operation life tests. performed.

1) Temperature Acceleration is determined by $TAF = \exp[(Ea/k \times 1/Tu - 1/Ts)]$

K is Boltzmann's constant(8617e-5 ev/K, Ea is the activation energy in eV

2) Voltage Acceleration is described by $VAF = \exp[B \times (Vs - Vu)]$

B is the voltage acceleration term in 1/V.

3) Acceleration Factor = $TAF(t) * AF$

Long time Failure Rate (1~10 years) for 1 technology is gauged by a Failure In Time (FIT) calculation based on accelerated stress data.

The units for FIT are failures per Billion device hours.

4) Mean Time To Failure (MTTF) = $(1/FITs) \times 10e9 @ 60\% \text{ confidence level.}$