

**PRODUCT / PROCESS CHANGE NOTIFICATION**

**1. PCN basic data**

<b>1.1 Company</b>		STMicroelectronics International N.V
<b>1.2 PCN No.</b>	ADG/20/12005	
<b>1.3 Title of PCN</b>	STL120N4F6AG, STL120N4LF6AG (6D4F, 6L4F): New Lead-frame and Die Attach Method Introduction (PFLAT Products AUTOMOTIVE)	
<b>1.4 Product Category</b>	see list	
<b>1.5 Issue date</b>	2020-04-07	

**2. PCN Team**

<b>2.1 Contact supplier</b>	
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<b>2.1.2 Phone</b>	+1 8475853058
<b>2.1.3 Email</b>	heather.robertson@st.com
<b>2.2 Change responsibility</b>	
<b>2.2.1 Product Manager</b>	Nicola LIPORACE, Mario ASTUTI
<b>2.1.2 Marketing Manager</b>	Michele SCUTO
<b>2.1.3 Quality Manager</b>	Francesco MINERVA

**3. Change**

<b>3.1 Category</b>	<b>3.2 Type of change</b>	<b>3.3 Manufacturing Location</b>
Materials	New direct material part number (same supplier, different supplier or new supplier), Lead frame base material	ST Shenzhen (China)

**4. Description of change**

	<b>Old</b>	<b>New</b>
<b>4.1 Description</b>	Etched Leadframe Soft Solder Dispensing	Stamped Leadframe Soft Solder Writing
<b>4.2 Anticipated Impact on form, fit, function, quality, reliability or processability?</b>	No Impact	

**5. Reason / motivation for change**

<b>5.1 Motivation</b>	Capacity increase
<b>5.2 Customer Benefit</b>	CAPACITY INCREASE

**6. Marking of parts / traceability of change**

<b>6.1 Description</b>	Dedicated Finished Codes
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**7. Timing / schedule**

<b>7.1 Date of qualification results</b>	2020-02-13
<b>7.2 Intended start of delivery</b>	2020-06-01
<b>7.3 Qualification sample available?</b>	Upon Request

**8. Qualification / Validation**

<b>8.1 Description</b>	12005 Validation.pdf		
<b>8.2 Qualification report and qualification results</b>	Available (see attachment)	<b>Issue Date</b>	2020-04-07

**9. Attachments (additional documentations)**

12005 Public product.pdf  
12005 Detailed Description.pdf  
12005 Validation.pdf  
12005 Details.pdf

**10. Affected parts**

<b>10. 1 Current</b>		<b>10.2 New (if applicable)</b>
<b>10.1.1 Customer Part No</b>	<b>10.1.2 Supplier Part No</b>	<b>10.1.2 Supplier Part No</b>
	STL120N4F6AG	
	STL120N4LF6AG	

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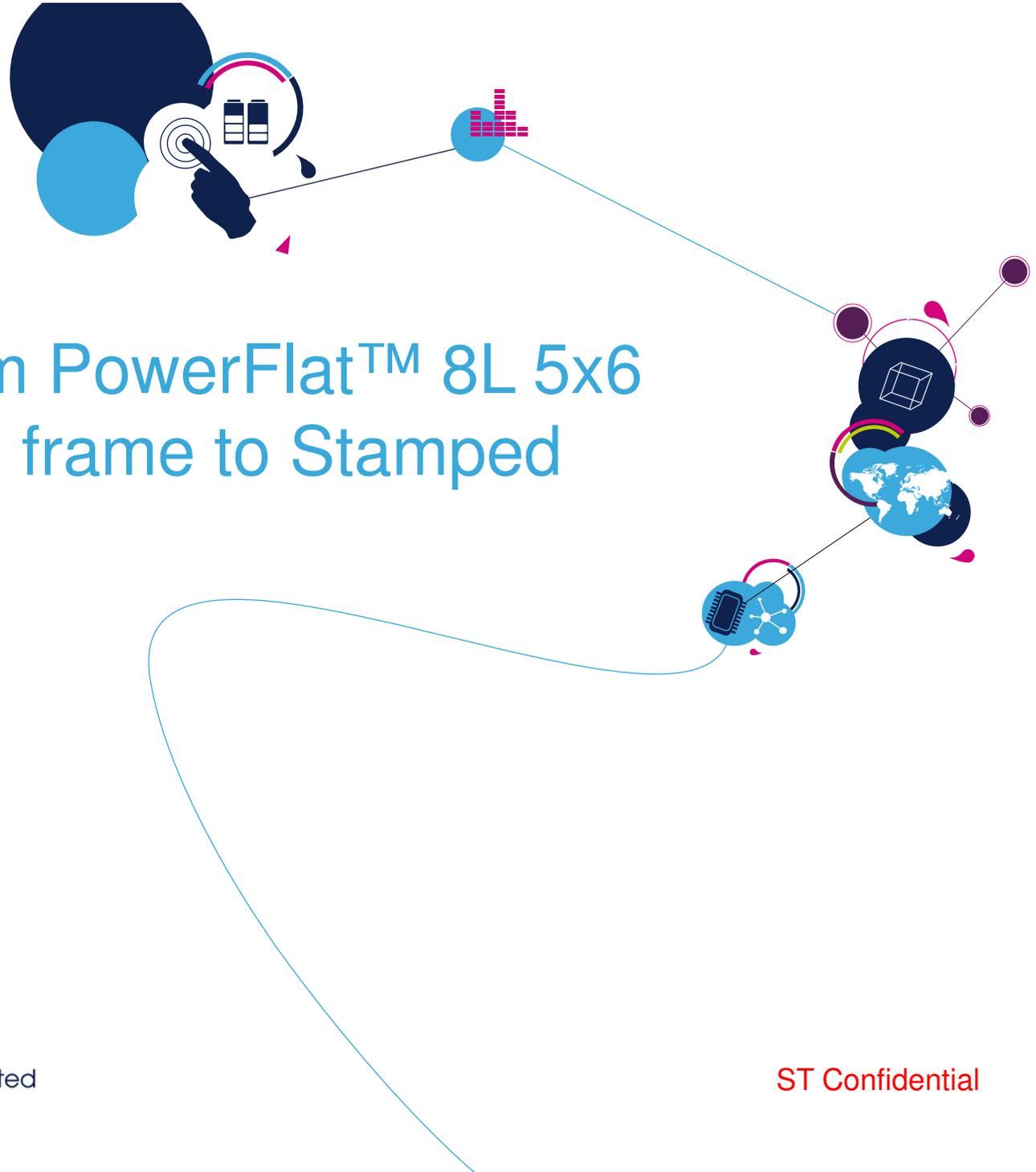
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# Migration from PowerFlat™ 8L 5x6 matrix etched frame to Stamped

Slide 3-4 – Change description

Slide 5-9 – Existing frame Vs new one

Slide 10 – ZVEI Guidelines

Slide 11 – Selected Test Vehicle

Slide 12 – Test vehicle reliability program and qualification data

Slide 13 – Conclusion

## Change description

Malesian SH Electronics (MSHE) has released a PTN about PowerFlat™ 8L 5x6 matrix frame in order to armonize their production flow. Here below are reported the introduced changes :

	CURRENT		NEW	
Supplier	MSHE		MSHE	
Manufacturing process	Plating + <b>Etching</b>	L/F cutting	Plating + <b>Stamping</b>	L/F cutting
Manufacturing location	<b>Japan</b>	Malaysia	<b>Malaysia</b>	Malaysia
Raw material	C194		C194	

In order to improve the die attach process for product with biggest die size, STS qualified on the new frame also a new setting on :

Die attach process	Soft solder dispensing	Soft solder writing
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- ST assembly production plant : Shenzhen, China



# Change description

Impacted products:

Commercial products :

- STL120N4F6AG
- STL120N4LF6AG

ST silicon line

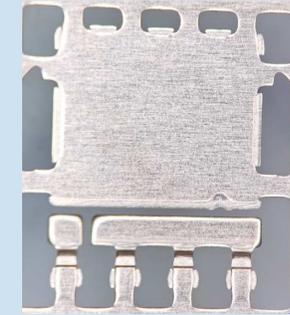
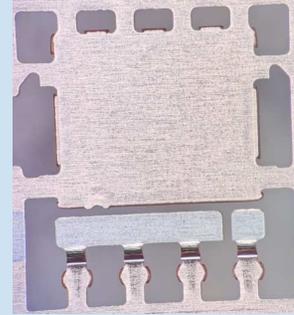
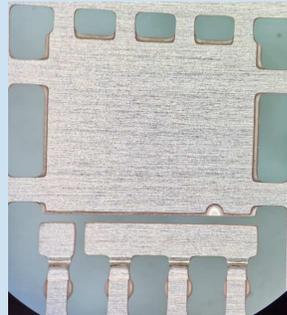
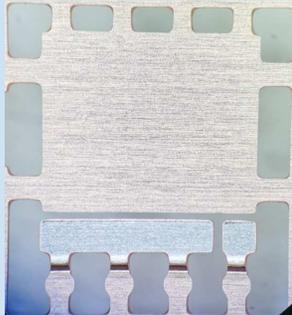
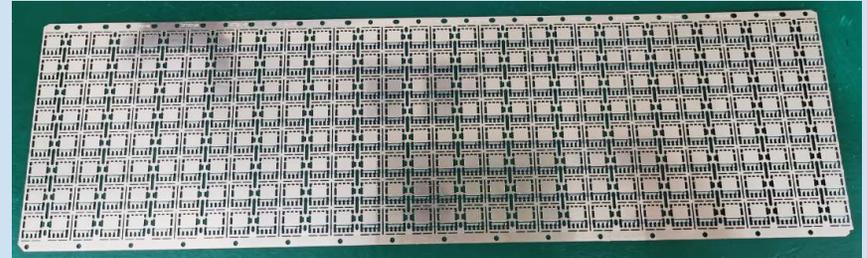
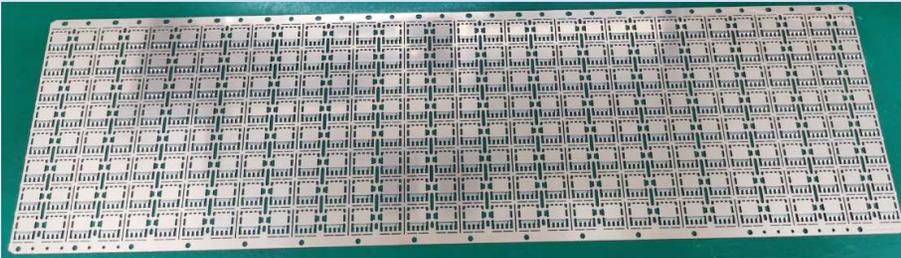
6D4F

6L4F

# FRAME PFLAT 8L 5x6 Ve1 OpAW Se/Ni/NiP

5FT40060 ( etched )

5FT80146 ( stamped )

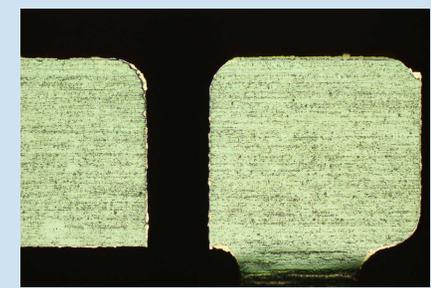
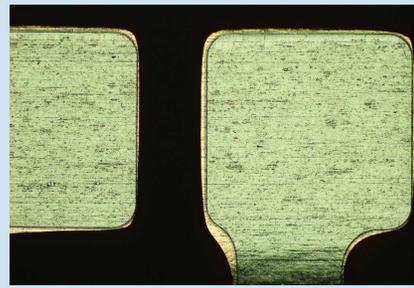


Front side

Back side

Front side

Back side



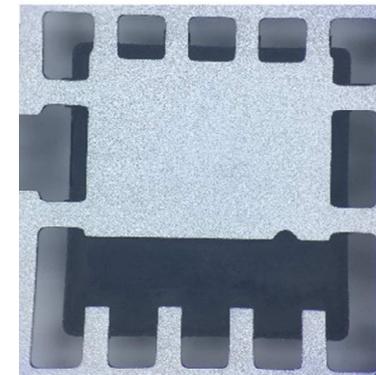
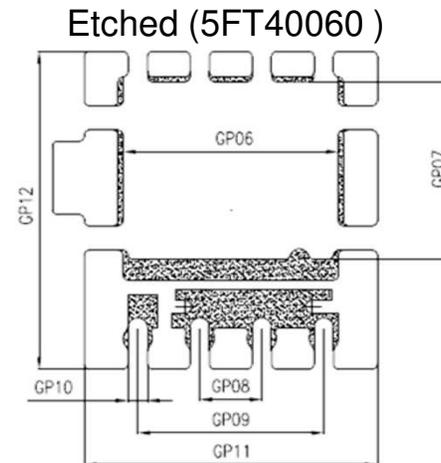
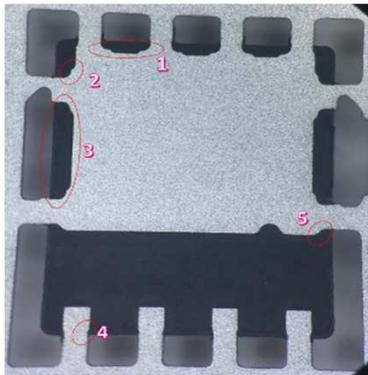
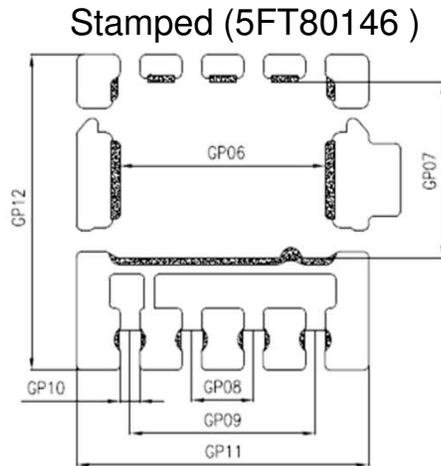
Die pad edge

Lead

Die pad edge

Lead

# Stamped vs Etched Leadframe Comparison 6



# Existing frame vs New one 7

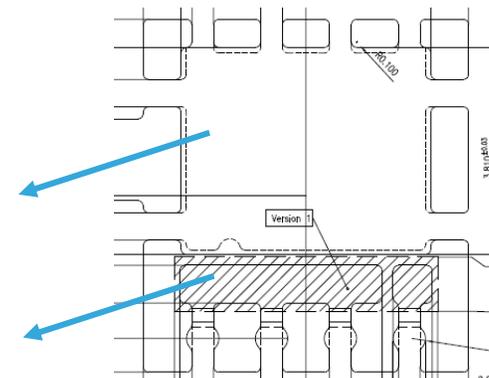
## SEM Image

LF	Lead tip 500X	On die pad 500X	Lead tip 1000X	On die pad 1000X
5FT40060 etched				
5FT80146 stamped				

Note:  
Plating Type = Sel Ni/NiP

On die pad

Lead Tip



# Existing frame vs New one

8

Lead Frame Comparison			
	Existing Frame	New Frame	Comparison
LEADFRAME SUPPLIER	MSHE	MSHE	Same
LOCATION	JAPAN	MALAYSIA	New
LEADFRAME MATERIAL	Hitachi C194	Hitachi C194	Same
LEADFRAME TYPE	Etched	Stamped	New
PLATING TYPE	Sel Ni/NiP	Sel Ni/NiP	Same
LEADFRAME THICKNESS	0.254 mm	0.254 mm	Same
DIE PAD SIZE	4.41 x 3.63 mm	4.22 X 3.625 mm	Smaller

# BOM comparison

## Product Line: 6D4F

Current Bill of Material	
ITEM	MATERIAL
WIRE	Al D3 Mils
RIBBON	Al 30x4mils
RESIN	SUMITOMO EME-E670CA
PREFORM	Pb/Ag/Sn 95.5/2.5/2
FRAME	PFLAT 8L 5x6 Ve1 Se1Ni/NiP <b>Etch</b>



New Bill of Material	
ITEM	MATERIAL
WIRE	Al D3 Mils
RIBBON	Al 30x4mils
RESIN	SUMITOMO EME-E670CA
PREFORM	Pb/Ag/Sn 95.5/2.5/2
FRAME	PFLAT 8L 5x6 Ve1 Se1Ni/NiP <b>Stamp</b>

# Stamped frame on P-FLAT 8L 5x6

## ZVEI Guidelines (AEC-Q101 Rev D)

- According to ZVEI recommendations, the notification is required.

		Assessment of impact on Supply Chain regarding following aspects - contractual agreements - technical interface of processability/manufacturability of customer - form, fit, function, quality performance, reliability		Remaining risks on Supply Chain?	
ID	Type of change	No	Yes		
SBv-PA-03	Change in leadframe dimensions	P	P		
SBv-PA-14	Change in process technology (e.g. sawing, die attach, bonding, molding, plating, trim and form, lead frame preparation)	--	P		

Extract from ZVEI **ZVEI:**  
Die Elektroindustrie

# Selected Test Vehicles

Lot #	Commercial product	Product line	Wafer fab
1	STL120N4F6AG	6D4F	Catania 8"
2	STL120N4F6AG	6D4F	Catania 8"
3	STL120N4LF6AG	6L4F	HHGrace

# Qualification program and Reliability results

Stress (Abrv)	Std ref.	Conditions	Sample Size (S.S)	Steps	Failure/SS		
					Lot 1	Lot 2	Lot 3
TEST	User specification	All qualification parts tested per the requirements of the appropriate device specification.			462	462	462
External visual	JESD22 B-101	All devices submitted for testing			462	462	462
<b>Package oriented tests</b>							
Pre-conditioning	JESD22 A-113	Dryng 24H @ 125°C Store 168H @ TA=85°C,RH=85% IR Reflow @ 260°C 3 times	All devices to be subjected to H3TRB, TC, AC, IOL	FINAL	Pass	Pass	Pass
TC	JESD22 A-104	TA=-55°C TO 150°C	231	1000cy	0/77	0/77	0/77
TCHT		125°C TEST after TC	231		0/77	0/77	0/77
TCDT	JESD22 A-104 Appendix 6	decap and wire pull for parts with internal bond wire sizes 5 mil diameter and less	15		0/5	0/5	0/5
		100% C-SAM inspection after TC	231		pass	pass	pass
AC	JESD22 A-102	TA=121°C ; PA=2ATM	231	96H	0/77	0/77	0/77
H3TRB	JESD22 A-101	TA=85°C ; RH=85% BIAS= 32V	154	1000H	0/77	0/77	
		TA=85°C ; RH=85% BIAS= 24V	77				0/77
IOL	MIL-STD-750 Method 1037	$\Delta T_j \geq 100^\circ\text{C}$	231	15Kcy	0/77	0/77	0/77
D.P.A.	AEC-Q101-004 Section 4	Devices after H3TRB - TC	8		0/2 0/2		0/2 0/2
Solderability	JESD22B-102		20		0/10		0/10
Physical Dimension	JESD22 B-100		60		0/30		0/30
Thermal Resistance	JESD24-3, 24-4, 24-6 as appropriate		20		0/10		0/10
Die Shear	MIL-STD-750 Method 2017		10		0/5		0/5



- The whole Qualification program was completed and all reliability stress tests shown positive results. Neither functional nor parametric rejects were detected at final electrical testing.
- Parameter drift analysis, performed on samples submitted to die and package oriented test showed a good stability on the main electrical monitored parameters. Package oriented tests have not put in evidence any critical area.

The migration of PowerFlat™ 8L 5x6 production from MSHE (Japan) etched matrix frame to MSHE (Malaysia) Stamped one will assure :

- The same previous package performances, as demonstrated by the qualification data provided in the previous pages.

## PRODUCT/PROCESS CHANGE NOTIFICATION

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'8JY5 HLUW 'A Yh cX' bHfcXi Wjcb'fD: @ H'DfcXi Wjg'5I HCA CHJ9Ł'

<p>AD57H98' DFC8I 7HG'</p>	<p>STL120N4F6AG STL120N4LF6AG</p>
<p>A5BI : 57HI F-B;' GH9D'</p>	<p>Assembly</p>
<p>BJC@98'D@BH'</p>	<p>ST Shenzhen (China)</p>
<p>7&lt;5B; 9'F95GCB'</p>	<p>Capacity Increase</p>
<p>7&lt;5B; 9' 89G7F-DHC'B'</p>	<p>New lead frame and die attach method has been qualified for STL120N4F6AG and STL120N4LF6AG:</p> <ul style="list-style-type: none"> <li>- Change Description</li> <li>- ZVEI guidelines ID</li> <li>- Leadframe comparison</li> <li>- BOM (Bill Of Material) comparison</li> </ul> <p>available on 12005 Detailed Description.pdf enclosed to this communication</p>
<p>HF57956=C'HM'</p>	<p>Dedicated Finished Good Codes</p>
<p>J5 @85H-CB'</p>	<p>Qualification report enclosed in this communication</p> <p>12089 Validation.pdf</p>
<p>G5AD@G'</p>	<p>Available on demand</p>
<p>AD@A9BH5H-CB'</p>	<p>From Q2/2020 we are ready to implement the change upon Customer agreement</p>



## Public Products List

Public 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

**PCN Title :** STL120N4F6AG, STL120N4LF6AG (6D4F, 6L4F): New Lead-frame and Die Attach Method Introduction (PFLAT Products AUTOMOTIVE)

**PCN Reference :** ADG/20/12005

**Subject :** Public Products List

Dear Customer,

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

STL120N4F6AG	STL120N4LF6AG	
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**Reliability evaluation for**  
*New L/F stamped on PowerFLAT™ 5x6 8L single island WF packages with NiNiP lead finishing manufactured in ST Shenzhen (China)*  
**AUTOMOTIVE**  
*Process change*

General Information	
<b>Commercial Product</b>	: STL120N4F6AG STL86N3LLH6AG
<b>Product Line</b>	: 6D4FA1 6L3CA1
<b>Product Description</b>	: Power MOSFET
<b>Package</b>	: PowerFLAT 5x6 WF
<b>Silicon Technology</b>	: STripFET VI
<b>Division</b>	: <i>Power Transistor Division</i>

Traceability	
<b>Diffusion Plant</b>	: CT 8" (Catania Italy) HHGrace (China)
<b>Assembly Plant</b>	: ST Shenzhen (China)
<b>Reliability Lab</b>	: Catania (Italy)
Reliability Assessment	
<b>Passed</b>	<input checked="" type="checkbox"/>

**Disclaimer:** this report is a summary of the qualification plan results performed in good faith by STMicroelectronics to evaluate the electronic devices conformance to its specific mission profile. This report and its contents shall not be disclosed to a third party, except in full, without previous written agreement by STMicroelectronics or under the approval of the author (see below)

### REVISION HISTORY

Version	Date	Author	Changes description
1.0	6 February 2020	A.SETTINIERI	FINAL REPORT

**APPROVED BY:**  
 Corrado CAPPELLO  
 ADG Q&R department - Catania  
 STMicroelectronics

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## 1. RELIABILITY EVALUATION OVERVIEW

### 1.1 Objective

Reliability evaluation for New L/F stamped on PowerFLAT™ 5x6 8L single island WF packages with NiNiP lead finishing manufactured in ST Shenzhen (China)

### 1.2 Reliability Test Plan

Reliability tests performed on this device are in agreement with ZVEI / Q101 guidelines and are listed in the Test Plan. For details on test conditions, generic data used and spec reference see test results summary at Par.3 .

#	Stress	Abrv	Reference	Data type	Test flag	Comments
1	Pre and Post-Stress Electrical Test	TEST	User specification or supplier's standard Specification	1	Y	
2	External Visual	EV	JESD22B-101	1	Y	
3	Pre-conditioning	PC	JESD22A-113	1	Y	
4	Temperature Cycling	TC	JESD22A-104	1	Y	
4a	Temperature Cycling Hot Test	TCHT	JESD22A-104	1	Y	
4a alt	TC Delamination Test	TCDT	JESD22A-104	1	Y	
5	Autoclave	AC	JESD22A-102	1	Y	
6	High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	1	Y	
7	Intermittent Operational Life / Thermal Fatigue	IOL / TF	MIL-STD-750 Method 1037	1	Y	
8	Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	1	Y	
9	Solderability	SD	JESD22B-102	2	Y	
10	Physical Dimension	PD	JESD22B-100	2	Y	
11	Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	3	Y	
12	Die Shear	DS	MIL-STD-750 Method 2017	3	Y	

### 1.3 Conclusion

All reliability tests have been completed with positive results. Neither functional nor parametric rejects were detected at final electrical testing.  
 Parameter drift analysis performed on samples submitted to die and package oriented test showed a good stability of the main electrical monitored parameters.  
 Package oriented tests have not put in evidence any criticality.

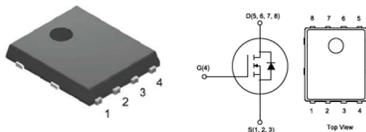
On the basis of the overall results obtained, we can give a positive judgment on the reliability evaluation for New L/F stamped on PowerFLAT™ 5x6 8L single island WF packages with NiNiP lead finishing on STL120N4F6AG and STL120N4F6AG Automotive product assembled in ST Shenzhen (China) in agreement with ZVEI / Q101 guidelines

## 2. DEVICE/TEST VEHICLE CHARACTERISTICS

### 2.1 Generalities

Power MOSFET STripFET VI

### 2.2 Pin Connection



### 2.3 Traceability

Reference “Product Baseline” document if existing, else provide following chapters/information:

**D.U.T.: STL120N4F6AG**

**PACKAGE: PowerFLAT 5x6 WF**

Wafer fab information	
Wafer fab manufacturing location	CT 8” (Catania - Italy)
Technology	STripFET VI
Process family	PowerMOSFET
Die finishing back side	Ti-NiV-Au
Die size	2540 x 3860 μm <sup>2</sup>
Bond pad metallization layers	AlSiCu
Passivation type	TEOS+SiN (Nitride)
Metal levels/Materials	1/AlCu

Assembly Information	
Assembly plant location	ST Shenzhen (China)
Package code description	PowerFLAT 5x6 WF
Lead frame/Substrate	FRAME PFLAT 8L 5x6
Die attach material	PREFORM Pb/Ag/Sn (with solder writing process)
Wires bonding materials/diameters	Gate: Al/Mg 3 mils - Source: RIBBON Al 30x4 mils
Molding compound	Halogen Present

**D.U.T.: STL86N3LLH6AG**

**PACKAGE: PowerFLAT 5x6 WF**

<b>Wafer fab information</b>	
Wafer fab manufacturing location	HHGrace
Technology	STripFET VI
Process family	PowerMOSFET
Die finishing back side	Ti-NiV-Au
Die size	1820 x 2500 $\mu\text{m}^2$
Bond pad metallization layers	AlSiCu
Passivation type	TEOS+SiN (Nitride)
Metal levels/Materials	1/AlCu

<b>Assembly Information</b>	
Assembly plant location	ST Shenzhen (China)
Package code description	PowerFLAT 5x6 WF
Lead frame/Substrate	FRAME PFLAT 8L 5x6
Die attach material	PREFORM Pb/Ag/Sn
Wires bonding materials/diameters	Gate: Al/Mg 3 mils - Source: RIBBON Al 30x4 mils
Molding compound	Halogen Present

<b>Reliability Testing Information</b>	
Reliability laboratory location	Catania (Italy)
Electrical testing location	Catania (Italy)

### 3. TESTS RESULTS SUMMARY

#### 3.1 Lot Information

Lot #	Commercial Product	Product line	Package	Wafer Fab	Assembly plant	Note
1	STL120N4F6AG	6D4FA1	PowerFLAT 5x6 WF	CT8” (Catania-Italy)	ST Shenzhen (China)	
2				HHGrace (Subcontractor)		
3	STL86N3LLH6AG	6L3CA1				

#### 3.2 Test results summary

Stress (Abrv)	Std ref.	Conditions	Sample Size (S.S)	Steps	Failure/SS		
					Lot 1	Lot 2	Lot 3
<b>TEST</b>	User specification	All qualification parts tested per the requirements of the appropriate device specification.			462	462	462
<b>External visual</b>	JESD22 B-101	All devices submitted for testing			462	462	462
<b>Package oriented tests</b>							
<b>Pre-conditioning</b>	JESD22 A-113	Dryng 24H @ 125°C Store 168H @ TA=85°C, RH=85% IR Reflow @ 260°C 3 times	All devices to be subjected to H3TRB, TC, AC, IOL	FINAL	Pass	Pass	Pass
<b>TC</b>	JESD22 A-104	TA=-55°C TO 150°C	231	1000cy	0/77	0/77	0/77
<b>TCHT</b>		125°C TEST after TC	231		0/77	0/77	0/77
<b>TCDT</b>	JESD22 A-104 Appendix 6	decap and wire pull for parts with internal bond wire sizes 5 mil diameter and less	15		0/5	0/5	0/5
		100% C-SAM inspection after TC	231		pass	pass	pass
<b>AC</b>	JESD22 A-102	TA=121°C ; PA=2ATM	231	96H	0/77	0/77	0/77
<b>H3TRB</b>	JESD22 A-101	TA=85°C ; RH=85% BIAS= 32V	154	1000H	0/77	0/77	
		TA=85°C ; RH=85% BIAS= 24V	77				0/77
<b>IOL</b>	MIL-STD-750 Method 1037	ΔTj≥100°C	231	15Kcy	0/77	0/77	0/77
<b>D.P.A.</b>	AEC-Q101-004 Section 4	Devices after H3TRB - TC	8		0/2 0/2		0/2 0/2
<b>Solderability</b>	JESD22B-102		20		0/10		0/10
<b>Physical Dimension</b>	JESD22 B-100		60		0/30		0/30
<b>Thermal Resistance</b>	JESD24-3, 24-4, 24-6 as appropriate		20		0/10		0/10
<b>Die Shear</b>	MIL-STD-750 Method 2017		10		0/5		0/5