PRODUCT/PROCESS CHANGE NOTIFICATION

PCN DSG-COM/03/145

PCN LEADFREE PLATING FOR SO8 PACKAGE IN MUAR first lines

2003/02/7

	PCN DSG-COM/03/145	
Product Family /Commercial Product	STANDARD LINEAR products in SO8 package	
Type Of Change	Package assembly process change	
Reason For Change	Environmental directive	
Description of the change	To remove lead from plating by using preplating nickel palladium gold leadframe NiPdAu. This change will not affect ELECTRICAL & MECHANICAL parameters. Samples available: LM393DT/LM358DT. Other samples: on request. PLEASE BOOK YOUR SAMPLE ORDER IN NON-STANDARD WITH THE FOLLOWING COMMENT "AS PER LEADFREE PCN DSG-COM/03/145".	
Forecasted date of change	07-May-2003	
Forecasted date of samples for customer	07-Feb-2003	
Forecasted date for **STMicroelectronics** change qualification report availability	07-Feb-2003	
Marking to identify changed product	"E" letter on the package close to ST LOGO	
Description of qualification program	See Attached Qualification Plan	
Product Line(s) and/or Part Number(s)	See Attached List	
Manufacturing Location(s)		
Estimated Date of first shipment	07-May-2003	
Division Product Manager	Jean Claude KAIRE	Date: Jan.29 ,03
Division Q.A. Manager	Francoise PACCARD	Date: Jan.29 ,03

Customer Acknowledgement of Receipt — PCN DSG-COM/03/145

Please sign and return to STMicroelectronics Sales Office

☐ Qualification Plan Denied	Name:
☐ Qualification Plan Approved	Title:
	Company:
☐ Change Denied	Date:
☐ Change Approved	Signature:

Remark

2003/02/7

PROCESS CHANGE / TRANSFER QUALIFICATION REPORT

PCN reference: DSG-COM/03/145

Qualification Report n°: QASO8N91

Qualification Type: Material change

Process: Leadfree plating

New glue Hitachi 4900

Date of issue: 22th January 2003

Reference documents:

SOP 2.5.9 Process critical and key parameters
0076604 Process Qualification and release to production
0078588 Reliability requirements for product qualification
0046008 Process control plan for Front End
0060531 FMEA procedure
0061050 Back end qualification procedure
0091984 Construction analysis
0037709 Package construction analysis
7006451 Management of manufacturing source change
0033689 Process flow chart

Content

1. PROCESS MAIN SPECIFICATION CHANGE

1.1 Process change description.

1.1.1 Nature of Change: Leadfree plating NiPdAu preplated leadframe and glue change (Hitachi 4900)
1.1.2 Reason for Change: To be compliant with Environmental directives.
1.1.3 Affected process: SO8 assembled in ST Muar
1.1.4 Affected products: All standard linear devices assembled in SO8
1.1.5 Implementation date: April 2003

1.2 DETAILLED DESCRIPTION OF CHANGE

	New Process	Current Process
Assembly site	ST Muar (Malaysia)	ST Muar (Malaysia)
Assembly flow + Control Plan	7124337	7071671
Frame (material)	**Copper + NiPdAu preplating**	**Copper**
Die attach material	**Hitachi 4900ST**	**Ablebond 8390**
Wire material **Wire diameter**	Gold 1 MIL	Gold 1 MIL
Mold compound	MP8000 CH4	MP8000 CH4
Wire bond method	Thermosonic	Thermosonic
Lead finishing	NiPdAu (preplated)	Tin plating (SnPb85/15)

LEAD-FREE components are defined by STMicroelectronics as ECOPACK® components.

The implementation of the ECOPACK specification includes the suppression of lead (Pb) in those alloys used the lead finishing of components.

The identification of ECOPACK products will be achieved through specific labelling on component boxes. Whenever possible, the letter “E” will be added in the marking pattern beside the ST logo on the package body.

1.3 MAJOR EFFECTS OF CHANGE ON QUALITY, PARAMETRIC, ELECTRICAL OR RELIABILITY DATA

No effect on solderability: ECOPACK components are solderable with both current SnPb and AgSnCu lead-free PCB assembly processes.

Reliability improvement: In addition to the change of connection coating, a change in materials (glue) occurs in SO Narrow in order to meet the higher soldering temperature constraints required for lead-free soldering using, in particular, the IPC/JEDEC JSTD020B standard as reference.

2. QUALIFICATION PLAN

2.1 PROCESS QUALIFICATION REQUIREMENTS

2.1.1 Flow Chart comparison (1) yes [X] no [ ] N/A [ ]

2.1.2 Control Plan comparison (1) yes [X] no [ ] N/A [ ]

2.1.3 FMEA study (1) yes [X] no [ ] N/A [ ]

2.1.4 Process construction analysis (1) yes [X] no [ ] N/A [ ]

2.1.5 Quantity of qualification lots [ ] 1 [ ] 2 [X] 3 [ ] 4

2.1.6 Critical parametric parameters analysis (Cpk) yes [X] no [ ] N/A [ ]

Bond pull test, Bond shear test.

2.1.7 Non critical parameters analysis (Mean) yes [X] no [ ] N/A [ ]

Note 1: as described in related ADCS procedure

2.2 Test Vehicles (TV) description.

Line	Sales Type	P&L	Dice size	Package	Assy	Reliab plant	Lot #
0431*	TL431CD	71	1.38x1.12mm	SO8	ST Muar	Grenoble +Muar	1
0158*	LM358D	71	1.07x 1.01	SO8	ST Muar	Grenoble	1
0082*	TL082CD	71	1.74x1.48	SO8	ST Muar	Muar	1

* shrinked die version

2.3 FINAL TEST QUALIFICATION REQUIREMENTS [x] yes [ ] no

2.3.1 Quantity of qualification lots [ ] 1 [X] 2 [ ] 3

2.3.2 Lot average yield data: [ ] 1 [X] 2 [ ] 3

2.3.3 Package type SO8

2.3.4 Parameter distributions [X] N/A [ ] LotA [ ] LotB [ ] Lot C

2.3.4.1List of parameters:

2.3.4.2 Qualification criteria: N/A

2.4 BENCH MEASUREMENTS QUALIFICATION REQUIREMENTS

[X] yes [ ] no [ ]N/A

Construction analysis conforms to ST specification.

2.5 SPECIFIC TESTS QUALIFICATION REQUIREMENTS [] yes [ ] no [x] N/A

2.5.1 ESD [] yes [x] no

2.5.1 Latch-up [] yes [x] no

2.6 RELIABILITY QUALIFICATION REQUIREMENTS [x] yes [] no

2.6.1 Reliability tests performed on [x] LotA [x] LotB [x] LotC

2.6.2 Reliability tests:

Tests	Conditions	Test	LotA	LotB	LotC	Comments
HTB	Ta=125°C Vs=absolute max rating	1000h	X	X	X	Purpose: to point out problems connected to electrical stress related with the field application condition
Environment Sequence	PPT 3 atm. + TMC	48h 100 cy.	X	X	X	
THB	Ta=85C RH=85pct Vs=nominal	1000h	X	X	X	Purpose: To point out failure mechanism mainly due to electrochemical effects developped inside the device for contamination ions and electrical field applied
TMC	Ta=-65/+150C	1000c	X	X	X	Purpose: to point out the thermomechanical mismatch among the different materials employed
PPT	Ta=121°C P=2atm	480h	X	X	X	Purpose: to point out critical water entry path with consequential electrolytic and galvanic corrosion.
Jedel level determination	Jedel level 1 168h 85°C / 85%RH + 3IR reflow soldering		X*	X**	X**	Purpose: To point out problem connected to the reflow soldering.
TMSK	Ta=-65/+150C	500shk	X		X	Purpose: to point out the thermomechanical mismatch among the different materials employed

* With 260°C reflow peak (see Appendix 1)
** With 245°C reflow peak (see Appendix 1)

2.6.3 Drift analysis on Vio parameter (HTB & THB) [x yes [ ] no

2.6.4 Qualification criteria: no reject after reliability.

3. QUALIFICATION RESULTS

3.1 Process qualification results.

Bond Pull Test

Device	Wire size	Min	Max	Average	Stdev	Cpk	comments
TL431CD LM358CD	1.0mil 1.0 mil	8.3g 8.5g	14.4g 12.7g	10.9 10.5	1.34 1.26	1.72 1.71	Minimum specification: 4g

Bond shear test

Device	Wire size	Min	Max	Average	Stdev	Cpk	comments
TL431CD LM358CD	1.0mil 1.0 mil	45.0g 43.2g	65.4g 60.8g	57.2 53.1	5.72 5.04	1.94 1.92	Minimum specification: 32g

3.2 Bench Test qualification results

3.2.1 X-ray analysis

Wire sweeping conform

No glue void

3.2.2 External visual

NiPdAu plating: No exposed copper
Surface finish: Uniform stains free & uniform print
Cracks: Not visible at x10
Resin holes: not visible at x10
Other: No other visual defect

3.2.3 Scanning acoustic microscopy

No delamination.

3.2.4 Microsection

Resin holes: no void
Glue thickness: conform (min: 11.3µm, max 11.8µm)
Glue voids: no void
Die tilt: conform (0.5µm)
Die scribing: conform
NiPdAu plating thickness: conform
Package alignment : conform

3.2.5 Decapped devices

Loop height: conform
Ball size variation: conform
Bond shape: conform:
Bond centering: conform
Weld shape: conform
Weld centering: conform
Die scribing: conform
Die chipping: conform

3.2.6 External dimension measurement

Conform

3.2.7 Solderability

Conform (both after 24h steam aging and 24 hours dry air) on 80 units

3.3 FINAL TEST QUALIFICATION

	TL431CD	LM358D
Test Yield	99.75%	99.91

3.4 Reliability qualification results

Test	Conditions	Duration	Steps	Lot 1 TL431CD	Lot 2 LM358D	Lot 3 TL082CD
TMC	-65/+150°C	1000 cy	100cy 1000cy	0/78 0/78	0/78 0/78	0/78 0/78
TMSK	-65/+150°C	500 shks	100 shks 500shks	0/78 0/78	0/78 0/78	0/78 0/78
PPT	121°C, 2atm.	480 hours	168h 240h 480h	0/78 0/78 0/78	0/78 0/78	0/78 0/78 0/78
Envir. Sequ.	TMC + PPT	100cy + 48h	100cy 48h	0/78 0/78	0/78 0/78	0/78 0/78
HTB	125°C	1000 h	168 1000h	0/78 0/78	0/78 0/78	0/60 0/60
THB	85°C, 85%HR	1000 h	168 1000h	0/78 0/78	0/78 0/78	0/60 0/60
RSM 245°C				0/20 + 0/15	0/15	0/20
RSM 260°C				0/20		0/20

Test marked in blue performed in ST Muar

3.4.1 Drift analysis

	168h	1000
HTB (mean Vref drift) TL431CD	2.57mV	1.88mV
THB (mean Vref drift) TL431CD	0.54mV	1.17mV
HTB (mean Vio drift) LM358D	0.047mV	0.108
THB (mean Vio drift) LM358D	-0.01mV	0.05
HTB (mean Vio drift) TL082CD	0.32mV	0.29mV
THB (mean Vio drift) TL082CD	0.20mV	0.15mV

PROCESS CHANGE QUALIFICATION CERTIFICATE (7420046)

PROCESS or PACKAGE: SO8 NRS NiPdAu preplated frame qualification	PLANT: Muar Malaysia

CERTIFICATE NUMBER	C212SON1
GROUPS INVOLVED	DSG
DIVISION INVOLVED	Standard linear IC's
TRANSFER TO PLANT	
TRANSFER FROM PLANT	

DESIGN RULE MANUAL	0018063
PROCESS FMEA	7141456
PROCESS FLOW CHART	7124337
PROCESS CONTROL PLAN	7124337
PARAMETRIC TESTING DOCUMENTATION	N/A
WLR	N/A
RELIABILITY REPORT	QASONIP1
CONSTRUCTION ANALYSIS REPORT	NO 09/02
ASSEMBLY REPORT	Muar ASM PPF Qual. run
QUALIFICATION REPORT	QASONIP1
TEST VEHICLE PROCESS	Bipolar
TEST VEHICLE PACKAGE	SO8
TEST VEHICLE SALES TYPE	TL0431CD, LM358D, TL082CD

Approval

Group	**Name**	**Date**
DSG PROD.ENG. STD LINEAR	NATHALIE BANCHERI	24-DEC-2002
DSG PROD.ENG. MANAGER STD LINEAR	ALAIN CHASSAGNEUX	20-DEC-2002
DSG QUALITY MANAGT GNB	FRANCOISE PACCARD	07-JAN-2003
QA DIRECTOR ST MUAR	RICHARD WONG	24-DEC-2002

APPENDIX 1 INFRARED REFLOW SOLDERING

Packages are submitted to a soldering profile while sitting on a PC board of 1.6mm thick
Soldering atmosphere : air or nitrogen or mixture of both.
Temperature are measured on top of package body .
Soldering profile requirements:

CONDITION	NOMINAL
Heating rate	3°C per second maximum
125°C to 180°C	90 to 150 seconds
Above 220°C	60 to 90 seconds
Peak temperature	**245°C +0°/-5 °C**
Above 240°C	10 to 30 seconds
Cooling rate	6°C per seconds maximum
Time from Room Temperature to Peak	240 to 360 seconds

- **APPENDIX 3 HIGH TEMPERATURE LEAD FREE SOLDERING PROFILE : 260°C MAX**

Packages are submitted to a soldering profile while sitting on a PC board of 1.6mm thick
Soldering atmosphere : air or nitrogen or mixture of both.
Temperature are measured on top of package body .
Soldering profile requirements :

CONDITION	NOMINAL
Heating rate	3°C per second maximum
125°C to 180°C	90 to 150 seconds
Above 220°C	60 to 90 seconds
Peak temperature	**260°C+0/-5°C**
Above 250°C	10 to 30 seconds
Cooling rate	6°C per seconds maximum