PEX8648-BB
(AB/BA to BB Metal Layer Change)

Product Reliability Qualification

Family Qualification:
PEX8648-BB
PEX8647-BB
PEX8632-BB
PEX8624-BB
PEX8616-BB
PEX8612-BB

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February 09, 2009

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February 09, 2009

1. Purpose:

Perform a Deneb product family reliability qualification of the BB die revision in 90 nm low-K fab process technology with flip chip BGA (FCBGA) assembly.

The Deneb BB die represents metal layer changes only from its prior revisions.

This document summarizes the qualification plan for the 'BB' revision and results from prior revisions to qualify the latest revision of the product as per below.

2. Scope:

The PEX8648-BB50BC F, fabricated in 90 nm Low-K process technology and assembled in 27x27 FCBGA package will be used as the prime reliability qualification vehicle for the following devices: PEX8648-BB, PEX8647-BB, PEX8632-BB, PEX8624-BB, PEX8616-BB, and PEX8612-BB. TSMC 90nm Low K CMOS technology generates consistent and reproducible performance from lot to lot, through a mature fabrication process, in-process monitors, and an excellent reliability history.

3. Background information:

Wafer Fabrication Information (TSMC)

Process Type	CMOS LOGIC General Purpose
Process Name	90nm Low-K
Number of metal layers	9

Substrate Information (PPT)

Solder mask material	AUS-703
Dielectric Material	ABF-GX13

Assembly Process Information (ASE Kaohsiung)

Package Name	FCBGA, Flip Chip Ball Grid Array
Package size	27x27x1.78 mm^3
Solder ball size	0.6mm diameter
Solder ball pitch	1mm
Number of Solder Balls	676
Solder ball composition	SAC305 (96.5Sn/ 3Ag/ 0.5Cu)
Solder bump for die attachment (exemption 15)	63/37 Sn/Pb
MSL – Moisture Sensitivity Level	4

Note: Green (SAC305) solder balls used for 'BB' Qualification. Both Green and non-Green (Sn/Pb) qualified originally during 'AA' Package Qualification.

4. Die Qualification Results QUALIFICATION PLAN and RESULTS:

The following is the product qualification test plan and results for PEX8648-BB50BC F, 90 nm Low-K, 1P/9M LV CMOS in order to convert from rev. AB/BA to BB represented by a metal layer change.

Note: * = Conditional/Full qualification/release
** = Damaged during analysis, cause unkown

4.1 High Temperature Operating Life Test (JESD22- 108-B), Condition: Ta= 125°C, Voltage: Vdd max = 1.1V

Lot# / Date Code	SS	Time point	Completion Date	Results	Notes
N64191.00.W02 / 0751 N64191.00.W03 / 0802 N64193.00.W01 / 0803	120 (Rev. AA)	168 hr Cum*	2/20/08	0/120	Complete. Pass
N64192.05 / 0820	120 (Rev. AB)		6/12/2008	0/120	Complete. Pass
N65292.00/0834	120 (Rev. BA)		9/11/2008	0/120	Complete. Pass
N65294.0V.W02/0849	120 (Rev. BB)		12/22/2008	0/120	Complete. Pass
N64191.00.W02/ 0751 N64191.00.W03/ 0802 N64193.00.W01/ 0803	120 (Rev. AA)	500 hr Cum	3/12/08	0/120	Complete. Pass
N64192.05 / 0820	120 Rev. AB)		7/7/2008	0/120	Complete. Pass
N65292.00/0834	120 (Rev. BA)		9/24/2008	0/120	Complete. Pass
N65294.0V.W02/0849	120 (Rev. BB)		1/8/2009	0/120	Complete. Pass (''BB' 500 hr. HTOL is for information purposes)
N64191.00.W02 / 0751 N64191.00.W03 / 0802 N64193.00.W01/ 0803	120 (Rev. AA)	1000 hr Cum	4/7/08	0/120	Complete. Pass
N64192.05 / 0820	120 (Rev. AB)		7/29/08	1/120**	Complete. Pass
N65292.00/0834	120 (Rev. BA)		10/16/2008	0/120	Complete. Pass
N65294.0V.W02/0849	120 (Rev. BB)		2/2/2009	0/120	Complete. Pass (''BB' 1000 hr. HTOL is for information purposes)

4.2 Electrostatic discharge (ESD)

a. Human Body Model JESD22-A114E, 2kV

870 Maude Avenue Sunnyvale, CA 94085
Tel: (408) 962-3417 Fax: (408) 774-2169
www.plxtech.com

Lot# / Date Code	SS	Results	Notes
N64193.00.W01 / 0803	5 (Rev AA)	0/5	Complete 2/25/08 All units pass. Conditional and Full Qualification
N64192.05 / 0820	5 (Rev AB)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 6/12/2008
N65292.00 / 0834	5 (Rev BA)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 9/11/2008
N65294.0V.W02/0849	5 (Rev BB)	0/5	Conditional/Full Qualification Completion Date: 12/22/2008

b. Charge Device Model JESD22-C101C, 500V

Lot# / Date Code	SS	Results	Notes
N64193.00.W01 / 0803	5 (Rev AA)	0/5	Completed. 3/28/08. All units pass. Conditional and Full Qualification
N64192.05 / 0820	5 (Rev AB)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 6/12/2008
N65292.00 / 0834	5 (Rev BA)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 9/11/2008
N65294.0V.W02/0849	5 (Rev BB)	0/5	Conditional/Full Qualification Completion Date: 12/22/2008

4.3 Latch Up, JESD 78A, +/- 100mA

Lot# / Date Code	SS	Results	Notes
N64193.00.W01 / 0803	6 (Rev AA)	0/6	Complete 3/10/08. All units pass. Conditional and Full Qualification
N64192.05 / 0820	6 (Rev AB)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 6/12/2008
N65292.00 / 0834	6 (Rev BA)	0/5	Completed. Conditional/Full Qualification All units pass. Completion Date: 9/11/2008
N65294.0V.W02/0849	5 (Rev BB)	0/5	Conditional/Full Qualification Completion Date: 12/22/2008

Note: This product is laser marked.

5 Package Qualification Results

The PEX8648-AA50BC F device was utilized as the package reliability qualification vehicle for the Deneb family of products which includes: PEX8648-xx, PEX8647-xx, PEX8632-xx, PEX8624-xx, PEX8616-xx, PEX8612-xx.

5.1 Pre-Condition Level 4 (JESD-A113-E), 96 hrs 30C/60%RH, Peak 245 ˚C

Lot#/ID / Date Code	SS	Results	Notes
1. N64191.00.W02 / 0750	45	0/45	Complete 1/30/08.
2. N64191.00.W02 / 0751	45	0/45	All units pass.
3. N64191.00.W03 / 0802	45	0/45	Conditional Qualification

5.2 HAST per JESD22-A110, 130 C/85% RH, 96 hrs (after precon from 1 above)

Lot#/ID / Date Code	SS	Results	Notes
N64191.00.W02 / 0750	15	0/15	Complete 2/11/08.
N64191.00.W02 / 0751	15	0/15	All units pass.
N64191.00.W03 / 0802	15	0/15	Conditional and Full Qualification

5.3 Temperature Cycle Test (JESD22-A104B, Condition C), - 65˚C to 150˚C 1000 cycles (after precon from 1 above)

Lot# / Date Code	SS	Cycles	Results	Notes
N64191.00.W02 / 0750	15	250 cy	0/15	Complete 2/11/08.
N64191.00.W02 / 0751	15	250 cy	0/15	All units pass.
N64191.00.W03 / 0802	15	250 cy	0/15	Conditional Qualification
N64191.00.W02 / 0750	15	500 cy cum	0/15	Complete 2/27/08
N64191.00.W02 / 0751	15		0/15	All units pass.
N64191.00.W03 / 0802	15		0/15	
N64191.00.W02 / 0750	15	1000 cy cum	0/15	All units pass.
N64191.00.W02 / 0751	15		0/15	Complete 3/2/08
N64191.00.W03 / 0802	15		0/15	Full Qualification

5.4 High Temperature Storage Life (JESD22-A103-B), 150˚C for 1000 hours (after precon from 1 above)

Lot# / Date Code	SS	Completion Date	Results	Notes
N64191.00.W02 / 0750	15	3/19/08	0/15	Complete 3/19/08
N64191.00.W02 / 0751	15		0/15	All units pass, * 1 unit – Invalid
N64191.00.W03 / 0802	15		0/15*	Full Qualification.

5.5 Die Shear- As built

Specification	Lot#	SS	Maximum	Minimum	Average
>5 kgF	1	3	26.21	18.44	22.3
	2	3	22.59	18.87	2.73

5.6 Solder Ball Shear Data

a. As built

Specification (mean-3σ)	Lot#	SS	avg (g)	σ (g)	Result (mean-3σ)
700gm	SN1	15	1047	64	855
700gm	SN2	15	1030	47	889
700gm	SN3	15	910	69	703

b. Post 96 hrs HAST

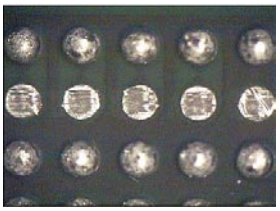
Specification (mean-3σ)	Lot#	SS	avg (g)	σ (g)	Result (mean-3σ)
500gm	SN1	10	1405.0	64.3	1212.0
500gm	SN2	10	1325.0	79.1	1087.8
500gm	SN3	10	1230.0	48.3	1085.1

Post HAST-Fail code A

c. Post 1000 cycles TMCL

Specification (mean-3σ)	Lot#	SS	avg (g)	σ (g)	Result (mean-3σ)
500gm	SN1	10	1430.0	82.3	1183.0
500gm	SN2	10	1430.0	71.5	1215.5
500gm	SN3	10	1355.0	83.2	1105.5

Post TMCL- Fail code A



Post Stress Ball Shear Legend:

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A = Ball Sheared (good breakage)
B = Pad Lift
C = Ball lift, lack of solder wetting
D = Intermetallic break
E = Shear above ball centerline
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5.7 Package Outline Drawing Analysis

Test	Sample size	Accept/Reject	Teat condition	Pass/Fail Criteria
Physical Dimensions	15	0/1	JESD22-B100-A Case drawing	No dimension outside of specification

Note: This product is laser marked.

5.8 Package Cross Section

Package	Thickness SPEC., mm	Measured (Height), mm
	27x27_676L	27x27_676L
Heat spreader	0.55+/-0.05	0.5
Epoxy (Heat Spreader)	0.025~.100	0.05
TIM	0.040~.200	0.05275
Die	0.545+/-0.0254	0.545
Solder bump	0.08+/-0.015	0.069
Underfill	0.08+/-0.015	0.069
Solder ball	0.4~0.6	0.441
Total thickness	2.13~2.43	2.208
Substrate	**Thickness Spec., µm**	**Measured (Height), µm**
S/M	21+/-7.5	16.8
Outer Cu thickness	15+/-5	16.52
1st dielectric layer	30+/-6	30.92
Inner Cu thickness	22+/-5	23.68
Core	400+/-60	405.28
Inner Cu thickness	22+/-5	24.34
2nd dielectric layer	30+/-6	30.96
Outer Cu thickness	15+/-5	16.52
S/M	21+/-7.5	16.8
Total thickness	580+/-100	585.4

7 .0 CONCLUSION

This reliability qualification report applies to the Deneb family of products, all of which are manufactured with the same process technology (90nm Low-K), package type (FCBGA), and materials. The PEX8648-BB50BC F device is going to be utilized as the qualification vehicle for the Deneb family of products which includes: PEX8648-xx, PEX8647-xx, PEX8632-xx, PEX8624-xx, PEX8616-xx, PEX8612-xx.

8 .0 REVISION HISTORY

Revision	Date	Orginator	Comments
Rev. 1.0	11/26/08	Norbe Mendoza	Initial release of BB Qual Plan
Rev. 2.0	12/22/08	Norbe Mendoza	Release Conditional/Full Qualification
Rev. 2.1	1/16/09	Norbe Mendoza	Update 500 Cum Results
Rev. 2.2	2/09/09	Norbe Mendoza	Update 1000 Cum Results