Product / Process Change Notice

PCN No.: Q000-PCN-PA201705-01 Date: 2017-05-17.

Change Title: Add Greatek as new assembly site for QFN 20L package products.

Change Classification: ☑ Major ☐ Minor
Change item: ☐ Design ☐ Raw Material ☐ Wafer FAB ☑ Package Assembly ☐ Testing ☐ Others: _____.

Affected Product(s) :

The affected products are I2130YYI, I2130YYIR, I2115AYYI, I2115AYYIR and NAU8224YG.

Description of Change(s) :

Add new assembly site for the affected products(QFN 20L package type) at Greatek (Greatek Electronics Inc, Taiwan) as the 2nd source for back up. Greatek is a qualified vendor for Nuvoton in assembly and testing process.

New Supplier

Greatek Electronics Inc, Taiwan (hereinafter "Greatek"), (136, Gung-Yi Rd., Chunan Cheng, Miaoli Hsien, 350, Tawin)

Reason for Change(s) :

To increase manufacturing capacity and flexibility and to have multiple manufacturing routes for backup in case of disruption, Nuvoton is adding a new assembly source at Greatek.

Impact of Change(s) : (positive & negative)

Form: No change on top effective marking except marking code. The marking code of Greatek shall be "G".

Fit: No change.

Function: No change.

Reliability: No concern (Passed Nuvoton package qualification.)

Qualification Plan/ Results :

1. QFN packages were qualified as per Nuvoton's standard qualification procedures, please refer to appendix A for the qualification report."
2. Samples for customer evaluation are available and can be provided immediately.
3. Approval is necessary as early as possible to start manufacturing.

Implementation Plan :

☐ Date Code: _____ onward ☐ Lot No.: _____ onward ☐ Implemented date: Aug. 15, 2017 (scheduled)

Originator:	***H.Y. Lai / Q100***	***Approval:(QA Director)***	***K.L. Lin/ Q000***
Contact for Questions & Concerns	Name: HYLai TEL: 886-3-5770066 (ext. 31226) FAX: 886-3-5792673. Address: No.4, Creation Rd. III Science-Based Industrial Park Hsinchu, Taiwan, R.O.C.. E-mail: hylai0@nuvoton.com.		

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.*

☐ Approval ☐ Disapproval ☐ 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		Responsible	Completed date	Remark
		before	after			
NA	NA	NA	NA	NA	NA	NA

Verifed by: _____.

Appendix A: QFN packages qualification report at Greatek

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PACKAGE QUALIFICATION REPORT

Subcontractor: Greatek
Package Type: QFN Series
Package Material: GREEN
Wire Bonding Material: Cu wire

ASSISTANT MANAGER：黃玠升

RA MANAGER ：蔡明耀

Publication Release Date: Mar.2010

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SUMMARY

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

▷. **Wire Pull Test**	**: 5 units / 30 wires**
▷. **Ball Shear Test**	**: 5 units /30 balls**
▷. **Pre-condition Test**	**: 0/405EA**
▷. **Pressure Cooker Test**	**: 0/135 EA**
▷. **Temperature Cycle Test**	**: 0/135 EA**
▷. **Highly Temp. Storage Life Test**	**: 0/135 EA**
▷. **Solderability Test**	**: 0/15 EA**

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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)
7. Solderability Test

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)
7. Solderability Test

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 $\geqq$ 1.66

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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 $\geqq$ 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)

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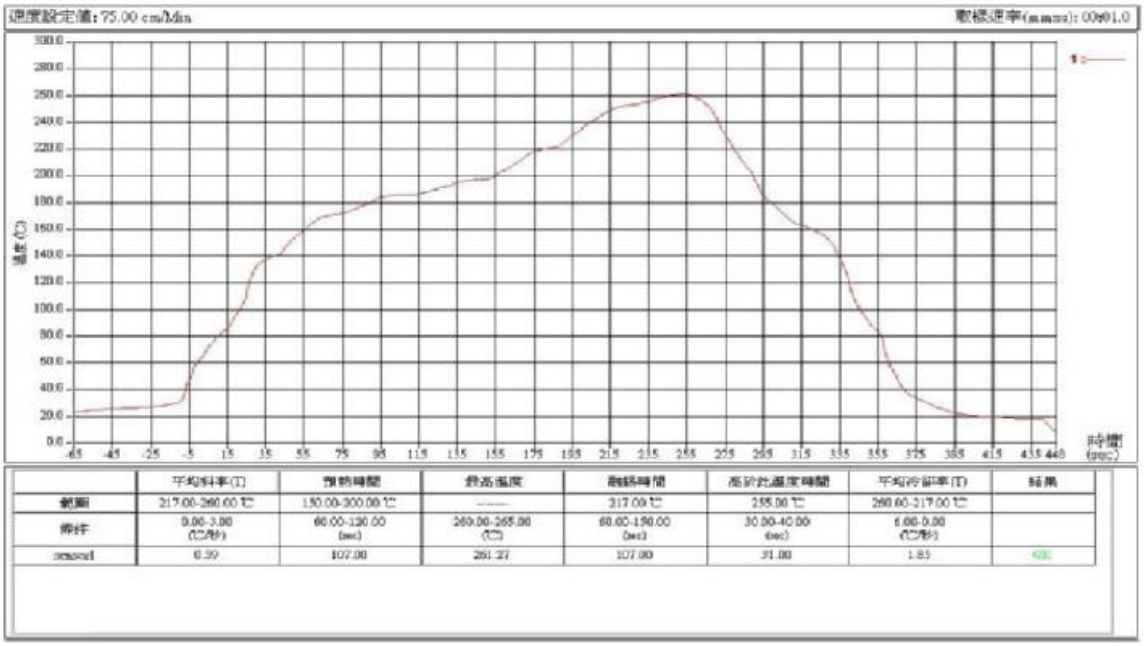
IR PROFILE(Tmax:260℃) for SMD.



	平均斜率(1)	預熱時間	最高溫度	融錫時間	高於此溫度時間	平均冷卻率(1)	結果
範圍	217.00-260.00 ℃	150.00-300.00 ℃	------	217.00 ℃	255.00 ℃	260.00-217.00 ℃	
焊錫	0.00-3.00 (℃/秒)	60.00-120.00 (sec)	260.00-265.00 (℃)	60.00-150.00 (sec)	30.00-40.00 (sec)	6.00-0.00 (℃/秒)	
measured	0.39	107.00	261.27	107.00	31.00	1.85	OK

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

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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℃,Time: 500/1000hrs

7. Solderability Test :

The purpose of this test method is to evaluation the solderability of terminations that are normally joined by soldering operation. This evaluation is made on the basis of the ability of these terminations be wetted by a coating of solder ,and to produce a suitable fillet when dip soldered.

Test procedure is as following:

Stept1: Steam aging (8hrs)

Stept2: Dipping with flux(type R) , Condition: 245±5℃ , Dwell Time:5±0.5secs.

B. Test Results

1. Wire Pull Test

- Sample size : 5units / 30wires
- Spec: ≧ 3 g
- Max: 12.21 g
- Min: 7.32 g
- Avg. : 11.14 g

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- Sd : 0.86
- CPK: 3.14

Criteria : CPK $\geqq$ 1.66

2. Ball Shear Test

- Sample size : 5units / 30 balls
- Spec: ≧ 10 g
- Max: 21.93 g
- Min: 16.34 g
- Avg. : 18.85 g
- Sd: 0.97
- CPK: 3.05

Criteria : CPK $\geqq$ 1.66

3.1 Pre-condition Test

Run	Lot No	SAT before Precondition	SAT After Precondition	Remark
	Lot number	Topside Result	Topside Result	
#1	2108B055 –ZX	0/135	0/135	
#2	2108B055 –ZY	0/135	0/135	
#3	2108B055 –ZZ	0/135	0/135	

*Criteria: Acc/Rej = 0/1.

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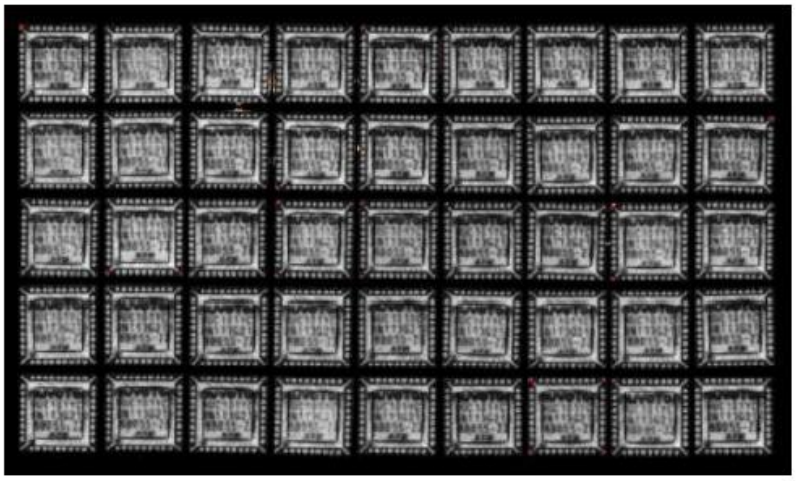
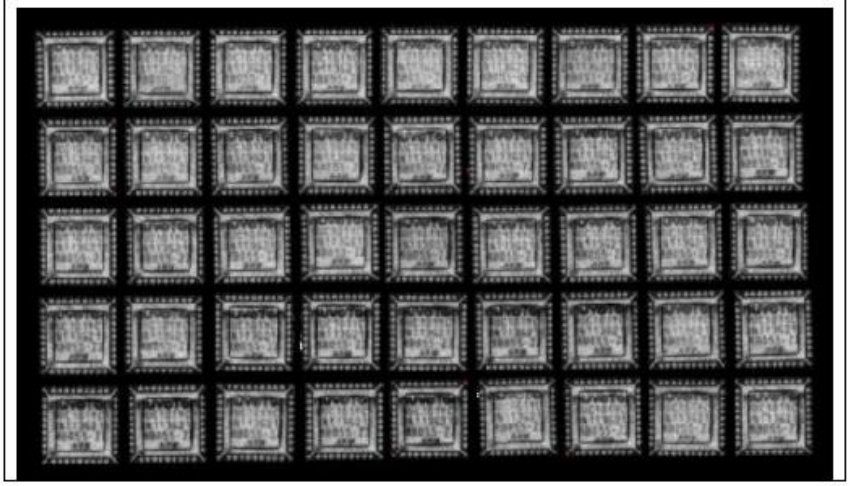
3.2 SAT confirmation:

SAT before Precondition

SAT after Precondition


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4. Pressure Cooker Test (PCT)

Run	Lot No	168 Hrs	Remark
#1	2108B055 –ZX	0/45	
#2	2108B055 –ZY	0/45	
#3	2108B055 –ZZ	0/45	

*Criteria : Acc/Rej = 0/1.

5. Temperature Cycle Test (TCT)

Run	Lot No	500 Cycles	Remark
#1	2108B055 –ZX	0/45	
#2	2108B055 –ZY	0/45	
#3	2108B055 –ZZ	0/45	

*Criteria : Acc/Rej = 0/1.

Run	Lot No	1000 Cycles	Remark
#1	2108B055 –ZX	0/45	
#2	2108B055 –ZY	0/45	
#3	2108B055 –ZZ	0/45	

*Criteria : Acc/Rej = 0/1.

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6. Highly Temp. Storage Life Test (HTSL)

Run	Lot No	500 Hrs	Remark
#1	2108B055 –ZX	0/45	
#2	2108B055 –ZY	0/45	
#3	2108B055 –ZZ	0/45	

*Criteria : Acc/Rej = 0/1.

Run	Lot No	1000 Hrs	Remark
#1	2108B055 –ZX	0/45	
#2	2108B055 –ZY	0/45	
#3	2108B055 –ZZ	0/45	

*Criteria : Acc/Rej = 0/1.

7. Solderability Test

Run	Lot No	Visual inspection	Remark
#1	2108B055 –ZX	0/5	
#2	2108B055 –ZY	0/5	
#3	2108B055 –ZZ	0/5	

After solderability :