Reliability Qualification Report

for

SDRAM with Pb/Halogen Free

(512Mb C die SDR SDRAM Industrial Grade)

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I - Information

Product Lot	512Mb X32bit TSOP86	
Target Quality	Industrial Grade (-40°C~95°C)	
Die Fabrication	Wafer Foundry	Powerchip
	Technology	63nm
	Die Metallization and Levels	Metallization: Al-Cu, 3 Levels 12
	Substrate Material Package	inches Si wafer
Package Assembly& Testing	Type	TSOP86 (400 X 875 mil^2)
	Bonding Wire	99.99% / 0.7 mil diameter ; MKE
	Molding compound	CEL-9200HF; Hitachi
	Die Attach Materials	FG-100 ; Hitachi
	Lead frame	Alloy42; SHINKO

- **Green requirement: RoHS, REACH compliant;**
- **The continuous reliability monitoring program ensure that all outgoing products will continue to meet the quality and reliability standards (JEDEC & AEC-Q100) verified during qualification;**

I - Information

Product Lot	512Mb X16bit TSOP54	
Target Quality	Industrial Grade (-40ºC~95ºC)	
Die Fabrication	Wafer Foundry	Powerchip
	Technology	63nm
	Die Metallization and Levels	Metallization: Al-Cu, 3 Levels 12
	Substrate Material Package	inches Si wafer
Package Assembly& Testing	Type	TSOP54 (400 X 875 mil^2)
	Bonding Wire	99.99% / 0.7 mil diameter ; MKE
	Molding compound	G631; Sumitomo
	Die Attach Materials	FG-100 ; Hitachi
	Lead frame	Alloy42; Fu-Shan

- **Green requirement: RoHS, REACH compliant;**
- **The continuous reliability monitoring program ensure that all outgoing products will continue to meet the quality and reliability standards (JEDEC & AEC-Q100) verified during qualification;**

II - Process Reliability

Test Items	Reference	Test Conditions	Sample Size	Results
Hot Carrier Injection (HCI)	JESD28 & 60	Ta=25°C;	15 per device	AC t0.01%> 10 years; Pass;
Time Dependent Dielectric Breakdown (TDDB)	JESD92	Ta=90°C;	60 per device	t0.01%> 10 years; Pass;
Negative Bias Temperature Instability (NBTI)	JEPP122	Ta=90°C;	15 per device	t0.01%> 10 years; Pass;
Electro Migration (EM)	JESD63 & 87	Ta=200°C; M1, M2, M3, 2TH, 3TH;	12 per structure	t0.01%> 10 years; Pass;
Note: Process Reliability bridge to Powerchip Foundry 63nm DDR Quality Document Process Product Qual Report, Ver. 1.01				

III - Life Test

Test Items	Reference	Test Conditions	Sample Size	Stress	Results	FIT
Early Life Test for A2 (ELFR)	AEC-Q100-008	Ta=125ºC; Vdd=3.3V;	800x3	48hrs	0/2400	<16 FITs ; Pass
Early Life Test for Ind (ELFR)	JESD22-A108	Ta=125ºC; Vdd=3.3V;	800x3	48hrs	0/2400	<16 FITs ; Pass;
High Temp. Operation Life Test *A (HTOL)	JESD22-A108	Ta=125ºC; Vdd=4.6V;	132x3	500hrs 1000hrs	0/396	<6 FITs ; Pass;

*A: Done the test after Pre-conditioning as follow sequence.

Pre-condition: Infrared Re-flow 260°C, 3 times

IV - Environmental Test

Test Items	Reference	Test Conditions	Sample Size	Stress	Results
High Temp. Storage Test *A (HTS)	JESD22-A103	Ta=150°C;	100x3	500hrs; 1000hrs	0/300 (TSOP54) 0/300 (TSOP86) 0/300 (BGA90) Pass;
Unbiased High Accelerated Stress Test*A (u-HAST)	JESD22-A110	Ta=130°C; 85% RH;	100x3	96hrs	0/300 (TSOP54) 0/300 (TSOP86) 0/300 (BGA90) Pass;
Temp. Cycling *A (TC)	JESD22-A104	Ta=-65°C/+150°C;	100x3	500x; 1000x;	0/300 (TSOP54) 0/300 (TSOP86) 0/300 (BGA90) Pass;
Pressure Cooker Test *A (PCT)	JESD22-A118	Ta=121°C; 100% RH;	77x3	96hrs	0/231 (TSOP54) 0/231 (TSOP86) 0/231 (BGA90) Pass;

*A: Done the test after Pre-conditioning as follow sequence. => (3 Lots, 450pcs/Lot => pass)

Pre-condition: 1). TC: -65°C/+150°C (5x)

2). Baking: 125°C (24hrs)

3). Soaking: 30°C / 60%RH (192hrs)

4). Reflow: 3x 260°C

IV - Environmental Test

■ 512MS63 TSOP54 Flatness(Coplanarity) Condition:

Test Items	Reference	Test Conditions	Sample Size	Stress	Results
Package Flatness	JEDEC-SPP-024	Baking: 125°C; Soaking: 30°C / 60%RH; Reflow: 3x 260°C;	4x3	-	0/12 (TSOP54) Pass; 0/12 (TSOP86) Pass;

■ 512MS63 TSOP54 Flatness(Coplanarity) Measurement Result:

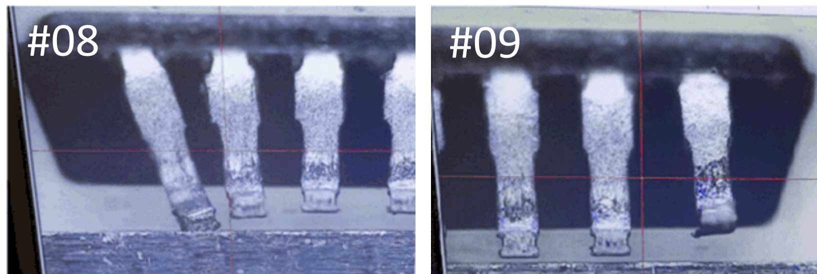
Sample	Initial	1st Reflow	2nd Reflow	3rd Reflow
##0	11..3377	22..0011	11..7744	11..9911
011	0.56	1.22	1.2	1.33
#02	1.01	1.81	1.82	2.08
#03	1.38	1.99	1.96	2.03
#04	1.25	2.06	2.08	1.72
#05	0.96	2.24	2.3	2.18
#06	1.1	1.91	1.1	1.01
#07	0.78	1.59	1.96	1.62
#08	1.06	1.96	2.04	1.91
#09	1.08	1.79	1.77	1.72
#10	1.25	1.62	1.69	1.64
#11	0.86	2.3	2.26	1.96
#12	1.38	2.3	2.3	2.18
max	0.56	1.22	1.1	1.01
mmeinan	1.06	1.88	1.83	1.76
	0.24	0.30	0.37	0.33

IV - Environmental Test

■ 512MS63 TSOP86 Flatness(Coplanarity) Measurement Result:

#01	1.84	2.6	2.3	2.3
#02	1.44	2.5	1.8	2.2
#03	1.66	2.6	2	2.5
#04	1.62	2.3	2.2	2.3
#05	1.38	1.9	1.9	1.9
#06	1.22	1.7	2.4	2.6
#07	1.7	1.5	2.6	2.8
#08	1.53	2.1	2.6	2.1
#09	1.27	2	1.4	*3.8
#10	1.27	2	2.4	*3.1
#11	1.23	2	1.3	2.3
#12	1.37	2.1	2.5	2.1
max	1.84	2.6	2.6	2.8
min	1.22	1.5	1.3	1.9
mean	1.46	2.11	2.12	2.31
std	0.21	0.34	0.44	0.26

* #08, #09 pin has been damaged due to handling.



V - ESD Sensitivity

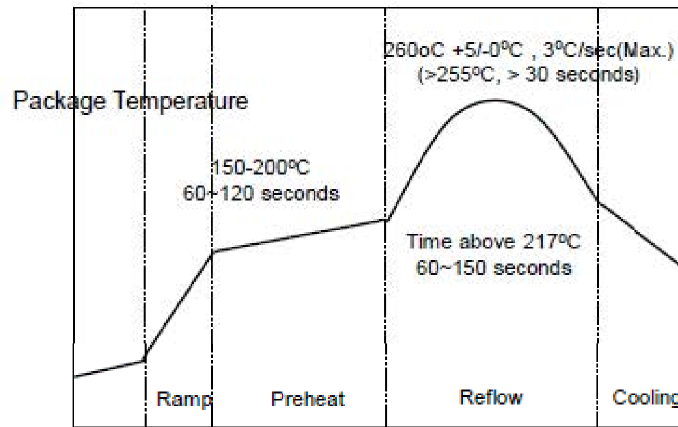
Test Items	Reference	Test Conditions	ESD Voltage	Sample Size	Results
Human Body Mode (HBM)	AEC-Q100-002 or AEC-Q101-001	Stress Voltage: ±2000V ;	±2000V	10x3	0/30 (TSOP54) 0/30 (TSOP86) 0/30 (BGA90) Pass;
Machine Mode (MM)	AEC-Q100-003 or AEC-Q101-002	Stress Voltage: ±200/250V;	±200V ±250V	20x3	0/60 (TSOP54) 0/60 (TSOP86) 0/60 (BGA90) Pass;
Charge Device Mode (CDM)	AEC Q100-011	Stress Voltage: ±500/750V;	±500V ±750V	2x3	0/6 (TSOP54) 0/6 (TSOP86) 0/6 (BGA90) Pass;

VI - Latch-Up Immunity

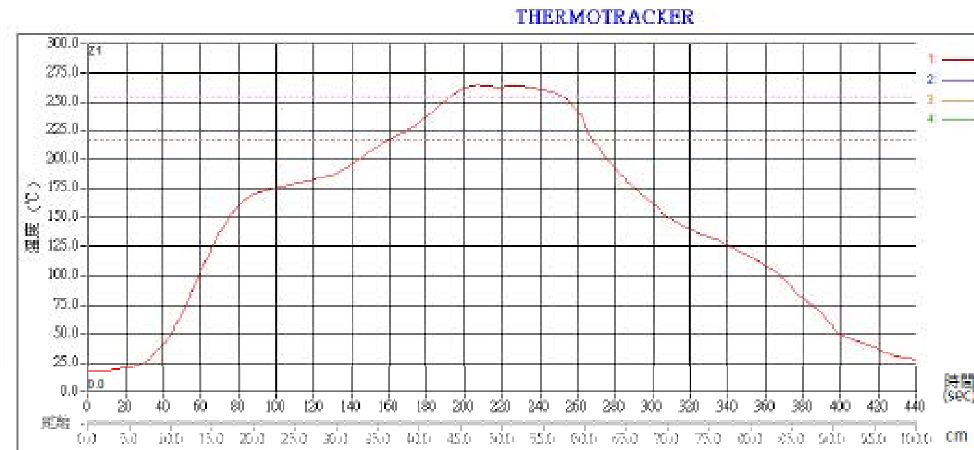
Test Items	Reference	Latch Up Trigger Test Conditions	Sample Size	Results
Voltage Supply Over Voltage Test	AEC-Q100-004	1.5xVdd_Max ; High Temperature(Ta=125°C)	1X3	0/3 (TSOP54) 0/3 (TSOP86) 0/3 (BGA90) Pass;
I-Test		±100mA; ±125mA High Temperature(Ta=125°C)	1X6	0/6 (TSOP54) 0/6 (TSOP86) 0/6 (BGA90) Pass;
E-TEST		Stress Voltage: +5.40V/-1.80V; High Temperature(Ta=125°C)	2X3	0/6 (TSOP54) 0/6 (TSOP86) 0/6 (BGA90) Pass;

VII - Temperature Profile of IR Reflow

JEDEC's Specification



UniIC IR Reflow Profile



IR Reflowing condition	JEDEC criteria	ChipMOS measured
Preheat temperature 150 to 200°C	60~120 seconds	68 seconds
Temperature maintained above 217°C	60~150 seconds	107 seconds
Average ramp-up rate (include 217°C to peak temperature)	< 3°C/second	1.14°C/second
Time within 5°C of actual peak temperature	> 30 seconds	58 seconds
Peak temperature	260 +5/-0 °C	264.5°C
Ramp-down rate	< 6°C/second	1.87°C/second
Time 25°C to peak temperature	8 minutes max.	207 seconds