# PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APM-DIS/10/5583
Notification Date 08/06/2010

**APM - ASD & IPAD Division**

**Protection ICs and ACS devices in SO-8 package**

**assembled in our ST China plant**

**ECOPACK2 grade/Cu wire & NiPdAgAu plating**

**Table 1. Change Implementation Schedule**

| | |
|---|---|
| Forecasted implementation date for change | 30-Jul-2010 |
| Forecasted availabillity date of samples for customer | 30-Jul-2010 |
| Forecasted date for **STMicroelectronics** change Qualification Plan results availability | 30-Jul-2010 |
| Estimated date of changed product first shipment | 05-Nov-2010 |

**Table 2. Change Identification**

| | |
|---|---|
| Product Identification (Product Family/Commercial Product) | Protection ICs and ACS devices in SO-8 package |
| Type of change | Multiple types of changes |
| Reason for change | Evolution of our technology |
| Description of the change | The ECOPACK(r) program is the cornerstone of our efforts for being leader in offering environmentally friendly packaging. Progressing in this program, ST is implementing technical solutions designed to progressively remove banned substances from manufacturing. To meet the so called "Halogen-Free" requirements of the market, ST is converting its Protection ICs and ACS devices in SO-8 package to the ECOPACK(r)2 grade. The permanent evolution of our technology leads us to implement at the same time the copper wire bonding process instead of gold and the NiPdAgAu plating, for the considered parts. |
| Product Line(s) and/or Part Number(s) | See attached |
| Description of the Qualification Plan | See attached |
| Change Product Identification | Internal codification, product marking and labelling, Q.A. number |
| Manufacturing Location(s) | |

**Table 3. List of Attachments**

| | |
|---|---|
| Customer Part numbers list | |
| Qualification Plan results | |

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| Customer Acknowledgement of Receipt | **PCN APM-DIS/10/5583** |
|---|---|
| Please sign and return to STMicroelectronics Sales Office | **Notification Date 08/06/2010** |
| ☐ Qualification Plan Denied | Name: |
| ☐ Qualification Plan Approved | Title: |
| | Company: |
| ☐ Change Denied | Date: |
| ☐ Change Approved | Signature: |

Remark

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# DOCUMENT APPROVAL

| Name | Function |
|---|---|
| Paris, Eric | Division Marketing Manager |
| Duclos, Franck | Division Product Manager |
| Cazaubon, Guy | Division Q.A. Manager |

**PRODUCT/PROCESS**
CHANGE NOTIFICATION

PCN APM-DIS/10/5583

# APM - ASD & IPAD Division[1]

## Protection ICs and ACS devices in SO-8 package assembled in our ST China plant:

## ECOPACK®2 grade / Cu wire & NiPdAgAu plating conversion

*(1) APM: Analog, Power & MEMS Group - ASD: Application Specific Device - IPAD: Integrated Passive and Active Devices*

## WHY THIS CHANGE

The ECOPACK® program is the cornerstone of our efforts for being leader in offering **environmentally friendly packaging**. Progressing in this program, ST is implementing technical solutions designed to progressively remove banned substances from manufacturing.

To meet the so called **"Halogen-Free"** requirements of the market, ST is converting its **Protection ICs** and **ACS devices** in **SO-8 package** to the **ECOPACK®2** grade.

The permanent evolution of our technology leads us to implement at the same time the **copper wire bonding process** instead of gold and the **NiPdAgAu plating**, for the considered parts.

The **involved product** series are listed below:

| Package | Product Family | Involved Series or Product | ECOPACK®2 conversion | Cu wire bonding | NiPdAgAu plating |
|---|---|---|---|---|---|
| **SO-8** | **Protection** | CLP190ERL<br>CLP30-200B1RL<br>ETP01-xx21RL<br>LCDP15x1(D)RL<br>LCP03-1501<br>LCP1521SRL<br>LCP3121RL<br>PEP01-5841<br>QPS200BRL<br>THBTxxx11D(RL)<br>TPIxxx11N(RL)<br>TPN3021RL<br>TPP25011RL<br>TSI220B1 | **All** | **All** | **All** |
| | **ACS** | ACS102-6T1(TR) | | | |

**Specific devices** not expressly listed in the above table are included in the announced change.

## WHAT IS THE CHANGE

The assembly **Bill of Material** status is summarized in the table below.

| Material | SO-8 package | |
|---|---|---|
| | Current | New |
| **Lead frame plating** | NiPdAu (Pd thickness = 30nm) | NiPdAgAu (Pd thickness = 10nm) |
| **Die attach glue material** | EN4900ST10 | Ablestick 8061 |
| **Wire bonding** | Au 2 mils | Cu 2 mils |
| **Molding compound** | Nitto MP8000 | Nitto GE900TC |

This new BOM does **not impact** the **electrical**, **dimensional** and **thermal** parameters of the products. The verification is included in the **qualification program**.

There is **no change** in the **packing modes** and the standard **delivery quantities**. All products involved in the change will remain in full compliance with the **ST ECOPACK®2** grade.

The **ECOPACK®2** grade is defined as follows:

1. **RoHS* compliant**, including with exemptions,
2. **500 ppm** maximum of **Antimony** as oxide or organic compound in each organic assembly materials (glue, substrate, mold compounds, housing).
3. **900ppm** maximum of [Bromine + Chlorine], in each organic assembly material.

*(*) Restriction of the use of certain Hazardous Substances*

## HOW AND WHEN

Qualification and test results:

The **qualification program** mainly consists of **reliability tests** and **comparative electrical characterizations**.

The **reliability test report** is annexed to the present document.

Sampling:

**Qualification samples** of selected devices and test vehicles are available on request as indicated below.

| Product Family | Salestypes (including test vehicles) | Samples availability |
|---|---|---|
| **Protection ICs** | LCP1521S | From week 33-2010 |
| | LCP1531 | From week 33-2010 |
| | TPN3021 | From week 33-2010 |
| | THBT20011D | From week 33-2010 |
| **ACS** | ACS102-6T1 | From week 33-2010 |

**Other samples** are available on request for delivery within notice period if ordered within 30 days from notification.

Change implementation schedule:

Those changes will be **implemented** in ST's manufacturing site located in **China**.

The **production change** and **first shipments** will be implemented according to our work in progress and materials availability as indicated in the schedule below:

| Product Family | Production Change | 1st Shipments |
|---|---|---|
| **All** | From Week 31 - 2010 | From Week 44 - 2010 |

Following Jedec Standard No. 46-C, lack of acknowledgement of the PCN within **30 days** will constitute acceptance of the change. After acknowledgement, lack of additional response within the **90 day** period from PCN notification will constitute acceptance of the change. In any cases, **first shipments** may start earlier with customer's **written agreement**.

Deliveries of **current product versions** will continue while the conversion is brought to completion and as long as former product stocks last.

Marking and traceability:

The **marking** of the modified components will be differentiated with an **additional letter “G” that will be printed to the right of the “ST” logo**.

The **traceability** for the modified products will be ensured by an **internal codification**, by the **product marking** and **labelling**, and by the **Q.A. number**.

Annex: **Reliability Test Report** for qualification program.

# Reliability Report
# Protection & ACS in SO-8 package assembled in our ST China plant
## ECOPACK2 grade /Cu wire & NiPdAgAu plating conversion

| General Information | |
|---|---|
| **Product Line** | *Protection & ACS* |
| **Part-number** | *Refer to the table below* |
| **Product Group** | *APM* |
| **Product division** | *ASD&IPAD* |
| **Package** | *SO-8* |
| **Maturity level step** | *Qualification* |

| Locations | |
|---|---|
| **Wafer fab** | *STMicroelectronics Tours* |
| **Assembly plant** | *ST Shenzhen (China)* |
| **Reliability Lab** | *STMicroelectronics Tours* |

**List of impacted series products**

| Package | Product Family | Involved Series or Product | ECOPACK®2 conversion | Wire bondingCu wire bonding | Plating |
|---|---|---|---|---|---|
| SO-8 | Protection | CLP190ERL<br>CLP30-200B1RL<br>ETP01-xx21RL<br>LCDP15x1(D)RL<br>LCP03-1501<br>LCP1521SRL<br>LCP3121RL<br>PEP01-5841<br>QPS200BRL<br>THBTxxx11D(RL)<br>TPIxxx11N(RL)<br>TPN3021RL<br>TPP25011RL<br>TSI220B1 | All | Copper | NiPdAgAu |
| | ACS | ACS102-6T1(TR) | | | |

## DOCUMENT INFORMATION

| Version | Date | Pages | Prepared by | Approved by | Comment |
|---|---|---|---|---|---|
| 1 | 29-July-10 | 8 | D.PELTIER | F.JAUFFRET | Preliminary report |
| | | | | | |
| | | | | | |

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.

This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.

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# 1 APPLICABLE AND REFERENCE DOCUMENTS

| Document reference | Short description |
|---|---|
| **AEC-Q100** | Stress test qualification for automotive grade integrated circuits |
| **AEC-Q101** | Stress test qualification for automotive grade discrete semiconductors |
| **JESD47** | Stress-Test-Driven Qualification of Integrated Circuits |
| | |

# 2 GLOSSARY

| | |
|---|---|
| **DUT** | Device Under Test |
| **PCB** | Printed Circuit Board |
| **SS** | Sample Size |
| | |

# 3 RELIABILITY EVALUATION OVERVIEW

## 3.1 Objectives

The ECOPACK® program is the cornerstone of our efforts for being leader in offering **environmentally friendly packaging**. Progressing in this program, ST is implementing technical solutions designed to progressively remove banned substances from manufacturing.

To meet the so called **"Halogen-Free"** requirements of the market, ST is converting its **Protection ICs** and **ACS devices** in **SO-8 package** to the **ECOPACK®2** grade.

The permanent evolution of our technology leads us to implement at the same time the **copper wire bonding process** instead of gold and the **NiPdAgAu plating**, for the considered parts.

The assembly **Bill of Material** status is summarized in the table below.

| **Material** | **SO-8 package** | |
|---|---|---|
| | **Current** | **New** |
| **Lead frame plating** | NiPdAu (Pd thickness = 30nm) | NiPdAgAu (Pd thickness = 10nm) |
| **Die attach glue material** | EN4900ST10 | Ablestick 8061 |
| **Wire bonding** | Au 2 mils/Au 1.3 mils | Cu 2 mils |
| **Molding compound** | Nitto MP8000 | Nitto GE900TC |

## 3.2 Product reliability description

The qualification methodology is failure mechanisms driven (JESD94). All potential failure mechanisms have been identified. Reliability trials follow JESD47 and 0061692 specifications.

## 3.3 Conclusion

Based on the reliability results, plan requirements have been fulfilled without exception. It is stressed that reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the ruggedness of the products and safe operation, which is consequently expected during their lifetime.

# 4 DEVICE CHARACTERISTICS

## 4.1 Device description

Refer to the assembly bill of material.

# 5 TESTS RESULTS SUMMARY

## 5.1 Test vehicle

| Lot # | Part number | Wafer fab. | Assembly plant |
|---|---|---|---|
| 1 | LCP1521SRL | ST Tours | ST Shenzhen |
| 2 | CLP190ERL | ST Tours | ST Shenzhen |
| 3 | TPN3021RL | ST Tours | ST Shenzhen |
| 4 | ACS102-6T1-TR | ST Tours | ST Shenzhen |

## 5.2 Test plan and results summary

**LCP1521SRL**

| Test | PC | Std ref. | Conditions | SS | Steps | Failure/SS Lot 1 | Note |
|---|---|---|---|---|---|---|---|
| **package Oriented Tests** | | | | | | | |
| Precond MSL1 | Y | JESD22 A-113 | T=85°C, HR=85% | 25 | 168h | 0/25 | |
| AC | Y | JESD22 A-102 | T=121°C, P= 2 Bars | 25 | 96h | 0/25 | |
| THB | Y | JESD22 A-101 | T=85°C, HR= 85%, V=100V | 77 | 168h | 0/77 | |
| | | | | | 504h | 0/77 | |
| | | | | | 1000h | 0/77 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 16h dry ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 16hdry ageing | 15 | visual inspection | 0/15 | |
| **die Oriented Tests** | | | | | | | |
| Repetitive Surge | Y | ADCS0060282 | IPP=30A/µs, 10/1000s | 18 | measure at 100s | 0/18 | |
| | | | | | measure at 500s | 0/18 | |
| | | | | | measure at 1000s | 0/18 | |
| HTRB | N | JESD22 A-108 | Tj=150C V=175V | 77 | 168h | 0/77 | |
| | | | | | 504h | 0/77 | |
| | | | | | 1000h | 0/77 | |

**CLP190ERL**

| Test | PC | Std ref. | Conditions | SS | Steps | Failure/SS Lot 2 | Note |
|---|---|---|---|---|---|---|---|
| **package Oriented Tests** | | | | | | | |
| Precond MSL1 | Y | JESD22 A-113 | T=85°C, HR=85% | 25 | 168h | 0/25 | |
| AC | Y | JESD22 A-102 | T=121°C, P= 2 Bars | 25 | 96h | 0/25 | |
| TC | Y | JESD22 A-104 | -65°C /+150°C, 2 cycles/hour | 77 | 100 cycles | 0/77 | |
| | | | | | 500 cycles | 0/77 | |
| THB | Y | JESD22 A-101 | T=85°C, HR= 85%, V=100V | 76 | 168h | 0/76 | |
| | | | | | 504h | 0/76 | |
| | | | | | 1000h | 0/76 | |
| RSH | N | JESD22 B106 | 260°C 10s ON, 15s OFF | 12 | | 0/12 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 16h dry ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 16hdry ageing | 15 | visual inspection | 0/15 | |

**TPN3021RL**

| Test | PC | Std ref. | Conditions | SS | Steps | Failure/SS Lot 3 | Note |
|---|---|---|---|---|---|---|---|
| **package Oriented Tests** | | | | | | | |
| Precond MSL1 | Y | JESD22 A-113 | T=85°C, HR=85% | 25 | 168h | 0/25 | |
| AC | Y | JESD22 A-102 | T=121°C, P= 2 Bars | 25 | 96h | 0/25 | |
| **die Oriented Tests** | | | | | | | |
| HTRB | N | JESD22 A-108 | Tj=150C, V=28V | 77 | 168h | 0/77 | |
| | | | | | 504h | 0/77 | |
| | | | | | 1000h | 0/77 | |

**ACS102-6T1-TR**

| Test | PC | Std ref. | Conditions | SS | Steps | Failure/SS Lot 4 | Note |
|---|---|---|---|---|---|---|---|
| **package Oriented Tests** | | | | | | | |
| Precond MSL1 | Y | JESD22 A-113 | T=85°C, HR=85% | 25 | 168h | 0/25 | |
| AC | Y | JESD22 A-102 | T=121°C, P= 2 Bars | 25 | 96h | 0/25 | |
| TC | Y | JESD22 A-104 | -65°C /+150°C, 2 cycles/hour | 77 | 100 cycles | 0/77 | |
| | | | | | 500 cycles | 0/77 | |
| RSH | N | JESD22 B106 | 260°C 10s ON, 15s OFF | 12 | | 0/12 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 8h steam ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 220C,SnPb, 16h dry ageing | 15 | visual inspection | 0/15 | |
| Solderability | N | J-STD-002 | 245C,SnAgCu, 16hdry ageing | 15 | visual inspection | 0/15 | |
| **die Oriented Tests** | | | | | | | |
| HTRB | N | JESD22 A-108 | Tj=125°C, V=600V | 310 | 168h | 0/77 | |
| | | | | | 504h | 0/77 | |
| | | | | | 1000h | 0/77 | |

# 6 ANNEXES

## 6.1 Tests Description

| Test name | Description | Purpose |
|---|---|---|
| **Die Oriented** | | |
| **HTRB**<br>High Temperature Reverse Bias | The device is stressed in static configuration, trying to satisfy as much as possible the following conditions:<br>low power dissipation;<br>max. supply voltage compatible with diffusion process and internal circuitry limitations; | To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way.<br>To maximize the electrical field across either reverse-biased junctions or dielectric layers, in order to investigate the failure modes linked to mobile contamination, oxide ageing, layout sensitivity to surface effects. |
| **Package Oriented** | | |
| **PC**<br>Preconditioning | The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption. | As stand-alone test: to investigate the moisture sensitivity level.<br>As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance.<br>The typical failure modes are "pop corn" effect and delamination. |
| **AC**<br>Auto Clave (Pressure Pot) | The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature. | To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity. |
| **TC**<br>Temperature Cycling | The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere. | To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation. |
| **THB**<br>Temperature Humidity Bias | The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity. | To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence. |

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