

Product / Process Change Notice

PCN No.: Q000-PCN-PA201403-03

Date: 2014-03-25.

| | | | |
|--|---|-------------------------------|-----------------|
| <p>Change Title: <u>Add ASE-CL as new assembly site for OFN 32L package products.</u></p> <p>Change Classification: <input checked="" type="checkbox"/> Major <input type="checkbox"/> Minor</p> <p>Change item: <input type="checkbox"/> Design <input type="checkbox"/> Raw Material <input type="checkbox"/> Wafer FAB <input checked="" type="checkbox"/> Package Assembly <input type="checkbox"/> Testing <input type="checkbox"/> Others: _____.</p> | | | |
| <p>Affected Product(s) :</p> <p>The affected products are NAU8401YG, NAU8501YG and NAU8820YG.</p> | | | |
| <p>Description of Change(s) :</p> <p>Add new assembly site for NAU8401YG, NAU8501YG and NAU8820YG products at ASECL (ASE Group ChungLi site, Taiwan). ASECL is a qualified vendor for Nuvoton in assembly, also ASECL had been passed several audits by international semiconductor corporations with automotive certification, please refer to appendix A for the details.</p> <p><u>New Supplier</u></p> <p>ASE Group ChungLi site, Taiwan (hereinafter "ASECL"), (550, Chung-Hwa Road Section 1, Chung-Li, 320, Taiwan, R.O.C.)</p> | | | |
| <p>Reason for Change(s) :</p> <p>To increase manufacturing capacity and flexibility and to have multiple manufacturing routes for backup in case of disruption, Nuvoton is adding a new source of NAU8401YG, NAU8501YG and NAU8820YG products at ASECL.</p> | | | |
| <p>Impact of Change(s) : (positive & negative)</p> <p>Form: No change on top effective marking except assembly vendor marking code. The assembly vendor marking code of ASECL shall be "A", as illustrated in fig.1.</p> <p>Fit: No change.</p> <p>Function: No change.</p> <p>Reliability: No concern (Passed Nuvoton package qualification.)</p> | | | |
| <p>Qualification Plan/ Results :</p> <p>QFN packages were qualified as per Nuvoton's standard qualification procedures, please refer to appendix B & C for the qualification report."</p> | | | |
| <p>Implementation Plan :</p> <p><input type="checkbox"/> Date Code: _____ onward <input type="checkbox"/> Lot No.: _____ onward <input checked="" type="checkbox"/> Implemented date: <u>Jun. 23, 2014 (scheduled)</u></p> | | | |
| Originator: | HYLai / Q100 | Approval:(QA Director) | C.C. Chen/ Q000 |
| Contact for Questions & Concerns | <p>Name: <u>HYLai</u> TEL: <u>886-3-5770066 (ext. 1226)</u> FAX: <u>886-3-5792673.</u></p> <p>Address: <u>No.4, Creation Rd. III Science-Based Industrial Park Hsinchu, Taiwan, R.O.C..</u></p> <p>E-mail: <u>hylai0@nuvoton.com.</u></p> | | |

Customer Comments:

Note: Please sign this notice, and return to **Nuvoton** contact within **30** days. If no response is received within **30** days, this Change Request will be assumed to meet your approval.

| | | |
|-----------------------------------|--------------------------------------|---|
| <input type="checkbox"/> Approval | <input type="checkbox"/> Disapproval | <input type="checkbox"/> Conditional Approval: _____. |
| Date: _____ | Dept. name: _____ | Person in charge: _____. |

Follow-up and Tracing:

A. copies to

FAB: Integration _____ _____ _____ _____ _____.

Test / Product: _____ _____ _____ _____ _____.

Design/ Marketing: _____ _____ _____ _____ _____.

Production control/ Others: _____ _____ _____ _____ _____.

B. Changes:

1. Document / Test program:

| Document No/ test program | Document name/ test program name | version | | responsibor | Completed date | Remark |
|---------------------------|----------------------------------|---------|-------|-------------|----------------|--------|
| | | before | after | | | |
| NA | NA | NA | NA | NA | NA | NA |

Verified by: _____.

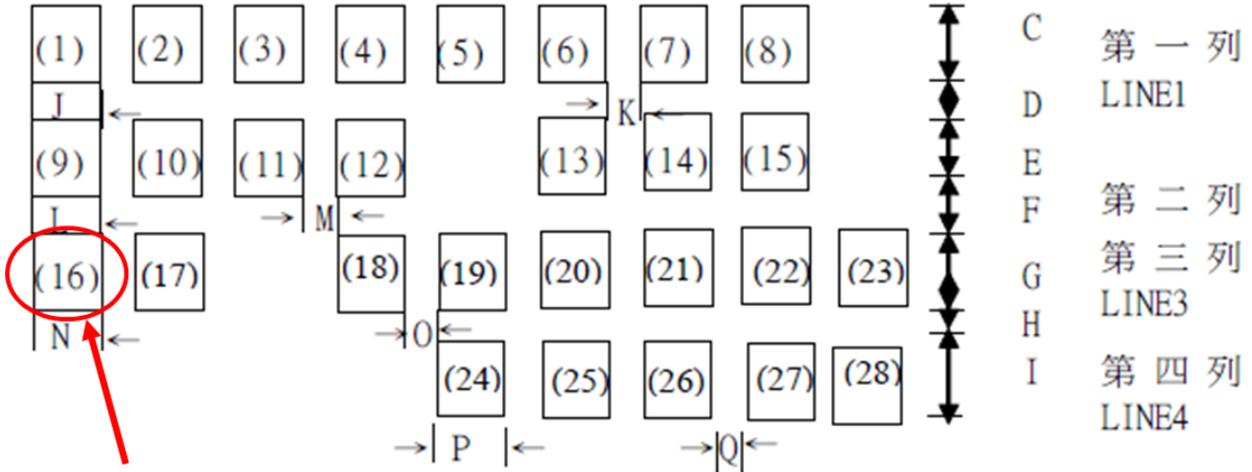
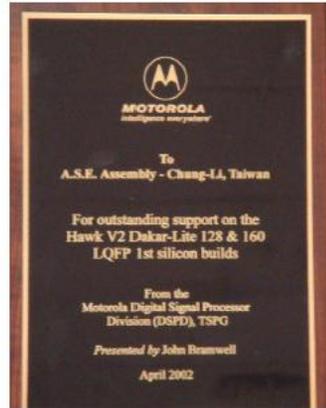


Fig.1: The Assembly vendor code of ASECL on top marking will be marked as "A"

Appendix A: ASECL passed several audits by international semiconductor corporations.

Automotive Customer Award



Automotive Customer Audit Result

The followings are summarized past Automotive Customer audit result on using Siemens VDA 6.3 checklist. All are above 90%.

| Item No. | Customer | Audit Date | Audit Score |
|----------|-----------|----------------------|-------------|
| 1 | Sxx / Pxx | 10 Jul 2007 | 91.1% |
| 2 | Fxx / Bxx | 26 - 28 Nov 2007 | 92.0% |
| 3 | Fxx / Sxx | 14 Jan 2008 | 92.0% |
| 4 | Sxx / Lxx | 20 Jan 2009 | 94.0% |
| 5 | Cxx / Cxx | 16 & 17 Feb 2009 | 91.0% |
| 6 | Fxx / Bxx | 07 - 09 Jun 2010 | 90.3% |
| 7 | Sxx / Mxx | 13 & 14 July 2011 | 97.0% |
| 8 | Sxx / Bxx | 21 & 22 Nov 2011 | 95.0% |
| 9 | Sxx / Kxx | 11 May 2012 | 97.0% |
| 10 | Fxx / Lxx | 17 & 18 May 2012 | 99.5% |
| 11 | Fxx / Cxx | 25 & 26 Oct 2012 | 94% |
| 12 | Fxx / Cxx | 16 & 17 May 2013 | 94% |
| 13 | Axx / Cxx | 13 & 14 June 2013 | 94% |

Note: Some other Automotive Customers use their own Audit System which also showed Excellent result, such as Dxxx, Fxxx, Txxx, Kxxx, Cxxx, Txxx, Hxxx.



Appendix B: QFN packages qualification report for Cu wire.

PACKAGE QUALIFICATION REPORT

Company: ASE(Chung-Li)

Package: QFN Series

Package Material: GREEN

Wire Bonding Material: Cu wire

ASSISTANT MANAGER : 許心怡

RA MANAGER : 蔡明耀

Publication Release Date: May.2011

SUMMARY

The QFN series product was passed the qualification tests.
A summary of the test result was as follows:

| | |
|------------------------------------|----------------------|
| Pa. Wire Pull Test | : 5 units / 30 wires |
| Pa. Ball Shear Test | : 5 units / 30 balls |
| Pa. Pre-condition Test | : 0/270 EA |
| Pa. Pressure Cooker Test | : 0/135 EA |
| Pa. Temperature Cycle Test | : 0/135 EA |
| Pa. Highly Temp. Storage Life Test | : 0/135 EA |

Publication Release Date: Dec. 2010

I . ENVIRONMENTAL TEST

A. Introduction

1. Wire Pull Test
2. Ball Shear Test
3. Pre-condition Test
4. Pressure Cooker Test (PCT)
5. Temperature Cycle Test (TCT)
6. High Temp. Storage Life Test(HTSL)

B. Test Results

1. Wire Pull Test
2. Ball Shear Test
3. Pre-condition Test
4. Pressure Cooker Test (PCT)
5. Temperature Cycle Test (TCT)
6. Highly Temp. Storage Life Test(HTSL)

I . ENVIRONMENTAL TESTS OF PROCEDURE

A. Introduction

1. Wire Pull Test

1.1 SCOPE

Wire Pull Test is to measure the First bond and Second bond quality at the Assembly wire bonding process.

1.2 TEST CONDITION

5 units 30 wires CPK \geq 1.66

Publication Release Date: Dec.2010

2. Ball Shear Test

2.1 SCOPE

Ball Shear Test is to measure the Copper ball quality on pad of chip.

2.2 Test condition:

5 units 30 balls CPK \geq 1.66

3. Pre-condition Test

3.1 SCOPE

Pre-condition Test is to measure the resistance of SMD (Surface Mount Devices) to the storage environment at the customer site and to thermal stress created by IR reflow or Vapor Phase Reflow.

3.2 TEST CONDITION

Step 1 : TCT(-65°C/150°C, 5 cycles)

Step 2 : Bake(125°C, 24 hours)

Step 3 : Soak(30°C/60%RH, 192 hours)

Step 4 : IR reflow (260 °C), 3 Passes.

3.3 SAT COFIRMATION: To confirm delamination, cracking, popcorn .

Criteria: IPC/JEDEC J-STD-020D

3.4 IR REFLOW PROFILE (FOR IPC/JEDEC J-STD-020D)

| Temp. | Criteria |
|--|--------------------|
| Preheat 150 °C to 200 °C | 60~120 sec |
| Time maintained above: Above 217 °C | 60~150 sec |
| Peak temp | 260 °C +0 °C/-5 °C |

Publication Release Date: Dec.2010

| | |
|---|-----------|
| Time within 5 °C of actual Peak Temperature of peak | 20~40 sec |
|---|-----------|

4. Pressure Cooker Test (PCT)

4.1 SCOPE

PCT is to evaluate the device resistance to moisture penetration.

4.2 TEST CONDITION

Ta = 121°C, RH = 100%, Td = 168 Hrs. 2 ATM ,(JESD22-A102-A)

5. Temperature Cycle Test (TCT)

5.1 SCOPE

TCT is to evaluate the resistance of device to environmental temperature change.

5.2 TEST CONDITION

-65°C / 15min, transfer time 1min, +150 °C/15min, 1000 cycles.

MIL-STD-883E, Method 1010, Condition "C".

6. Highly Temp. Storage Life Test (HTSL)

6.1 SCOPE

The purpose of this test is to determine the effect on solid state electronic devices of storage at elevated temperature without electrical stress applied.

6.2 Test condition:

Temperature: 150°C ,Time:1000hrs

B. Test Results

1. Wire Pull Test

- Sample size : 5units / 30wires
- Spec: ≥ 3 g
- Max:11.697 g

Publication Release Date: Dec.2010

- Min: 9.603g
 - Avg. : 10.77 g
 - CPK: 4.988
- Criteria : CPK \geq 1.66

2. Ball Shear Test

- Sample size : 5units / 30 balls
 - Spec: \geq 15 g
 - Max: 17.787 g
 - Min: 15.238 g
 - Avg. : 16.651 g
 - CPK: 4.360
- Criteria : CPK \geq 1.66

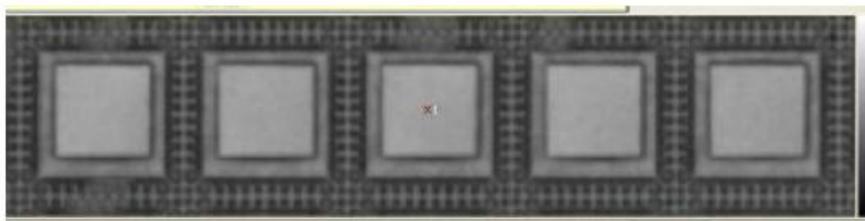
3.1 Pre-condition Test

| Run | Lot No. | SAT before Precondition | | SAT After Precondition | | Electric result |
|-----|-------------|----------------------------|----------|---------------------------|----------|--------------------|
| | | Topside | Backside | Topside | Backside | |
| #1 | E037B006-ZX | 0/135 | 0/135 | 0/135 | 0/135 | 0/135 |
| #2 | E037B006-ZY | 0/135 | 0/135 | 0/135 | 0/135 | 0/135 |
| #3 | E037B006-ZZ | 0/135 | 0/135 | 0/135 | 0/135 | 0/135 |

Publication Release Date: Dec.2010

*Criteria: Acc/Rej = 0/1.

3.2 SAT confirmation: PASS



4. Pressure Cooker Test (PCT)

| Run | Package | 168 Hrs | Result | Remark |
|-----|-------------|---------|--------|--------|
| #1 | E037B006-ZX | 0/45 | Pass | |
| #2 | E037B006-ZY | 0/45 | Pass | |
| #3 | E037B006-ZZ | 0/45 | Pass | |

*Criteria : Acc/Rej = 0/1.

5. Temperature Cycle Test (TCT)

| Run | Package | 1000 Cycles | Result | Remark |
|-----|-------------|-------------|--------|--------|
| #1 | E037B006-ZX | 0/45 | Pass | |
| #2 | E037B006-ZY | 0/45 | Pass | |
| #3 | E037B006-ZZ | 0/45 | Pass | |

*Criteria : Acc/Rej = 0/1.

6. Highly Temp. Storage Life Test (HTSL)

| Run | Package | 1000 Hrs | Result | Remark |
|-----|-------------|----------|--------|--------|
| #1 | E037B006-ZX | 0/45 | Pass | |
| #2 | E037B006-ZY | 0/45 | Pass | |

Publication Release Date: Dec. 2010

| | | | | |
|----|-------------|------|------|--|
| #3 | E037B006-ZZ | 0/45 | Pass | |
|----|-------------|------|------|--|

*Criteria : Acc/Rej = 0/1.

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PACKAGE QUALIFICATION REPORT

Company: ASE group Chung-Li

PKG: QFN 36L(6x6x1.0max)

PKG MATERIAL: Green / Au wire

RA ENGINEER: *JS Wang*

RA SECTION MANAGER: *YF Chang*

RA MANAGER: *Jamy Chang*

Publication Release Date: October, 2006

SUMMARY

The **QFN 36L** product was passed the qualification tests.
A summary of the test result was as follows:

| | |
|---|-------------|
| Fb. High Temp. Storage Life Test | : 0/135 pcs |
| Fb. Pre-condition Test | : 0/405 pcs |
| Fb. Pressure Cooker Test | : 0/135 pcs |
| Fb. Thermal Shock Test | : 0/135 pcs |
| Fb. Temperature Cycle Test | : 0/135 pcs |

Results of the life tests and environmental tests as well as the methods used on **QFN 36L** are described in details in the report.

Publication Release Date: October 2006

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. LIFE TEST

A. Introduction

1. High Temp. Storage Life Test (HTSL)

B. Test Results

1. High Temp. Storage Life Test (HTSL)

. ENVIRONMENTAL TEST

A. Introduction

1. Pre-condition Test
2. Pressure Cooker Test (PCT)
3. Thermal Shock Test (TST)
4. Temperature Cycle Test (TCT)

B. Test Results

1. Pre-condition Test
2. Pressure Cooker Test (PCT)
3. Thermal Shock Test (TST)
4. Temperature Cycle Test (TCT)

1 . LIFE TEST

A. Introduction

1. High Temperature Storage Life Test (HTSL)

1.1 SCOPE

HTSL test is to determine the stability of the device in high temperature environment.

Publication Release Date:October 2006

1.2 TEST CONDITION

Temp = 150°C , Td = 1000 hrs.

(MIL-STD-883E, Method 1008, Condition "C")

B. Test Results

1. High Temperature Storage Life Test (HTSL)

1.1 SUMMARY TABLE

| RUN | Lot No | 1000 Hrs | Remark |
|-----|-------------|----------|--------|
| #1 | 2621B010-ZX | 0/45 | |
| #2 | 2621B010-ZY | 0/45 | |
| #3 | 2621B010-ZZ | 0/45 | |

II. ENVIRONMENTAL TESTS

A. Introduction

1. Pre-condition Test

1.1 SCOPE

Pre-condition Test is to measure the resistance of SMD (Surface Mount Devices) to the storage environment at the customer site and to thermal stress created by IR reflow or Vapor Phase Reflow.

1.2 TEST CONDITION

Step 1 : TCT(-65°C/150°C, 5 cycles)

Step 2 : Bake(125°C, 24 hours)

Step 3 : Soak(30°C/60%RH, 192 hours)

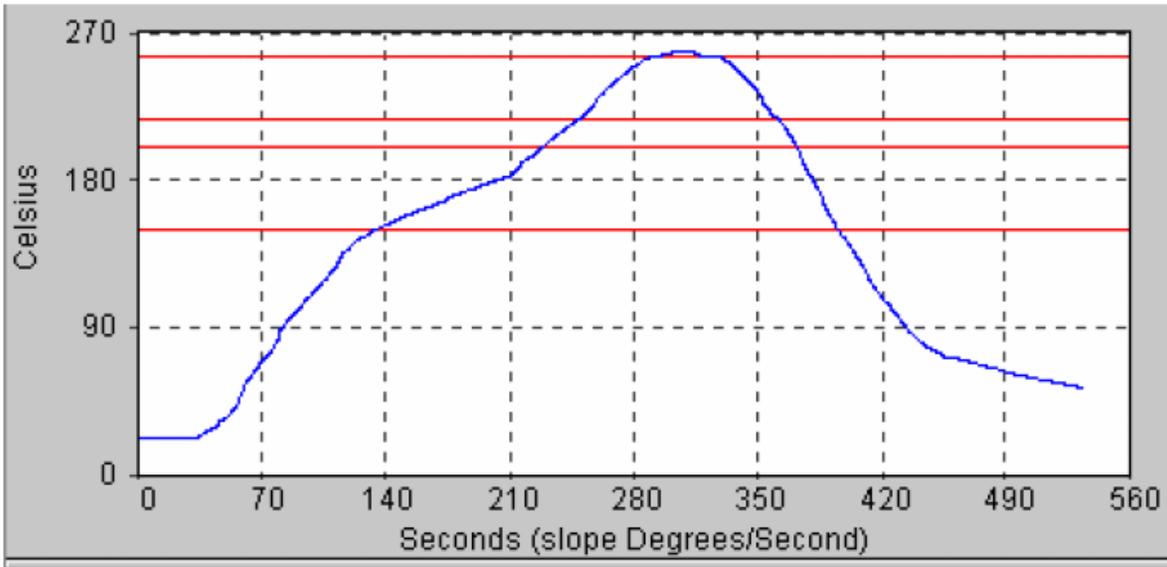
Step 4 : IR reflow (260 °C), 3 Passes.

1.3 SAT COFIRMATION: To confirm delamination, cracking, popcorn .

Criteria: IPC/JEDEC J-STD-020C

Publication Release Date:October 2006

1.4 IR REFLOW PROFILE (FOR IPC/JEDEC J-STD-020C)



| Temp. | Criteria |
|--|--------------------|
| Preheat 150 °C to 200 °C | 60~180 sec |
| Time maintained above: Above 217 °C | 60~150 sec |
| Peak temp | 260 °C +0 °C/-5 °C |
| Time within 5 °C of actual Peak Temperature of peak | 20~40 sec |

2. Pressure Cooker Test (PCT)

2.1 SCOPE

PCT is to evaluate the device resistance to moisture penetration.

2.2 TEST CONDITION

Ta = 121°C, RH = 100%, Td = 168 Hrs. 2 ATM ,(JESD22-A102-A)

Publication Release Date:October 2006

3. Thermal shock Test (TST)

3.1 SCOPE

TST is conducted to determine the resistance of a part to sudden exposure to extreme changes in temperature and to the effect of alternate exposures to these extremes.

3.2 TEST CONDITION

T=-65°C / 150°C/, transition period = 5 minutes, 100 cycles.

MIL-STD-883; Method 1011

4. Temperature Cycle Test (TCT)

4.1 SCOPE

TCT is to evaluate the resistance of device to environmental temperature change.

4.2 TEST CONDITION

-65°C / 15min, transfer time 1min, +150 °C/15min, 1000 cycles.

MIL-STD-883E, Method 1010, Condition "C".

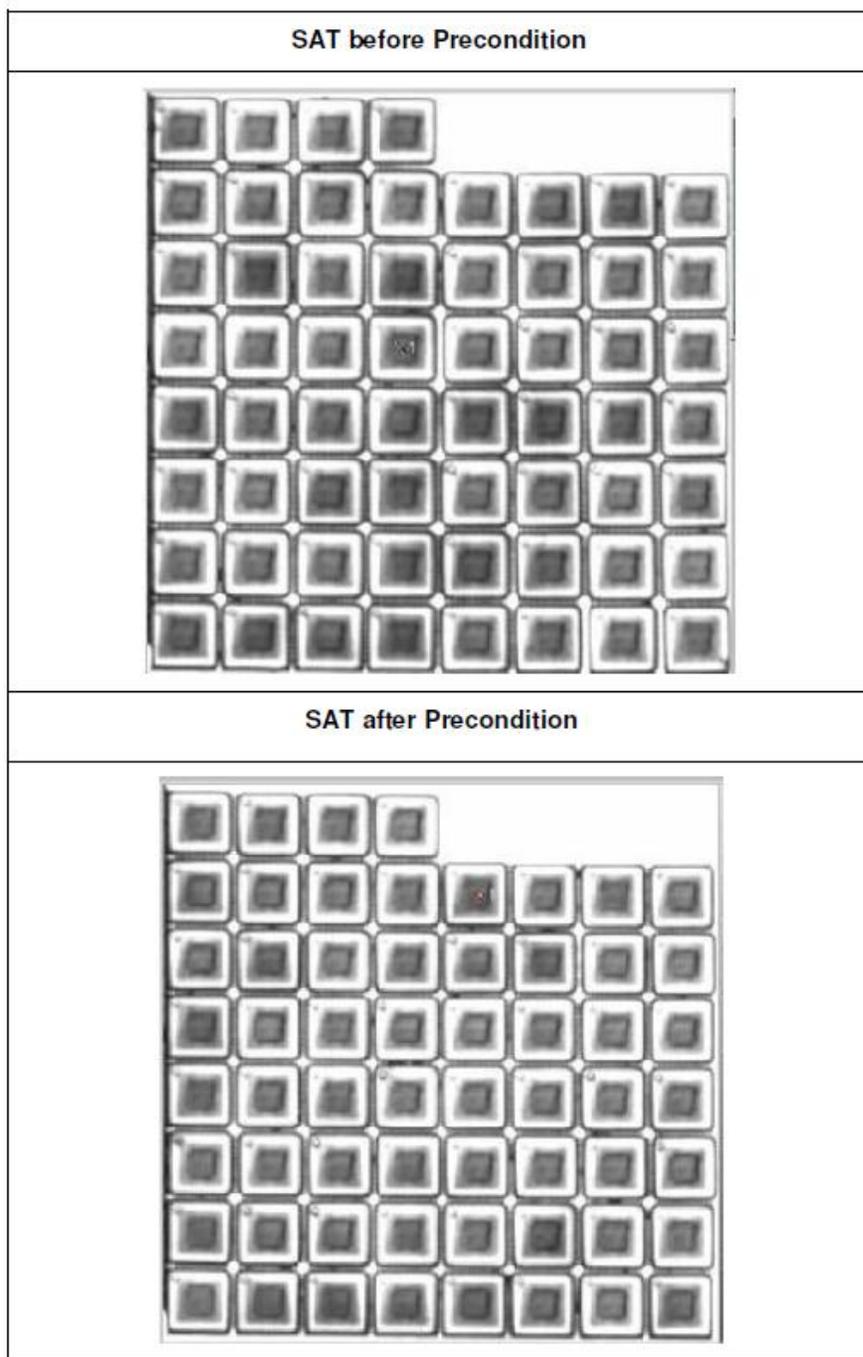
B. Test Results

1.1 Pre-condition Test

| Run | Lot No | SAT before Precondition | SAT After Precondition | Remark |
|-----|-------------|----------------------------|---------------------------|--------|
| | | Topside | Topside | |
| #1 | 2621B010-ZX | 0/135 | 0/135 | |
| #2 | 2621B010-ZY | 0/135 | 0/135 | |
| #3 | 2621B010-ZZ | 0/135 | 0/135 | |

*Criteria: Acc/Rej = 0/1.

1.2 SAT confirmation:



Publication Release Date: October 2006

2. Pressure Cooker Test (PCT)

| Run | Lot No | 168 Hrs | Remark |
|-----|-------------|---------|--------|
| #1 | 2621B010-ZX | 0/45 | |
| #2 | 2621B010-ZY | 0/45 | |
| #3 | 2621B010-ZZ | 0/45 | |

*Criteria : Acc/Rej = 0/1.

3. Thermal Shock Test (TST)

| Run | Lot No | 100 Cycles | Remark |
|-----|-------------|------------|--------|
| #1 | 2621B010-ZX | 0/45 | |
| #2 | 2621B010-ZY | 0/45 | |
| #3 | 2621B010-ZZ | 0/45 | |

*Criteria : Acc/Rej = 0/1.

4. Temperature Cycle Test (TCT)

| Run | Lot No | 1000 Cycles | Remark |
|-----|-------------|-------------|--------|
| #1 | 2621B010-ZX | 0/45 | |
| #2 | 2621B010-ZY | 0/45 | |
| #3 | 2621B010-ZZ | 0/45 | |

*Criteria : Acc/Rej = 0/1.

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