November 2019

PRODUCT/PROCESS CHANGE INFORMATION

PCI AMS/19/11931

Analog, MEMS & Sensors Group (AMS)

Introduction of a new Rough Lead frame for VFDFPN 4x4 8L package assembled in Carsem Malaysia

WHAT:

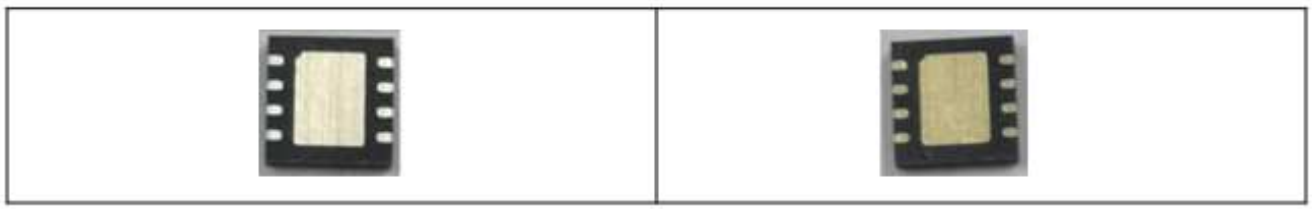
ST is pleased to announce the introduction of a Rough Lead frame (pre-plated NiPdAuAg) for products assembled in VFDFPN 4x4 8L. The rough texture will enhance adhesion between the Epoxy molding compound and the metal finish of the lead frame and improve the mechanical stability of the package.

Please note that the implementation of this rough Lead frame can be considered as a minor change as it will NOT **affect the internal structure of the lead-frame** (same form, fit, internal design and function),

Impacted Product(s): LED2000PUR, LED2001PUR, ST1CC40PUR, ST1L05DPUR, ST1S10PUR, ST1S30IPUR, ST1S32PUR, ST1S40IPUR, ST1S41PUR, ST8R00WPUR

Please find more information related to the change in the table here below :

Material	Current process	Modified process	Comment
Diffusion location	No change		No change
Assembly location	CARSEM S - MALAYSIA	CARSEM S - MALAYSIA	No change
Molding compound	Epoxy	Epoxy	No change
Die attach	Epoxy	Epoxy	No change
Lead-frame	Smooth Lead frame Ni/Pd/Au	Rough Lead frame Ni/Pd/Au/Ag	Enhanced adhesion between lead frame surface & molding compound but no change of form, fit, internal design and function
Wire	Gold 1.3 mil	Gold 1.3 mil	No change
Plating	NiPdAu	NiPdAuAg	The new LF is more opaque compared with old frame. See below photo as reference
MSL	1	1	No change



Current lead-frame **Modified lead-frame**

WHY:

The rough texture will enhance adhesion between the Epoxy molding compound and the metal finish of the lead frame and improve the mechanical stability of the package.

HOW:

The qualification program consists mainly of comparative electrical characterization and reliability tests on the selected Test Vehicle ST1S40IPUR.
You will find here after the Reliability Evaluation Report which summarizes the various test methods and conditions that ST used for this qualification program.

WHEN:

This new rough Lead-frame will be implemented from January 2020.

Marking and traceability:

Unless otherwise stated by customer's specific requirement, the traceability of the parts assembled with the new material set will be ensured by new internal sales type, date code and lot number.

The changes here reported will not affect the electrical, dimensional and thermal parameters keeping unchanged all the information reported on the relevant datasheets.
There is -as well- no change in the packing process or in the standard delivery quantities.

APPENDICES:

Reliability Evaluation Report

Reliability Evaluation Report

Introduction of a Rough Lead frame for ST1S40IPUR in VFDFPN 4x4x1.0 8L assembled in CARSEM S - MALAYSIA

General Information	
Product Lines	UA2701
Product Description	DC-DC CONVERTERS
P/N	*ST1S40IPUR*
Product Group	*AMS (Analog MEMS & Sensor Group)*
Product division	*General Purpose Analog & RF Division*
	POWER MANAGEMENT
Package	*VFDFPN 4x4x1.0 8L*
Silicon Process technology	*BCD6S*

Locations	
Wafer fab	*CHAF-GLOBALFOUNDRIES Fab2*
Assembly plant	*CARSEM S - MALAYSIA*
Reliability Lab	*Catania Reliability LAB*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	November 2019	6	Antonio Russo	Sergio Spampinato	Final Report

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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits

2 RELIABILITY EVALUATION OVERVIEW

2.1 OBJECTIVES

To qualify the new rough Lead Frame for ST1S40IPUR in VFDFPN 4x4x1.0 8L assembled in CARSEM S – MALAYSIA. Qualification activity have been performed by using three different assembly lots as requested by JEDEC JESD47 for these types of changes.

2.1 CONCLUSION

Qualification Plan requirements have been fulfilled without issue. It is stressed that reliability tests have to show that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests have to demonstrate the ruggedness of the products and safe operation, which is consequently expected during their lifetime.

3 CHANGE DESCRIPTION

Qualification of new rough Lead frame for ST1S40IPUR in VFDFPN 4x4x1.0 8L assembled in CARSEM S – MALAYSIA.

4 CONSTRUCTION NOTE

	UA2701 - ST1S40IPUR
Wafer/Die fab. Information	
Wafer fab manufacturing location	CHAF-GLOBALFOUNDRIES Fab2
Technology	BCD6S
Die finishing back side	Cr/NiV/Au
Die size	1725 x 1840 um
Passivation type	TEOS/SiN/Polyimide
Assembly information	
Assembly site	**CARSEM S - MALAYSIA**
Package description	VFDFPN 4x4x1.0 8L
Mold Compound	Epoxy
Frame	MLPDHS-4X4-8L-128X096-C194-8-NiPdAuAg
Die attach	Epoxy
Bond Wire	1.3 mils AU

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Commercial product	Rawline	Package	Product Line
1	ST1S40IPUR	RM3I*UA27DDF	VFDFPN 4x4x1.0 8L	UA2701
2				
3				

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	ss	Steps	SS			Note
						Lot 1	Lot 2	Lot 3	
Die Oriented Reliability trials									
HTSL	N	JESD22 A-103	Ta = 150°C	270	168 H	0/90	0/90	0/90	
					500 H	0/90	0/90	0/90	
					1000 H	0/90	0/90	0/90	
Package Oriented Reliability trials									
PC	-	JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times	540	Final	Pass	Pass	Pass	
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96 H	0/90	0/90	0/90	
					168 H	0/90	0/90	0/90	Eng. evaluation
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100cy	0/90	0/90	0/90	
					500 cy	0/90	0/90	0/90	10 units submitted to decap and wire bond pull after 500cyc TC. Results: Passed (see below table for details).
Package Assembly Integrity trials									
WBP	-	M2011	30 wires, characterization	15	Final	Pass CPK>1.66	Pass CPK>1.66	Pass CPK>1.66	
WBS	-	JESD22-B116	30 balls, characterization	15	Final	Pass CPK>1.66	Pass CPK>1.66	Pass CPK>1.66	
Solderability	-	JESD22-B102	>95% lead coverage	5	Final	Pass	Pass	Pass	

6 ANNEXES

6.1 Pin connections

Please refer to product datasheet

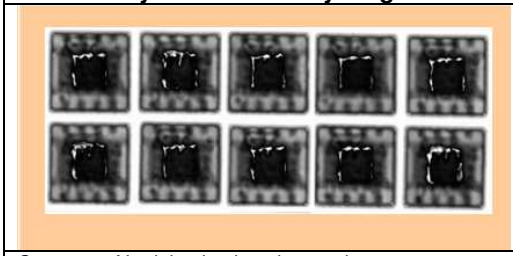
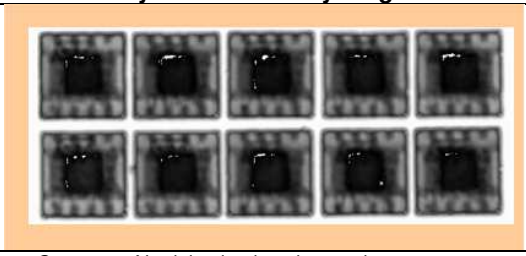
6.2 Package Mechanical data

Please refer to product datasheet

7 TEST DESCRIPTION

Test name	Description	Purpose
Die Oriented		
HTSL High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
Package Oriented		
PC 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. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop corn" effect and delamination.
AC 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 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.
Other		
WBS Wire Bond Shear	A process in which an instrument uses a chisel shaped tool to shear or push a ball or wedge/stitch bond off the bonding surface. The force required to cause this separation is recorded and is referred to as the bond shear strength. The bond shear strength of a ball bond, when correlated to the diameter of the ball bond, is an indicator of the quality of the metallurgical bond between the ball bond and the die bonding surface metallization.	This test establishes a procedure for determining the strength of the interface between a ball bond and a package bonding surface. This strength measurement is extremely important in determining the integrity of the metallurgical bond which has been formed.
WBP Wire Bond Pull	The apparatus for this test shall consist of suitable equipment for applying the specified stress to lead wire or terminal as required in the specified test condition. A calibrated measurement and indication of the applied stress in grams force (gf) shall be provided by equipment capable of measuring stresses.	The purpose of this test is to measure bond strengths, evaluate bond strength distributions, or determine compliance with specified bond strength requirements of the applicable acquisition document.

CSAM Analysis

Before MSL1 (No delamination found)	After MSL1 (No delamination found)
	
Comment: No delamination observed.	Comment: No delamination observed.
After 100cyc of Thermal cycling -65C/150C	**After 500cyc of Thermal cycling -65C/150C**
	
Comment: No delamination observed.	Comment: No delamination observed.

Wire Bond Pull after 500cyc of thermal cycling -65C/150C

EEV1908004 - Temperature cycle 500cycles (1.3 MILS)						
Sample	ENGJ29A5		ENGJ29A6		ENGJ29A7	
	Wire Pull (g)		Wire Pull (g)		Wire Pull (g)	
	Data	Mode	Data	Mode	Data	Mode
1	16.574	D1	17.525	D1	17.116	D1
2	17.867	D1	18.387	D1	18.252	D1
3	18.657	D1	18.192	D1	18.111	D1
4	17.24	D1	17.716	D1	16.24	D1
5	17.4	D1	18.569	D1	18.14	D1
6	17.645	D1	17.53	D1	17.967	D1
7	17.181	D1	17.647	D1	17.545	D1
8	18.817	D1	17.793	D1	17.754	D1
9	18.236	D1	19.071	D1	18.472	D1
10	16.163	D1	16.393	D1	16.115	D1
11	18.455	D1	18.413	D1	18.39	D1
12	17.697	D1	17.331	D1	18.088	D1
13	17.596	D1	17.703	D1	17.472	D1
14	19.887	D1	18.285	D1	18.324	D1
15	18.994	D1	18.488	D1	18.704	D1
16	17.55	D1	17.404	D1	17.104	D1
17	15.219	D1	18.083	D1	20.443	D1
18	18.985	D1	17.313	D1	16.851	D1
19	17.68	D1	17.536	D1	16.884	D1
20	18.357	D1	18.048	D1	18.277	D1
21	19.505	D1	18.202	D1	18.014	D1
22	16.731	D1	15.905	D1	16.6	D1
23	17.607	D1	17.942	D1	18.513	D1
24	17.288	D1	17.76	D1	17.894	D1
25	17.183	D1	17.216	D1	17.251	D1
26	18.129	D1	18.112	D1	18.593	D1
27	17.834	D1	18.947	D1	17.612	D1
28	16.737	D1	16.841	D1	17.271	D1
29	18.108	D1	17.602	D1	18.583	D1
30	17.297	D1	17.5	D1	20.535	D1
Maximum	**19.89**		**19.07**		**20.54**	
Minimum	**15.22**		**15.91**		**16.12**	
Spec Limit (L)	**4.00**		**4.00**		**4.00**	
Spec Limit (U)	-		-		-	
Mean	**17.75**		**17.78**		**17.90**	
Std. Dev.	**0.98**		**0.68**		**1.00**	

Note
Wire pull failure mode definition:
D1: wire break at neck
D2: other than neck
D3: lifted bond
D4: lifted weld
D5: lifted metal from die
D6: lifted metal from lead
D7: fracture on die (cratering)