


**PRODUCT / PROCESS CHANGE NOTIFICATION**

**1. PCN basic data**

1.1 Company		STMicroelectronics International N.V
1.2 PCN No.	ADG/20/12376	
1.3 Title of PCN	Qualification of STPS5L60U in SMB package at Assembly/Test location in China	
1.4 Product Category	STPS5L60U	
1.5 Issue date	2020-10-06	

**2. PCN Team**

<b>2.1 Contact supplier</b>	
2.1.1 Name	ROBERTSON HEATHER
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2.1.3 Email	heather.robertson@st.com
<b>2.2 Change responsibility</b>	
2.2.1 Product Manager	Stephane CHAMARD
2.1.2 Marketing Manager	Philippe LEGER
2.1.3 Quality Manager	Jean-Paul REBRASSE

**3. Change**

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Transfer	Line transfer for a full process or process brick (process step, control plan, recipes) from one site to another site: Assembly site (SOP 2617)	assy site Morocco (ST) and assy site China (subco)

**4. Description of change**

	Old	New
4.1 Description	Assy and test at ST backend in Morocco	Assy and test at subco in China
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	no	

**5. Reason / motivation for change**

5.1 Motivation	In the frame of the back-end locations management, ST has initiated a transfer of STPS5L60U in SMB package from its internal plant (Morocco) to back-end partners. This assembly and test plant in China is a subcontractor already qualified and delivering in high volume for ST on SMB package line.
5.2 Customer Benefit	MANUFACTURING FLEXIBILITY

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

6.1 Description	marking, internal codification, QA number
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**7. Timing / schedule**

7.1 Date of qualification results	2020-09-24
7.2 Intended start of delivery	2020-11-16
7.3 Qualification sample available?	Upon Request

**8. Qualification / Validation**

8.1 Description			
8.2 Qualification report and qualification results	In progress	Issue Date	

9. Attachments (additional documentations)		
12376 Public product.pdf 12376 Qualification of SMB package at Assembly Test location in China.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
	STPS5L60U	

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## 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 :** Qualification of STPS5L60U in SMB package at Assembly/Test location in China

**PCN Reference :** ADG/20/12376

**Subject :** Public Products List

Dear Customer,

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

STPS5L60U		
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(1) ADG: Automotive and Discretes Group

<h2 style="margin: 0;">PCN</h2> <h3 style="margin: 0;">Product/Process Change Notification</h3>			
<b>Qualification of STPS5L60U in SMB package at Assembly/Test location in China</b>			
<b>Notification number:</b>	ADG-DFD/20/12376	<b>Issue Date</b>	2020 Oct 5th
<b>Issued by</b>	Muriel NINA		
<b>Product series affected by the change</b>		STPS5L60U	
<b>Type of change</b>		Assy and Test line transfer	
<b>Description of the change</b>  STMicroelectronics is qualifying STPS5L60U in SMB package at subcontractor in China.			
<b>Reason for change</b>  In the frame of the back-end locations management, ST has initiated a transfer of STPS5L60U in SMB package from its internal plant (Morocco) to back-end partners. This assembly and test plant in China is a subcontractor already qualified and delivering in high volume for ST on SMB package line.			
<b>Former versus changed product:</b>		The changed products will remain fully compliant with product datasheet in term of electrical, dimensional or thermal parameters.  The Moisture Sensitivity Level of the part (according to the IPC/JEDEC JSTD-020D standard) remains unchanged.  The footprint recommended by ST remains the same.  There is no change in the packing modes and the standard delivery quantities either.  The products remain in full compliance with the ST ECOPACK®2 grade ("halogen-free").	
<b>Disposition of former products</b>  As communicated in Corporate PCI 11964, ST Morocco SMB production line discontinuation will occur in W48-2020. Units manufactured at ST Morocco will be delivered till stock depletion.			

(1) ADG: Automotive and Discretes Group

## Marking and traceability

Parts produced in China are differentiated by their **marking** as indicated below

Assembly location	Assy plant code	Plant and date code	
		Assy year	Assy week
Morocco (ST)	CZ (on label) Z (on unit)	Y (1 digit indicating the year)	WW (2 digits indicating the week number)
<b>China (subco)</b>	<b>GP (on label)</b> <b>GP (on unit)</b>		

**Traceability** for the implemented change will be ensured by an **internal codification (finish good)** and by the **Q.A. number**.

**Qualification complete date**

2020 week 40

## Forecasted sample availability

All qualification samples are available on request.

## Change implementation schedule

Sales types	Estimated production start	Estimated first shipments
<b>STPS5L60U</b>	<b>W43-2020</b>	<b>W47-2020</b>

**Comments:**

## Customer's feedback

Please contact your local ST sales representative or quality contact for requests concerning this change notification.

Absence of acknowledgement of this PCN within 30 days of receipt will constitute acceptance of the change

Absence of additional response within 90 days of receipt of this PCN will constitute acceptance of the change

**Qualification program and results**

20064QRP

## Reliability Evaluation Report

### *Qualification of STPS5L60U in China Subcontractor*

General Information		Locations	
Product Line	<i>Rectifiers</i>	Wafer fab	<i>ST SINGAPORE</i>
Product Description	<i>Power Schottky rectifiers</i>	Assembly plant	<i>ST Subcontractor 9941 - CHINA</i>
Product perimeter	<i>STPS5L60U</i>	Reliability Lab	<i>ST TOURS - FRANCE</i>
Product Group	<i>ADG</i>		
Product division	<i>Discrete &amp; Filter</i>		
Package	<i>SMB</i>		
Maturity level step	<i>QUALIFIED</i>	Reliability assessment	<i>PASS</i>

#### DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	24-Sept-2020	10	Christophe GOIN	Julien MICHELON	Initial release

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.

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## 1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD 47	Stress-Test-Driven Qualification of Integrated Circuits
JESD 94	Application specific qualification using knowledge based test methodology
JESD 22	Reliability test methods for packaged devices
MIL-STD-750C	Test method for semiconductor devices
AEC-Q005	Pb-Free Test Requirements

## 2 GLOSSARY

SS	Sample Size
PC	Pre-Conditioning
HTRB	High Temperature Reverse Bias
TC	Temperature Cycling
H3TRB	High Humidity High Temperature Reverse Bias
IOLT	Intermittent Operating Life Test
UHASt	Unbiased Highly Accelerated Stress Test
DPA	Destructive Physical Analysis (after TC and THB)
GD	Generic Data
SD	Solderability test
RSH	Resistance to Soldering Heat
THS	Temperature Humidity Storage

### **3 RELIABILITY EVALUATION OVERVIEW**

#### **3.1 Objectives**

The objective of this report is to qualify STPS5L60U product, a Power Schottky diode housed in SMB package, manufactured in a subcontractor located in China.

The involved products are listed in the table here below:

Product	Product Family	Package	Assembly Location
STPS5L60U	POWER SCHOTTKY	SMB	Subcontractor – CHINA (9941)

The reliability test methodology used follows the JESD47: « Stress Test driven Qualification Methodology ».

The following reliability tests ensuing are:

- TC and IOLT to ensure the mechanical robustness of the products.
- HTRB to evaluate the risk of contamination from the resin and the assembly process versus the die layout sensitivity.
- H3TRB, UHAST to check the robustness to corrosion and the good package hermeticity.
- RSH and Solderability to check compatibility of package with customer assembly.

For some tests, similarity methodology is used. See 5.1 “comments” for more details about similarities.

#### **3.2 Conclusion**

Qualification Plan requirements have been fulfilled without exception. Reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the robustness of the products and safe operation, which is consequently expected during their lifetime.

## 4 DEVICE CHARACTERISTICS

### 4.1 Device description

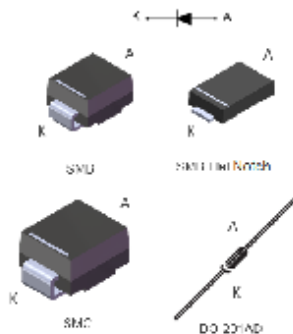
ST specification:



## STPS5L60

Datasheet

5 A - 60 V power Schottky rectifier



### Features

- Negligible switching losses
- Low forward voltage drop
- Low thermal resistance
- Avalanche rated
- ECOPACK2 component

### Applications

- Lighting
- Battery charger
- Set-top box
- DC / DC converter
- Notebook adapter
- Switching diode

### Description

Axial and surface mount power Schottky rectifier suited for switch mode power supplies and high frequency dc to dc converters.

Packaged in DO-201AD, SMB, SMC and SMB Flat Notch, this device is intended for use in low voltage, high frequency inverters and small battery chargers and for applications where there are space constraints, for example telecom battery charger.

Product status	
STPS5L60	
Product summary	
Symbol	Value
$I_{F(AV)}$	5 A
$V_{RRM}$	60 V
$T_J(max.)$	150 °C
$V_{F(typ.)}$	0.42 V

## 4.2 Construction Note

	STPS5L60U
<b>Wafer/Die fab. information</b>	
Wafer fab manufacturing location	ST SINGAPORE
Technology / Process family	Power Schottky Rectifier
<b>Wafer Testing (EWS) information</b>	
Electrical testing manufacturing location	ST SINGAPORE
<b>Assembly information</b>	
Assembly site	Subcontractor – CHINA
Package description	SMB CLIP
<b>Final testing information</b>	
Testing location	Subcontractor – CHINA

## **5 TESTS RESULTS SUMMARY**

### **5.1 Test vehicles**

<b>Lot #</b>	<b>Part Number</b>	<b>Package</b>	<b>Comments</b>
L1	STPS5L60U	SMB	Qualification lot
GD1	Generic data	SMB	Generic data for uHAST on SMB package
GD2	Generic data	SMB	Generic data for solderability on SMB package
GD3	Generic data	SMB	Generic data for Tin whiskers on SMB package

Detailed results in below chapter will refer to these references.

## 5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.			
						Lot 1	GD 1	GD 2	GD 3
Die Oriented Tests									
Pre and Post Electrical Test			I <sub>R</sub> , V <sub>F</sub> parameters following product datasheet	77	-	0/77			
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=75°C Voltage=48V	77	1000h	0/77			
Parametric Verifications	N	ST datasheet	Over part temperature range	60	-	Refer to paragraph 6.1 in Annexes			
Package Oriented Tests									
Physical dimensions	N	JESD22B-100		30	-	Refer to paragraph 6.2 in Annexes			
Pre and Post Electrical Test			I <sub>R</sub> , V <sub>F</sub> parameters following product datasheet	368	-	0/368			
TC	N	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-65°C	77	500cy	0/77			
H3TRB	N	JESD22-A101	Humidity (HR)=93% Temperature=60°C Voltage=48V	77	1000h	0/77			
UHASt	N	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	77	96h		0/77		
IOLT	N	MIL-STD 750 Method 1037	Delta Tj=125°C Intensity (If)=3.15A Time (off)=120s Time (on)=120s	77	500h	0/77			
RSH	N	JESD22A-111	Temperature=260°C Time (on)=10s	30	-	0/30			
SD	Y	J-STD-002 JESD22 B-102	Wet ageing SnPb bath 220°C	30	-			0/15	
			Dry ageing SnPb bath 220°C	30	-			0/15	
			Wet ageing SnAgCu bath 245°C	30	-			0/15	
			Dry ageing SnAgCu bath 245°C	30	-			0/15	
Whiskers	Y	AEC-Q005 JESD201	Pb free reflow TC -55°C / +85°C	18	1500cy				0/18
			Pb free reflow THS 30°C / RH = 60%	18	4000h				0/18
			Pb free reflow THS 55°C / RH = 85%	18	4000h				0/18
			No reflow TC -55°C / +85°C	18	1500cy				0/18
			No reflow THS 30°C / RH = 60%	18	4000h				0/18
			No reflow THS 55°C / RH = 85%	18	4000h				0/18
			SnPb reflow TC -55°C / +85°C	18	1500cy				0/18
			SnPb reflow THS 30°C / RH = 60%	18	4000h				0/18
SnPb reflow THS 55°C / RH = 85%	18	4000h				0/18			

## 6 ANNEXES

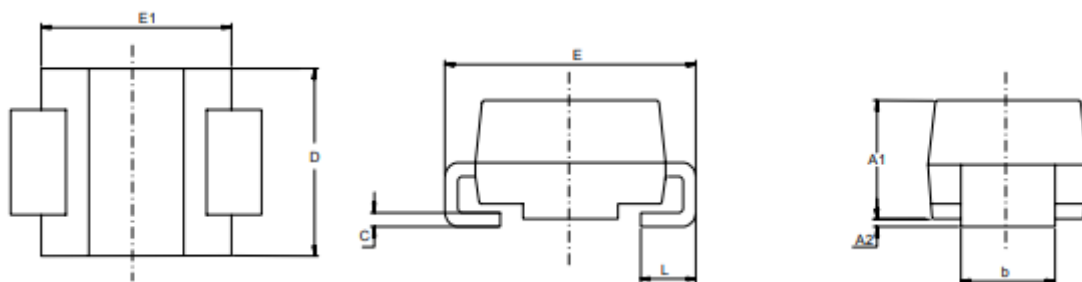
### 6.1 Parametric Verifications

Results on STPS5L60U product:

TEST	VBR	IR	IR	IR	IR	VF	VF	VF
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	25oC	25oC	100oC	110oC	125oC	25oC	100oC	125oC
Condition 2		VR=60V	VR=60V	VR=60V	VR=60V	IF=5A	IF=5A	IF=5A
Min. Datasheet	60V							
Typ. Datasheet			10mA	25mA	40mA	0.47V	0.43V	0.42V
Max. Datasheet		220uA	25mA	55mA	100mA	0.52V	0.49V	0.48V
UNIT	V	uA	uA	uA	uA	V	V	V
N	60	60	60	60	60	60	60	60
Min	68.480	81.530	8.981	14.730	0.031	0.450	0.405	0.392
Max	76.320	122.700	12.200	20.600	0.043	0.481	0.453	0.443
Avg	74.021	101.182	10.185	17.130	0.036	0.467	0.433	0.422

### 6.2 Physical Dimensions

SMB Package outline:



Reference	A1	A2	b	c	D	E	E1	L
Min. Datasheet	1.90	0.05	1.95	0.15	3.30	5.10	4.05	0.75
Max. Datasheet	2.45	0.20	2.20	0.40	3.95	5.60	4.60	1.50
Unit	mm	mm	mm	mm	mm	mm	mm	mm
N	30	30	30	30	30	30	30	30
Min	2.16	0.10	2.01	0.26	3.48	5.34	4.49	0.96
Max	2.22	0.14	2.06	0.28	3.50	5.39	4.53	1.11
Avg	2.19	0.12	2.04	0.27	3.49	5.36	4.51	1.04



## 6.3 Tests description

Test name	Description	Purpose
<b>Die Oriented</b>		
<b>HTRB</b> High Temperature Reverse	The diode is biased in static reverse mode at targeted junction temperature.	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices operating condition in an accelerated way. To maximize the electrical field across either reverse-biased junctions or dielectric layers, in order to investigate the failure modes linked to mobile contamination, oxide ageing, layout sensitivity to surface effects.
<b>Package Oriented</b>		
<b>H3TRB</b> Temperature Humidity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.
<b>TC</b> 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.
<b>UHASt</b> Unbiased Highly Accelerated Stress Test	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.
<b>IOLT</b> Intermittent Operating Life Test	All test samples shall be subjected to the specified number of cycles. When stabilized after initial warm-up cycles, a cycle shall consist of an "on" period, when power is applied suddenly to the device for the time necessary to achieve a delta case temperature (delta is the high minus the low mounting surface temperatures) of +85°C (+60°C for thyristors) +15°C, -5°C, followed by an off period, when the power is suddenly removed, for cooling the case through a similar delta temperature.	The purpose of this test is to determine compliance with the specified numbers of cycles for devices subjected to the specified conditions. It accelerates the stresses on all bonds and interfaces between the chip and mounting face of devices subjected to repeated turn on and off of equipment and is therefore most appropriate for case mount style (e.g., stud, flange, and disc) devices.
<b>RSH</b> Resistance to Solder Heat	Package is dipped by the leads in a solder bath after initial wet ageing (for SMDs only). Assessment by electrical test + no external crack	To simulate wave soldering process and verify that package will not be thermally damaged during this step.
<b>SD</b> Solderability	The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder.	This evaluation is made on the basis of the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish.
<b>Whiskers</b>	Forced growing of Tin Whiskers by various kind of environmental stress: temperature, moisture and temperature cycling.	To ensure no risk of electrical short due to Tin Whisker growth.