

PCN DSG-COM/03/145

## PCN LEADFREE PLATING FOR SO8 PACKAGE IN MUAR first lines

# 57

		PCN DSG-COM/03/145		
Product Family /Commercial Product	STANDARD LINEAR products ir	STANDARD LINEAR products in SO8 package		
Type Of Change	Package assembly process char	nge		
Reason For Change	Environmental directive			
Description of the change	To remove lead from plating by u	using		
	preplating nickel palladium gold	leadframe		
	NiPdAu. This change will not affe	ect		
	ELECTRICAL & MECHANICAL			
	parameters. Samples available:			
LM393DT/LM358DT. Other samples: on				
	request. PLEASE BOOK YOUR SAMPLE ORDER IN NON-STANDARD WITH THE FOLLOWING COMMENT "/			
	PER LEADFREE PCN DSG-CO	M/03/145".		
Forecasted date of change	07-May-2003			
Forecasted date of samples for customer	07-Feb-2003			
Forecasted date for <b>STMicroelectronics</b> change qualification report availability	07-Feb-2003			
Marking to identify changed product	"E" letter on the package close to	o 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 2.5.9Process critical and key parameters0076604Process Qualification and release to production0078588Reliability requirements for product qualification0046008Process control plan for Front End0060531FMEA procedure0061050Back end qualification procedure0091984Construction analysis0037709Package construction analysis7006451Management of manufacturing source change0033689Process flow chart



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#### 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 +	Copper
	NiPdAu preplating	
Die attach material	Hitachi 4900ST	Ablebond 8390
Wire material	Gold	Gold
Wire diameter	1 MIL	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 [)	K]3	[]4
<ul><li>2.1.5 Quantity of qualification lots</li><li>2.1.6 Critical parametric parameters an</li></ul>		[ ] 2 [ ) yes [X ]	< ]3 no[]	[]4 N/A[]
	alysis (Cpk)			

#### Note 1: as described in related ADCS procedure

\* shrinked die version

#### 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

2.3 FINAL TEST QUALIFICATION	N REQUIREMEN	ITS [x]y	es		[] <u>no</u>
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 []Lot	В	[] 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	1000h	Х	Х	Х	Purpose: to point out problems connected
	Vs=absolute max					to electrical stress related with the field
	rating					application condition
Environment	PPT 3 atm. +	48h	Х	Х	Х	
Sequence	TMC	100 cy.				
THB	Ta=85C RH=85pct	1000h	Х	Х	Х	Purpose: To point out failure mechanism
	Vs=nominal					mainly due to electrochemical effects
						developped inside the device for
						contamination ions and electrical field
						applied
TMC	Ta=-65/+150C	1000c	Х	Х	Х	Purpose: to point out the
						thermomechanical mismatch among the
						different materials employed
PPT	Ta=121°C P=2atm	480h	Х	Х	Х	Purpose: to point out critical water entry
						path with consequential electrolytic and
						galvanic corrosion.
Jedel level	Jedel level 1		X*	X**	X**	Purpose: To point out problem connected
determination	168h 85°C /					to the reflow soldering.
	85%RH + 3IR					
	reflow soldering					
TMSK	Ta=-65/+150C	500shk	Х		Х	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	1.0mil	8.3g	14.4g	10.9	1.34	1.72	Minimum specification: 4g
LM358CD	1.0 mil	8.5g	12.7g	10.5	1.26	1.71	

#### Bond shear test

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

#### 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	Lot 2	Lot 3
				TL431CD	LM358D	TL082CD
TMC	-65/+150°C	10 00 cy	100cy	0/78	0/78	0/78
			1000cy	0/78	0/78	0/78
TMSK	-65/+150°C	500 shks	100 shks	0/78	0/78	0/78
			500shks	0/78	0/78	0/78
PPT	121°C, 2atm.	480 hours	168h	0/78	0/78	0/78
			240h	0/78	0/78	0/78
			480h	0/78		0/78
Envir. Sequ.	TMC + PPT	100cy + 48h	100cy	0/78	0/78	0/78
			48h	0/78	0/78	0/78
HTB	125°C	1000 h	168	0/78	0/78	0/60
			1000h	0/78	0/78	0/60
THB	85°C, 85%HR	1000 h	168	0/78	0/78	0/60
			1000h	0/78	0/78	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	ALAIN CHASSAGNEUX	20-DEC-2002
STD LINEAR		
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 <u>HIGH TEMPERATURE LEAD FREE SOLDERING PROFILE : 260°C MAX</u>

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	
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