PRODUCT / PROCESS CHANGE INFORMATION

1. PCI basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCI No.	AMS/20/11952
1.3 Title of PCI	New MBD and Assembly process settings for LDLN025 in package VFDFPN 1x1 4L assembled in CARSEM – CHINA
1.4 Product Category	See product list
1.5 Issue date	2020-02-13

2. PCI Team	
2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
2.2 Change responsibility	
2.2.1 Product Manager	Marcello SAN BIAGIO
2.1.2 Marketing Manager	Salvatore DI VINCENZO
2.1.3 Quality Manager	Sergio Tommaso SPAMPINATO

3. Change		
3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Methods	Process flow chart: Revision change in Process (process technology,sawing, die attach, plasma, capillary, marking, packing, labelling,transportation, etc..)	Assembly : Subcontractor Carsem (China)

4. Description of change		
	Old	New
4.1 Description	New settings on Bonding placement, Wafer sawing, Die attach, Wire bond, Mold Package sawing. Please refer to the qualification report for all the details.	New settings on Bonding placement, Wafer sawing, Die attach, Wire bond, Mold Package sawing. Please refer to the qualification report for all the details.
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No impact	

5. Reason / motivation for change	
5.1 Motivation	This change will contribute to ST’s continuous service and quality improvement of the product and prevent potential quality issues.
5.2 Customer Benefit	QUALITY IMPROVEMENT

6. Marking of parts / traceability of change	
6.1 Description	New finished good codes

7. Timing / schedule	
7.1 Date of qualification results	2020-02-11
7.2 Intended start of delivery	2020-03-28
7.3 Qualification sample available?	Not Applicable

8. Qualification / Validation			
8.1 Description	11952 PCI_Assembly improvement plan in CARSEM SZ for LDLN025PUxx.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2020-02-13

9. Attachments (additional documentations)
11952 Public product.pdf 11952 PCI_Assembly improvement plan in CARSEM SZ for LDLN025PUxx.pdf

10. Affected parts		
10. 1 Current		10.2 New (if applicable)
10.1.1 Customer Part No	10.1.2 Supplier Part No	10.1.2 Supplier Part No
	LDLN025PU18R	
	LDLN025PU28R	
	LDLN025PU29R	
	LDLN025PU30R	

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PRODUCT/PROCESS
CHANGE INFORMATION

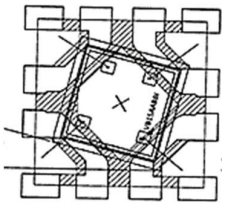
PCI AMS/20/11952

Analog, MEMS & Sensors Group (AMS)

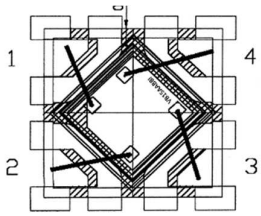
New MBD and Assembly process settings for LDLN025 in package VFDFPN 1x1 4L assembled in CARSEM - CHINA

WHAT:

Progressing on the activities related to continuous quality improvement, ST is pleased to announce the release of a new Assembly improvement actions on LDLN025 family products in package DFN 1x1 4L assembled in CARSEM – CHINA, including the die placement change from 14.2°C to 45°C, in order to align the Mounting Bonding Diagram of product with the similar one assembled in ST Calamba plant.



MBD: Current bonding placement



MBD: New bonding placement

Some additional settings on Carsem process have been performed in order to allow the die placement change, as well as additional ones have been introduced to optimize the process quality performances.

Impacted Product(s): LDLN025PUxxR family products assembled in CARSEM - CHINA

The table here below summarizes the new process settings changes.

Process	Current	New	Comment
Wafer sawing	Old blade: Z1: ZH05-SD3500-N1-50CC Z2:ZH05-SD4000-N1-70AA	New wider blade: Z1: K63C0-LCOH-CSZ Z2: G45E0-DUOM-CSZ	The wider blade allows to reduce residual die side from 658x658um to 629x629. Action to increase the margin at package sawing (die edge to pkg edge clearance)
Die Attach	1. MBD, die rotate 14.2 °C 2. DA use AD838 die placement tolerance ±38um	1. MBD, die rotate 45 °C 2. DA use AD8312plus with higher precision for die placement ±25.4um	1. The different die area overlap on die pad (overhang) and the die rotation increase bending stress robustness vs soldering stress 2. Action to improve the tolerance at package sawing.
Wire bond	Normal Bond	BSOB Bond	BSOB (Bond Stitch On Ball) in order to reduce the WB stress
Mold	Mold setting for Normal Bond	New Mold settings for BSOB Bond	Dedicated velocity settings to guarantee wire sweep within acceptance limits
Package sawing	Strip mount by one strip LF (4 blocks)	New block cut jig design and new strip mounting jig to 2 blocks	Action to reduce the overall LF warpage, so to reduce the package saw offset control specification

WHY:

This change will contribute to ST's continuous service and quality improvement of the product and prevent potential quality issues.

HOW:

The qualification program was based on a set of DOE trials, then cumulatively validated by the production monitoring on five line-stress lots, which included a dedicated set of reliability tests.
Result summary is reported on Appendix.

WHEN:

This Assembly Process change will be implemented in January 2020.

Marking and traceability:

The traceability of the parts assembled with the new material set will be ensured by new ST internal Finished Good codes: LDLN025PUxxR$1LQ, respectively for each LDLN025PUxxR commercial product code (example: LDLN025PU28R$1LQ for LDLN025PU28R).

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.

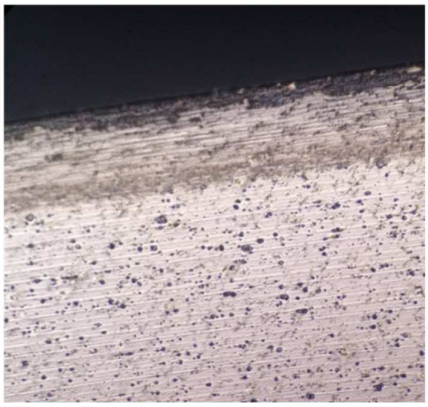
APPENDIX: QUALIFICATION SUMMARY

Process	Current	New	Comment
Wafer sawing	Old blade: Z1: ZH05-SD3500-N1-50CC Z2:ZH05-SD4000-N1-70AA	New wider blade: Z1: K63C0-LCOH-CSZ Z2: G45E0-DUOM-CSZ	The wider blade allows to reduce residual die thickness from 658x658um to 629x629. Action to increase the margin at package sawing (die edge to pkg edge clearance)

Wafer Saw – New Blade confirm

☐ **Blade confirm:**

Confirm the New Z1 blade , no problem found.



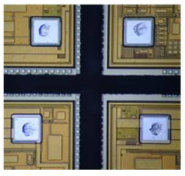
Wafer Saw – New Blade confirm

☐ **OP2 Yield:**

Customer Lot Number	Invoice Qty	2nd Opt In	2nd Opt Out	OP2 Yield	Defect
ENGY4610	64164	64164	64164	100%	0
ENGY4611	64973	64973	64973	100%	0

☐ **Topside Chipping:**

ENGY4610	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Max	Min	TTV
	Top Chip (um)	9.23	8.17	8.59	9.77	9.72	10.82	8.64	8.18	10.14	9.13	9.63	8.74	9.82	9.66	8.86	13.24	6.82	6.42
	Sample	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Mean	Stev	Ppk
	Top Chip (um)	9.72	10.21	10.2	9.63	6.82	9.22	8.93	13.24	7.42	11.28	9.26	10.6	10.9	8.57	7.9	9.43	1.25	1.48
ENGY4611	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Max	Min	TTV
	Top Chip (um)	9.15	11.31	8.36	9.57	10.93	9.66	9.83	8.49	8.51	9.63	10.3	6.24	10.75	9.66	8.77	12.70	6.24	6.46
	Sample	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Mean	Stev	Ppk
	Top Chip (um)	8.23	7.84	6.83	9.27	8.88	8.24	9.74	8.45	9.46	8.56	9.16	8.67	9.53	12.7	9.48	9.21	1.26	1.53



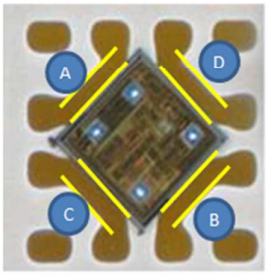
Conclusion: Pass

Process	Current	New	Comment
Die Attach	1. MBD, die rotate 14.2 °C 2. DA use AD838 die placement tolerance ±38um	1. MBD, die rotate 45 °C 2. DA use AD8312plus with higher precision for die placement ±25.4um	1. The different die area overlap on die pad (overhang) and the die rotation increase bending stress robustness vs soldering stress 2. Action to improve the tolerance at package sawing.

LDLN025-45 Degree Die Attach

- **Die placement measurement reading:**

	A(mil)	B(mil)	"X" Offset	C(mil)	D(mil)	"Y" Offset	die rotation
U1	3.95	3.67	0.28	4.06	4.06	0	45.6
U2	3.78	4.12	-0.34	4.05	3.82	0.23	46.1
U3	3.86	3.98	-0.12	4.1	4.89	-0.79	45.9
U4	3.9	3.86	0.04	3.99	4.03	-0.04	45.8
U5	4.02	3.99	0.03	3.84	4.21	-0.37	46.3



Remark:
1. Die attach machine set control Die placement ±1mil

LDLN025-45 Degree Die Attach

Die placement tighten control evaluate

- **Mass run 30k bonding with uplook**
- **Placement pass spec**
- **No placement/rotation out spec in 6 hour**

	X	Y	T
Average	0.08	0.10	-0.09
Range	19.14	38.38	1.93
S.D	1.69	2.74	0.18
Cp	4.94	3.04	2.25
Min.	-10.45	-15.21	-0.95
Max.	8.69	23.17	0.98
Target	0.00	0.00	0.00
USL	25.00	25.00	1.00
LSL	-25.00	-25.00	-1.50
Cpk	4.92	3.03	1.97
Out Spec	0	0	0

Conclusion: Pass

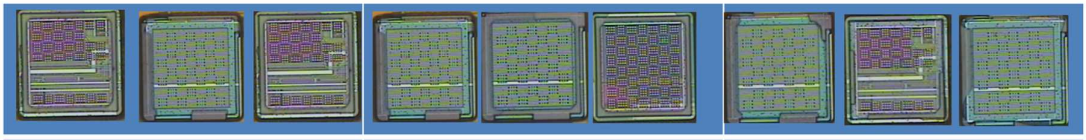
Process	Current	New	Comment
Wire bond	Normal Bond	BSOB Bond	BSOB (Bond Stitch On Ball) in order to reduce the WB stress

Confirmation Run after Optimize Tip and C/V parameters

Item	Bond power	Bond force	Bond time
L L L	88	15	12
M M M	90	17	14
H H H	92	19	16

T0	Ball Shear			Wire Pull			Ball Size			Ball Thickness		
	LL	MM	HH	LLL	MMM	HHH	LL	MM	HH	LLL	MMM	HHH
Maximum	25.67	27.68	27.98	7.59	7.58	7.72	50.97	51.93	52.79	12.77	12.72	12.64
Minimum	19.98	20.45	20.65	5.96	5.75	5.86	49.45	49.85	49.96	11.67	11.38	11.09
Spec Limit (L)	12.50	12.50	12.50	2.50	2.50	2.50	40.00	40.00	40.00	8.00	8.00	8.00
Spec Limit (U)	N/A	N/A	N/A	N/A	N/A	N/A	60.00	60.00	60.00	16.00	16.00	16.00
Mean	23.55	24.34	24.69	6.90	6.74	6.57	50.21	50.92	51.21	12.34	12.22	11.97
Ppk	2.18	2.21	2.46	2.64	2.54	2.67	NA	NA	NA	NA	NA	NA

Cratering test



LOW | MIDDLE | HIGH

Conclusion:

All buyoff data can meet ST's SPEC - Pass

7

Process	Current	New	Comment
Mold	Mold setting for Normal Bond	New Mold settings for BSOB Bond	Dedicated velocity settings to guarantee wire sweep within acceptance limits

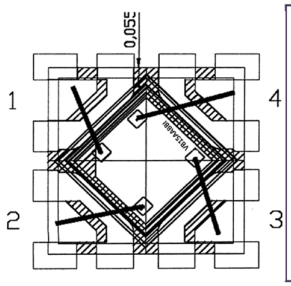
SGC LDLN025PU18R Wire Sweep Improvement Report

Background

SGC LDLN025PU18R encountered wire sweep issue(Max wire sweep>10%) after rotate die 45° and change to BSOB bonding

Lot	LotNo	Lot ID	QTY
1	SGC*ENGY3205	C201933001801	65082
2	SGC*ENGY3206	C201933001802	64974
3	SGC*ENGY3207	C201933001803	65300
4	SGC*ENGY3208	C201933001804	64846
5	SGC*ENGY3209	C201933001805	65306

Bond diagram



Package and Material Information:

Device : MQBB*VB48ADJ/LDLN025PU18R$1Q

Package Size :6MLPDHS#MNICOL1.3X1.6X2

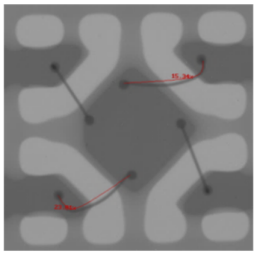
Lead frame : NiPdAuAg.ADV-RT2

Epoxy Type : Lintec LE5000S

Wire Size : 0.8Mil Au

Compound Type : G770HCD

Wire Sweep Photo

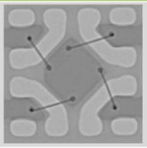
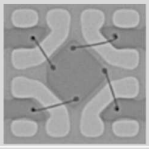
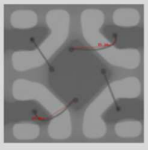


Remark : BSOB bonding, loop height:2.5±0.5mil

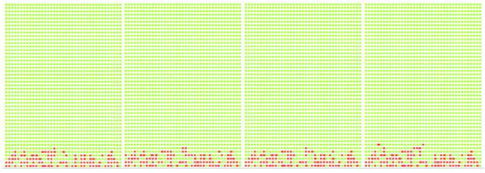
SGC LDLN025PU18R Wire Sweep Improvement Report

Analysis

1.Wire Sweep Distribution

Location	Wire sweep	Result
Gate		Max Wire Sweep: 3.12% Pass
Middle		Max Wire Sweep: 5.81% Pass
Air Vent		Max Wire Sweep: 23.01% Fail

Wire Sweep Mapping

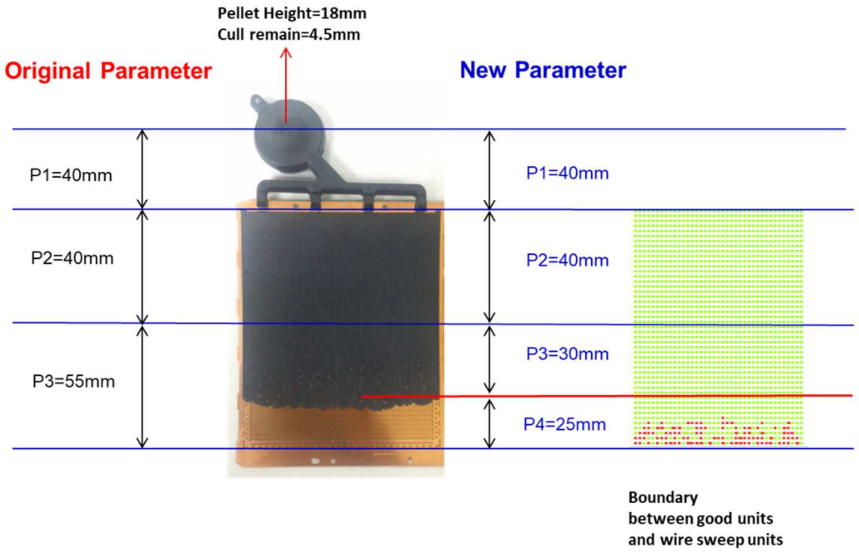


Wire sweep Spec:10%

SGC LDLN025PU18R Wire Sweep Improvement Report

Wire Sweep Improvement

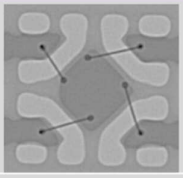
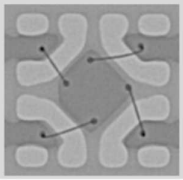
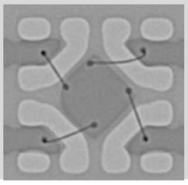
1,Short-shot(Molding position analysis)



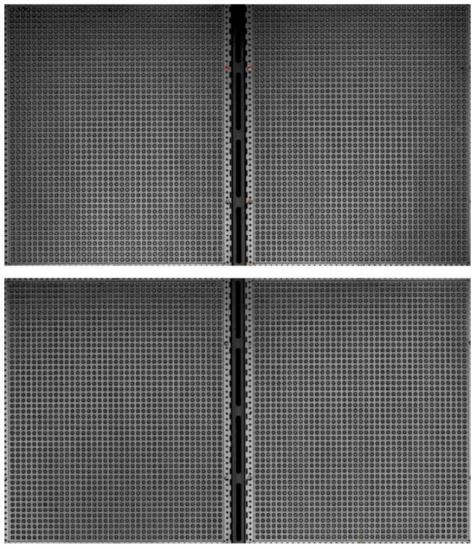
Wire Sweep Improvement

3, Optimize parameter confirm run(4 strip)

X-ray(Wire Sweep Spec:10%)

Location	Wire sweep	Result
Gate		Max Wire Sweep: 3.05% Pass
Middle		Max Wire Sweep: 6.11% Pass
Air Vent		Max Wire Sweep: 8.07% Pass

C-SAM



No delamination, Pass

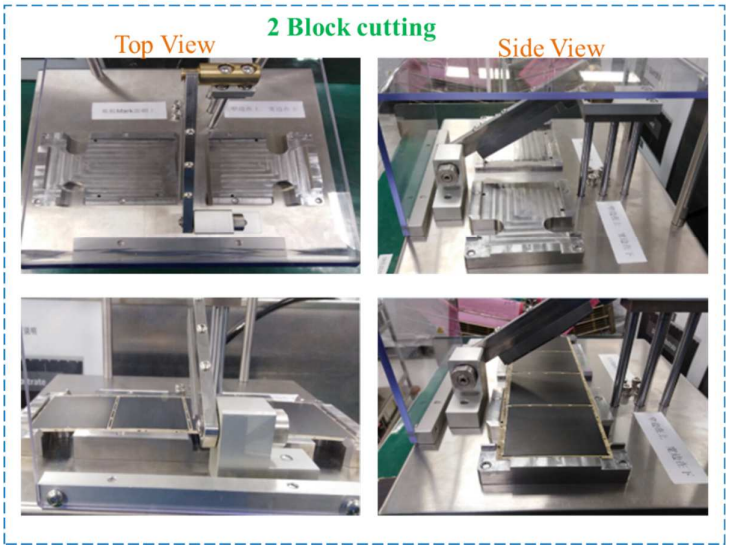
Conclusion

Below mold parameter solve wire sweep issue

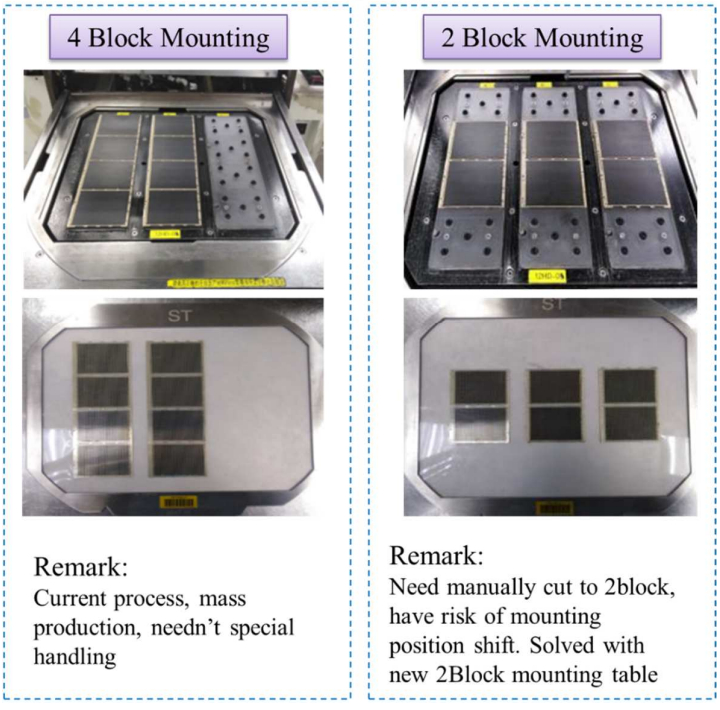
Parameter	Before	After
1st position (0.1mm)	40	40
1st velocity (0.1mm/s)	55	55
2nd position (0.1mm)	40	40
2nd velocity (0.1mm/s)	30	30
3rd position (0.1mm)	55	30
3rd velocity (0.1mm/s)	10	10
4th position (0.1mm)	NA	25
4th velocity (0.1mm/s)	NA	5

Process	Current	New	Comment
Package sawing	Strip mount by one strip LF (4 blocks)	New block cut jig design and new strip mounting jig to 2 blocks	Action to reduce the overall LF warpage, so to reduce the package saw offset control spec

Block Cut Jig

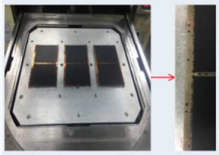
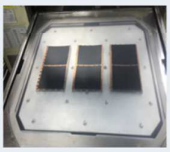


Different Mounting Type Comparison



2Block Mounting Table Buyoff

2Block mounting table buyoff:

Buyoff Item	Jig Appearance	Location Pin	Vacuum performance	Mounting Performance
Requirement	Surface smooth, no hump	Match with lead frame location hole, can lock lead frame completely	Can meet setting limit, and hold the lead frame completely	No bubble and lead frame shift
Photo				
Result	Pass - Surface smooth and no hump	Pass - Match with lead frame location hole, and can lock lead frame completely	Pass - Vacuum is ok and can hold lead frame completely	Pass - Not detect bubble and lead frame shift

Conclusion:
The 2 block mounting Jig has passed the buyoff, can be release to mass production.

RELIABILITY RESULT SUMMARY TABLE
Test Vehicle: LDLN025PU28R

Test	PC	Std ref.	Conditions	ss	Steps	SS (pcs)		Result summary
						Lot 1	Lot 2 Lot 3 Lot 4 Lot 5	
PC	-	JESD22 A-113	MSL1 : Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times	600	Final	200	100 per Lot	PASS **NO DELAM**
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C	100	96 H	100		PASS **No assembly related defects observed**
TC	Y	JESD22 A-104	Ta = -65°C to 150°C	500	100cy		100 per Lot	PASS **No assembly related defects observed**
					500 cy	100		PASS **No assembly related defects observed**

Public Products List

Publict Products are off the shelf products. They are not dedicated to specific customers, they are available through ST Sales team, or Distributors, and visible on ST.com

PCI Title : New MBD and Assembly process settings for LDLN025 in package VFDFPN 1x1 4L assembled in CARSEM – CHINA

PCI Reference : AMS/20/11952

Subject : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change.

LDLN025PU18R	LDLN025PU29R	LDLN025PU28R
LDLN025PU30R		

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