

## PRODUCT / PROCESS CHANGE NOTIFICATION

### 1. PCN basic data

1.1 Company		STMicroelectronics International N.V
1.2 PCN No.		ADG/21/13171
1.3 Title of PCN		Qualification of new assembly line for SMB Flat 2 leads wire package at ST Bouskoura in Morocco
1.4 Product Category		STPS3H100UFY STTH110UFY STTH112UFY STTH1L06UFY STTH1R06UFY STTH208UFY STTH2L06UFY STTH2R06UFY STTH310UFY STTH3L06UFY STTH3R06UFY
1.5 Issue date		2021-12-23

### 2. PCN Team

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2.2.2 Marketing Manager	Philippe LEGER
2.2.3 Quality Manager	Jean-Paul REBRASSE

### 3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Machines	(Not Defined)	ST Bouskoura in Morocco

### 4. Description of change

	Old	New
4.1 Description	Assembly line in ST Bouskoura (Morocco)	New assembly line for SMB Flat 2 leads wire at same Back-End plant (ST Bouskoura) in Morocco. With this new line, the manufacturing process will be enhanced with conversion to Pb-free based Die-attach material and with package outline optimization.
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No	

### 5. Reason / motivation for change

5.1 Motivation	With this additional line investment, STMicroelectronics will increase its production capacity to better serve its customers through service improvement and lead time reduction. To ease report on boards at customers side, ST is proposing package outline optimization with wettable leads termination and notch on package back side.
5.2 Customer Benefit	CAPACITY INCREASE

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

6.1 Description	Traceability of the change will be ensured by Finished Good/Type print on carton labels.
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### 7. Timing / schedule

7.1 Date of qualification results	2021-12-20
7.2 Intended start of delivery	2022-06-03

7.3 Qualification sample available?	Upon Request
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8. Qualification / Validation			
8.1 Description	13171 21077QRP.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2021-12-23

9. Attachments (additional documentations)			
13171 Public product.pdf 13171 SMB Flat 2L wire Morocco.pdf 13171 21077QRP.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
	STPS3H100UFY	
	STTH110UFY	
	STTH112UFY	
	STTH1L06UFY	
	STTH1R06UFY	
	STTH208UFY	
	STTH2L06UFY	
	STTH2R06UFY	
	STTH310UFY	
	STTH3L06UFY	
	STTH3R06UFY	

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# Qualification Report

## Qualification of new assembly line

### SMB Flat 2 leads wire package at ST Bouskoura

General Information		Locations	
Product Line	Rectifiers	Wafer fab	ST SINGAPORE ST TOURS - FRANCE
Product Description	Power Schottky and Ultrafast Diodes	Assembly plant	ST BOUSKOURA - MOROCCO
Product perimeter	STPS3H100UFY, STTH208UFY, STTH110UFY, STTH112UFY, STTH1L06UFY, STTH1R06UFY, STTH2L06UFY, STTH2R06UFY, STTH3L06UFY, STTH3R06UFY, STTH310UFY	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	
Product division	Discrete & Filter	PASS	
Package	SMB Flat		
Maturity level step	QUALIFIED		

## DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Dec-2021	17	Christophe GOIN	Aude DROMEL	Initial release. Linked to PCN 13171.

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
<b>AEC-Q101 Rev.E</b>	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications
<b>AEC-Q006</b>	Qualification Requirements For Components Using Copper (Cu) Wire Interconnections
<b>AEC-Q005</b>	Pb-Free Test Requirements
<b>JESD 47</b>	Stress-Test-Driven Qualification of Integrated Circuits
<b>JESD 94</b>	Application specific qualification using knowledge based test methodology
<b>JESD 22</b>	Reliability test methods for packaged devices
<b>MIL-STD-750C</b>	Test method for semiconductor devices

## 2 GLOSSARY

<b>SS</b>	Sample Size
<b>GD</b>	Generic Data
<b>ESD</b>	Electro-Static Discharge
<b>PC</b>	Pre-Conditioning
<b>MSL</b>	Moisture Sensitivity Level
<b>HTRB</b>	High Temperature Reverse Bias
<b>T<sub>j</sub></b>	Junction Temperature
<b>TC</b>	Temperature Cycling
<b>H3TRB</b>	High Humidity High Temperature Reverse Bias
<b>DPA</b>	Destructive Physical Analysis (after TC and H3TRB)
<b>IOLT</b>	Intermittent Operating Life Test
<b>UHAST</b>	Unbiased Highly Accelerated Stress Test
<b>RSH</b>	Resistance to Solder Heat
<b>DS</b>	Die Shear
<b>SD</b>	Solderability tests
<b>WG</b>	Tin Whiskers Growth
<b>BS</b>	Bond Shear
<b>WBS</b>	Wire Bond Strength

### **3 RELIABILITY EVALUATION OVERVIEW**

#### **3.1 Objectives**

The objective of this report is to qualify a new assembly line for rectifiers housed in SMB Flat package (wire) in ST Bouskoura - MOROCCO.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
STPS3H100UFY	Power Schottky Diode	Ultrafast Diode	ST Bouskoura - MOROCCO
STTH110UFY			
STTH112UFY			
STTH1L06UFY			
STTH1R06UFY			
STTH208UFY			
STTH2L06UFY			
STTH2R06UFY			
STTH310UFY			
STTH3L06UFY			
STTH3R06UFY			

The reliability test methodology used follows the JESD47: « Stress Test riven Qualification Methodology », AECQ-101 RevE and AEC-Q006 guidelines.

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.

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.

Reliability tests results are fully compliant with AEC-Q101 RevE and AEC-Q006 standards.

## 4 DEVICE CHARACTERISTICS

### 4.1 Construction Note

STPS3H100UFY	
<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	ST Bouskoura – Morocco
Package description	SMB Flat
Molding compound	ECOPACK®3
Lead finishing	Lead free (Pure Tin)
<b>Final testing information</b>	
Testing location	ST Bouskoura – Morocco

STTHxxxUFY	
<b>Wafer/Die fab. information</b>	
Wafer fab manufacturing location	ST Tours - France
Technology / Process family	Ultrafast Rectifier
<b>Wafer Testing (EWS) information</b>	
Electrical testing manufacturing location	ST Tours - France
<b>Assembly information</b>	
Assembly site	ST Bouskoura – Morocco
Package description	SMB Flat
Molding compound	ECOPACK®3
Lead finishing	Lead free (Pure Tin)
<b>Final testing information</b>	
Testing location	ST Bouskoura – Morocco

## 5 TESTS PLAN

### 5.1 Test vehicles

Lot #	Part Number	Package	Comments
L1	STPS3H100UFY	SMB Flat	Qualification lot 1
L2	STTH112UFY		Qualification lot 2
L3	STTH1L06UFY		Qualification lot 3
L4	STTH310UFY		Qualification lot 4
GD1	STPS3H100UFNY	SMB Flat	Generic data for SD
GD2	Dummies	SMB Flat	Generic data for whiskers

Detailed results in below chapter will refer to these references.

## 5.2 Test plan

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
Pre and Post-Stress Electrical Test	TEST	User specification or supplier's standard specification	All qualification parts tested per the requirements of the appropriate device specification			X
Pre-conditioning	PC	JESD22A-113	All qualification parts tested per the requirements of the appropriate device specification		As per targeted MSL	X
MSL research	MSL	J-STD-020	L1, L2, L3, L4	198		X
External Visual	EV	JESD22B-101	All qualification parts tested per the requirements of the appropriate device specification		Done during Assembly → Test & Finish inspection	X
Parametric Verification	PV	User specification	L1, L2, L3	90		X
High Temperature Storage Life	HTSL	JESD22B-101			Covered by HTRB	
Temperature Humidity Storage	THS	JESD22 A-118			Covered by H3TRB	
High Temperature Gate Bias	HTGB	JESD22A-108			Required for PowerMOSFET – IGBT only.	
High Temperature Reverse Bias	HTRB	JESD22A-108	L1, L2, L4	231		X
High Temperature Forward Bias	HTFB	JESD22A-108			Not required, applicable only to LEDs	
High Temperature Operating Life Test	HTOL	JESD22A-108			Covered by HTRB.	
Steady State Operational	SSOP	MIL-STD-750-1 M1038 Test B			Required for Voltage Regulator (Zener) only.	
AC blocking voltage	ACBV	MIL-STD-750-1 M1040 Test A			Required for Thyristor only.	
Temperature Cycling	TC	JESD22A-104	L1, L2, L3	231		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for PowerMOSFET – IGBT only.	
Temperature Cycling Delamination Test	TCDT	JESD22A-104 J-STD-035			Required for PowerMOSFET – IGBT only.	
Wire Bond Integrity	WBI	MIL-STD-750 Method 2037			For dissimilar metal bonding systems only	
Unbiased Highly Accelerated Stress Test	UHAST	JESD22A-118	L1, L3, L4	231		X
Autoclave	AC	JESD22A-102			Not recommended	
Highly Accelerated Stress Test	HAST	JESD22A-110			Covered by H3TRB	
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	L1, L3, L4	231		X
High Temperature High Humidity Bias	HTHBB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOL / TF	MIL-STD-750 Method 1037	L1, L3, L4	231	For power devices.	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1, L2, L3	90		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1, L2, L3	90		X

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1	4	After H3TRB and TC. For automotive products only	X
Physical Dimension	PD	JESD22B-100	GD	30		X
Terminal Strength	TS	MIL-STD-750 Method 2036			Required for leaded parts only	
Resistance to Solvents	RTS	JESD22B-107			Not applicable for Laser Marking	
Constant Acceleration	CA	MIL-STD-750 Method 2006			Required for hermetic packaged parts only.	
Vibration Variable Frequency	VVF	JESD22B-103			Required for hermetic packaged parts only.	
Mechanical Shock	MS	JESD22 B-104			Required for hermetic packaged parts only.	
Hermeticity	HER	JESD22A-109			Required for hermetic packaged parts only.	
Resistance to Solder Heat	RSH	JESD22 A-111 (SMD) B-106 (PTH)	L3	30	Not applicable for SMD pitch < 0.5mm, package size > 5.5*12.5mm and die paddle > 2.5*3.5mm	X
Solderability	SD	J-STD-002 JESD22B102	GD1	60		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate			Required in case of process change.	
Wire Bond Strength	WBS	MIL-STD-750 Method 2037	L1, L2, L3, L4	120		X
Bond Shear	BS	AEC-Q101-003	L1, L2, L3, L4	120		X
Die Shear	DS	MIL-STD-750 Method 2017	L1, L2, L3, L4	120		X
Unclamped Inductive Switching	UIS	AEC-Q101-004 section 2			Required for Power MOS and internally clamped IGBTs only	
Dielectric Integrity	DI	AEC-Q101-004 section 3			Required for PowerMOSFET – IGBT only.	
Short Circuit Reliability Characterization	SCR	AEC-Q101-006			Required for smart power parts only	
Whisker Growth Evaluation	WG	AEC-Q005 JESD201	GD2	120		X
Early Life Failure Rate	ELFR	JESD74			Recommended for new techno development in case of identified failure mechanism	
Low Temperature Storage	LTS	JESD-22 A119: 209			AQG324 test for Modules	
Thermal shock test	TST	JESD22-A104			AQG324 test for Modules	
Power Cycling (seconds)	PCsec	MIL-STD750-1 Method1037			AQG324 test for Modules	
Power Cycling (minutes)	PCmin	MIL-STD750-1 Method1037			AQG324 test for Modules	
Mechanical shock	MS	IEC 60068-2-27			AQG324 test for Modules	
Vibration	V	IEC60068-2-6			AQG324 test for Modules	

## AEC-Q006 Test requirements For Components Using Copper (Cu) Wire Interconnections

Qualification Step		Stress test		TC		H3TRB		IOLT		HTRB	
		SS	Lots	SS	Lots	SS	Lots	SS	Lots	SS	Lots
T0	CSAM @ T0	3x22	L1, L2, L3	3x22	L1, L2, L4	3x22	L1, L2, L4				
PC	Preconditioning MSL1	3x77	L1, L2, L3	3x77	L1, L2, L4	3x77	L1, L2, L4				
	CSAM	3x22	L1, L2, L3	3x22	L1, L2, L4	3x22	L1, L2, L4				
Stress x1	ATE Test	3x77	L1, L2, L3	3x77	L1, L2, L4	3x77	L1, L2, L4	3x77	L1, L2, L4		
	CSAM	3x22	L1, L2, L3	3x22 <sup>(6)</sup>	-						
	Ball + Stitch/Wedge pull	3x3 <sup>(7)</sup>	-	3x3 <sup>(7)</sup>	-						
	Ball shear	3x3 <sup>(7)</sup>	-	3x3 <sup>(7)</sup>	-						
	Cross section	3x1 <sup>(7)</sup>	-	3x1 <sup>(7)</sup>	-			3x1	L1, L2, L4		
Stress x2	ATE Test	3x70	L1, L2, L3	3x70	L1, L2, L4	3x77	L1, L2, L4	3x76	L1, L2, L4		
	CSAM	3x22	L1, L2, L3	3x22	L1, L2, L4						
	Ball + Stitch/Wedge pull	3x2	L1, L2, L3	3x2	L1, L2, L4						
	Ball shear	3x2	L1, L2, L3	3x2	L1, L2, L4						
	Cross section	3x1	L1, L2, L3	3x1	L1, L2, L4			3x1	L1, L2, L4		

As per AEC-Q006:

(6) Skip this step if you are performing to 2X. Include this step if you are performing per case 5 of Table 2.

(7) If agreed, sample for this test can be set aside unless an issue is found at 2X.

## 5.1 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
Parametric Verifications		ST datasheet	Over part temperature range	90	-	Refer to paragraph 6.1 in Annexes					
ESD		AEC-Q101-001 AEC-Q101-005	HBM CDM	90 90	-	Refer to paragraph 6.1 in Annexes					
Physical Dimension		JESD22B-100	-	30	-	Refer to paragraph 6.2 in Annexes					
External Visual Inspection		JESD22 B-101	-	1185	-	All qualification parts submitted for testing passed External & Visual inspection during manufacturing process					
Pre and Post Electrical Test		ST datasheet	$I_R$ , $V_F$ parameters following product datasheet	1185	-	0/1185					
PC		JESD22 A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	924	-	0/924					
MSL1 research	N	JESD22 A-113	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	198	168h	0/66	0/22	0/66	0/44		
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A AEC-Q006	Junction Temperature=105°C Voltage=100V	77	1000h	0/77					
					CS	0/1					
					2000h	0/76					
					CS	0/1					
			Junction Temperature=145°C Voltage=1200V	77	1000h		0/77				
					CS		0/1				
					2000h		0/76				
					CS		0/1				
			Junction Temperature=140°C Voltage=1000V	77	1000h				0/77		
					CS			0/1			
					2000h				0/76		
					CS				0/1		
TC	Y	JESD22-A104 AEC-Q006	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	231	CSAM T0	0/22	0/22	0/22			
					PC MSL1	0/77	0/77	0/77			
					CSAM PC	0/22	0/22	0/22			
					1000cy	0/77	0/77	0/77			
					CSAM 1kcy	0/22	0/22	0/22			
					2000cy	0/72	0/72	0/72			
					CSAM 2kcy	0/22	0/22	0/22			
					Ball Shear	0/2	0/2	0/2			
					Wire Pull	0/2	0/2	0/2			
					Stitch Pull	0/2	0/2	0/2			
					Cross-section	0/1	0/1	0/1			
			AEC-Q101 DPA after TC		2	-	0/2				

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
H3TRB	Y	JESD22-A101 AEC-Q006	Humidity (HR)=85% Temperature=85°C Voltage=80V	77	CSAM T0	0/22					
					PC MSL1	0/77					
					CSAM PC	0/22					
					1000h	0/77					
					2000h	0/72					
					CSAM 2000h	0/22					
					Ball Shear	0/2					
					Wire Pull	0/2					
					Stitch Pull	0/2					
					Cross-section	0/1					
IOLT	Y	MIL-STD 750 Method 1037 AEC-Q006	Humidity (HR)=85% Temperature=85°C Voltage=100V	154	CSAM T0		0/22	0/22			
					PC MSL1		0/77	0/77			
					CSAM PC		0/22	0/22			
					1000h		0/77	0/77			
					2000h		0/72	0/72			
					CSAM 2000h		0/22	0/22			
					Ball Shear		0/2	0/2			
					Wire Pull		0/2	0/2			
					Stitch Pull		0/2	0/2			
					Cross-section		0/1	0/1			
uHAST	Y	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	231	96h	0/77	0/77	0/77			
RSH	N	JESD22A-111 (SMD)	Temperature=260°C Time (on)=10s	30	-			0/30			

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
DS	N	MIL-STD-750 Method 2017	Post change	120	-	0/30	030	0/30	0/30		
WBS	N	MIL-STD-750 Method 2037	10 bonds from minimum 5 parts	120	-	0/30	030	0/30	0/30		
BS	N	AEC-Q101-003	10 bonds from minimum 5 parts	120	-	0/30	030	0/30	0/30		
SD	N	JESD22 B-102	Steam Ageing SnAgCu 245°C	10	-					0/10	
			Steam Ageing SnPb 220°C	10	-					0/10	
			Dry Ageing SnAgCu 245°C	10	-					0/10	
			Dry Ageing SnPb 220°C	10	-					0/10	
WG	N	AEC-Q005 JESD201	Pb free reflow TC -40°C/85°C	24	-						0/24
			Pb free reflow THS 55°C / RH = 85%	24	-						0/24
			No reflow THS 30°C / RH = 60%	24	-						0/24
			SnPb reflow TC -40°C/85°C	24	-						0/24
			SnPb reflow THS 55°C / RH = 85%	24	-						0/24

## 6 ANNEXES

### 6.1 Parametric Verifications & ESD

Results on STPS3H100UFY product:

TEST	VF	VF	VF	VF	VF	VF	VF	VF	ESD HBM	ESD CDM
EQUIPMENT	TESEC_881TT_TEST292								ESD-CDM	ESS6008
Condition 1	-40°C	-40°C	25°C	25°C	125°C	125°C	150°C	150°C	25°C	25°C
Condition 2	IF=3A	IF=6A	IF=3A	IF=6A	IF=3A	IF=6A	IF=3A	IF=6A		
Condition 3										
Min. Datasheet										
Typ. Datasheet					0.63V	0.71V				
Max. Datasheet			0.84V	0.94V	0.68V	0.80V				
Comments									AEC-Q101	AEC-Q101
UNIT	V	V	V	V	V	V	V	V	KV	KV
N	30	30	30	30	30	30	30	30	30	30
Min	0.867	1.086	0.784	0.875	0.640	0.738	0.602	0.706	>1.0	>8.0
Max	0.889	1.154	0.793	0.884	0.649	0.748	0.612	0.715	>1.0	>8.0
Avg	0.881	1.131	0.789	0.879	0.644	0.744	0.607	0.711		

TEST	IR	IR	IR	IR	VBR	VBR	VBR	VBR	RTH
EQUIPMENT	TESEC_881TT_TEST292								MESU1150
Condition 1	-40°C	25°C	125°C	150°C	-40°C	25°C	125°C	150°C	
Condition 2	VR=100V	VR=100V	VR=100V	VR=100V					
Condition 3									
Min. Datasheet					100V	100V			
Typ. Datasheet			0.4mA						15°C/W
Max. Datasheet		1uA		3.3mA					
Comments									
UNIT		nA	uA	mA	V	V	V	V	°C/W
N	No value due to frost issues	30	30	30	30	30	30	30	10
Min		138.300	249.800	1.059	119.300	127.700	139.100	127.300	9.825
Max		217.600	337.400	1.445	123.000	131.900	144.600	135.500	10.950
Avg		152.710	271.217	1.151	122.190	130.867	143.107	133.630	10.236

Results on STTH1L06UFY product:

TEST	VF	VF	VF	IR	IR	IR
EQUIPMENT	TESEC_881TT_TEST292					
Condition 1	-40°C	24°C	150°C	-40°C	24°C	150°C
Condition 2	IF=1A	IF=1A	IF=1A		VR=600V	VR=600V
Condition 3						
Min. Datasheet						
Typ. Datasheet			0.9V			10uA
Max. Datasheet		1.4V	1.15V	1uA	1uA	75uA
Comments						
UNIT	V	V	V	nA	nA	uA
N	30	30	30	30	30	30
Min	1.220	1.130	0.913	No value due to frost issues	1.629	1.777
Max	1.261	1.169	0.938		7.027	2.257
Avg	1.240	1.148	0.924		3.527	2.019

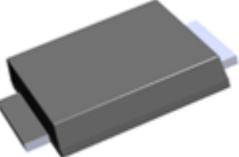
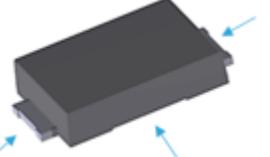
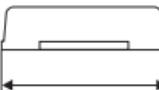
TEST	VBR	VBR	VBR	RTH	ESD HBM	ESD CDM
EQUIPMENT	TESEC_881TT_TEST292					
Condition 1	-40°C	24°C	150°C		25°C	25°C
Condition 2						
Condition 3						
Min. Datasheet	600V	600V	600V			
Typ. Datasheet				21°C/W		
Max. Datasheet						
Comments					AEC-Q101	AEC-Q101
UNIT	V	V	V	°C/W	KV	KV
N	30	30	30	10	30	30
Min	675.900	722.700	794.100	12.030	6	>1
Max	688.400	736.000	813.300	13.240	6	>1
Avg	681.397	728.613	802.787	12.519	6	

Results on STTH112UFY product:

TEST	VF	VF	VF	VF	IR	IR	IR	IR
EQUIPMENT	TESEC_881TT_TEST292							
Condition 1	-40°C	24°C	125°C	150°C	-40°C	24°C	125°C	150°C
Condition 2	IF=1A	IF=1A	IF=1A	IF=1A		VR=1.2kV	VR=1.2kV	VR=1.2kV
Condition 3								
Min. Datasheet								
Typ. Datasheet				1.10V			1uA	
Max. Datasheet		1.900V		1.55V		5.0uA	50uA	
Comments								
UNIT	V	V	V	V	nA	nA	uA	uA
N	30	30	30	30	30	30	30	30
Min	1.417	1.324	1.121	1.077	No value due to frost issues	0.000	1.001	4.647
Max	1.608	1.489	1.224	1.169		125.000	1.659	7.041
Avg	1.534	1.429	1.191	1.140		31.993	1.185	5.496

TEST	VBR	VBR	VBR	VR	RTH	ESD CDM	ESD HBM	
EQUIPMENT	TESEC_881TT_TEST292						ESD-CDM	ESS6008
Condition 1	-40°C	24°C	125°C	150°C		24°C	25°C	
Condition 2								
Condition 3								
Min. Datasheet	1200V	1200V	1200V	1200V				
Typ. Datasheet					20°C/W			
Max. Datasheet								
Comments						AEC-Q101	AEC-Q101	
UNIT	V	V	V	V	°C/W	KV	KV	
N	30	30	30	30	10	30	30	
Min	1330.000	1398.000	1504.000	1506.000	10.580	>1	2	
Max	1448.000	1520.000	1632.000	1631.000	11.290	>1	2	
Avg	1419.267	1490.733	1600.300	1596.567	10.930		2	

## 6.2 Physical Dimensions

Former SMB Flat Package			New SMB Flat Package																																																																																																																		
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## 6.3 Tests description

Test name	Description	Purpose
<b>PC</b> 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.
<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>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>WBS</b> Wire Bond Strength	To apply the specified stress to the bond, lead wire, or terminal.	To measure bond strength, evaluate bond strength distributions, or to determine compliance with specified bond strength requirements of the applicable acquisition document. This test may be applied to the wire-to-die bond, wire-to-substrate bond, or the wire-to-package lead bond inside the package of wire-connected microelectronic devices bonded by soldering, thermo-compression, ultrasonic, or related techniques
<b>BS</b> Bond Shear	This test establishes a procedure for determining the strength of the interface between a gold ball bond and a die bonding surface, or an aluminum wedge/stitch bond and a die or package bonding surface, on either pre-encapsulation or post-encapsulation components. This strength measurement is extremely important in determining two features: 1) the integrity of the metallurgical bond which has been formed. 2) the reliability of gold and aluminum wire bonds to die or package bonding surfaces. This test method can be used only when the ball height and diameter for ball bonds, or the wire height (1.25 mil and larger at the compressed bond area) for wedge/stitch bonds, are large enough and adjacent interfering structures are far enough away to allow suitable placement and clearance (e.g., above the bonding	To check the integrity of the metallurgical bond.

Test name	Description	Purpose
<b>DPA</b> Destructive Physical Analysis	Specific construction analysis on random parts that have successfully completed H3TRB or TC.	To investigate on reliability stresses impact on delamination, corrosion and product construction integrity.
<b>DS</b> Die Shear	A sufficient force to shear the die from its mounting shall be applied to the die.	To establish the integrity of the semiconductor die attachment to the package header or other substrate.
<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>WG</b> Tin Whiskers Growth	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



## 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 new assembly line for SMB Flat 2 leads wire package at ST Bouskoura in Morocco

**PCN Reference :** ADG/21/13171

**Subject :** Public Products List

Dear Customer,

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

STTH2R06UFY	STTH110UFY	STTH112UFY
STTH1R06UFY	STPS3H100UFY	STTH3L06UFY
STTH208UFY	STTH310UFY	STTH1L06UFY
STTH2L06UFY	STTH3R06UFY	



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## **PCN**

### **Product/Process Change Notification**

#### **Qualification of new assembly line for SMB Flat 2 leads wire package**

#### **at ST Bouskoura in Morocco**

<b>Notification number:</b>	ADG/21/13171	<b>Issue Date</b>	23-Dec-2021		
<b>Issued by</b>	Isabelle BALLON				
<b>Product series affected by the change</b>	STPS3H100UFY STTH110UFY STTH112UFY STTH1L06UFY STTH1R06UFY STTH208UFY STTH2L06UFY STTH2R06UFY STTH310UFY STTH3L06UFY STTH3R06UFY				
<b>Type of change</b>	Back-End realization				

#### **Description of the change**

STMicroelectronics is qualifying the transfer of SMB Flat 2 leads wire production activity to a new assembly line at same Back-End plant (ST Bouskoura) in Morocco.

With this new line, the manufacturing process will be enhanced with conversion to Pb-free based Die-attach material and with package outline optimization.

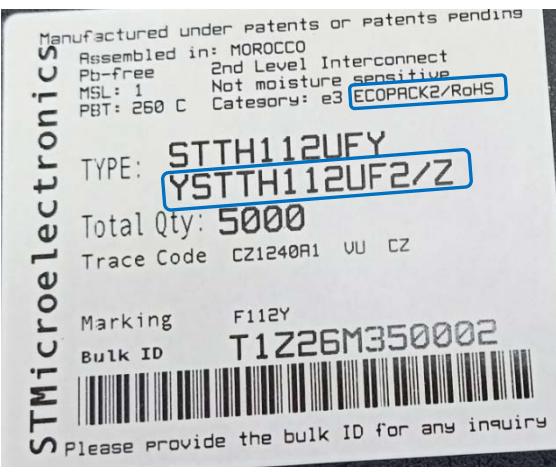
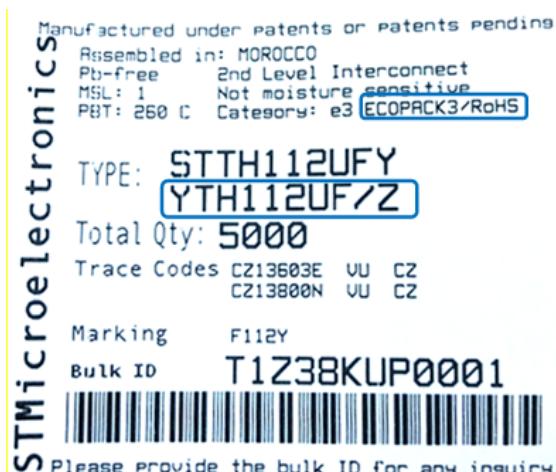
#### **Reason for change**

With this additional line investment, STMicroelectronics will increase its production capacity to better serve its customers through service improvement and lead time reduction.

To ease report on boards at customers side, ST is proposing package outline optimization with wettable leads termination and notch on package back side.

<b>Former versus changed product:</b>	The changed products do not present modified electrical or thermal parameters, leaving unchanged the current information published in the product datasheet.  Package outline modification with wettable leads termination and notch on package back side, keeping unchanged recommended footprint. All products (Former and New) are compliant to a common Package outline.
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(1) ADG: Automotive and Discrete Group

	<p>The Moisture Sensitivity Level of the part (according to the IPC/JEDEC JSTD-020D standard) remains unchanged.</p> <p>There is no change in the packing modes and the standard delivery quantities either.</p> <p>The products are now proposed as ECOPACK®3 grade (Lead-free and Green Molding Compound)</p>
<b>Disposition of former products</b>	
Units manufactured on former line will be delivered till stock depletion.	
<b>Marking and traceability</b>	
Traceability of the change will be ensured by Finished Good/Type print on carton labels.	
<b>Commercial part number/Order code</b>	<b>Former Finished Good/Type</b>
STTHxxxUFY	<b>YSTTHxxxxUFx/Z</b>
STPS3H100UFY	YPS3H100UF <b>6%</b> Z
<b>Former Label</b>	<b>New Label</b>
<b>Example for STTH112UFY</b>	
	
<b>Qualification completion date</b>	Week 51-2021

(1) ADG: Automotive and Discrete Group

### Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Rectifiers	Power Schottky	STPS3H100UFY	Week 10-2022
Rectifiers	Ultrafast	STTH110UFY	Week 10-2022
Rectifiers	Ultrafast	STTH112UFY	Week 10-2022
Rectifiers	Ultrafast	STTH1L06UFY	Week 10-2022
Rectifiers	Ultrafast	STTH1R06UFY	Week 10-2022
Rectifiers	Ultrafast	STTH208UFY	Week 10-2022
Rectifiers	Ultrafast	STTH2L06UFY	Week 10-2022
Rectifiers	Ultrafast	STTH2R06UFY	Week 10-2022
Rectifiers	Ultrafast	STTH310UFY	Week 10-2022
Rectifiers	Ultrafast	STTH3L06UFY	Week 10-2022
Rectifiers	Ultrafast	STTH3R06UFY	Week 10-2022

### Change implementation schedule

Sales-types	Estimated production start	Estimated first shipments
All	Mar-2022	Jun-2022
<b>Comments:</b>		With early PCN acceptance, possible shipment starting W15-2022.
<b>Customer's feedback</b>		
<p>Please contact your local ST sales representative or quality contact for requests concerning this change notification.</p> <p>Absence of acknowledgement of this PCN within 30 days of receipt will constitute acceptance of the change.</p> <p>Absence of additional response within 180 days of receipt of this PCN will constitute acceptance of the change.</p>		
<b>Qualification program</b>		21077QRP Attached

# Qualification Report

## Qualification of new assembly line

### SMB Flat 2 leads wire package at ST Bouskoura

General Information		Locations	
Product Line	Rectifiers	Wafer fab	ST SINGAPORE ST TOURS - FRANCE
Product Description	Power Schottky and Ultrafast Diodes	Assembly plant	ST BOUSKOURA - MOROCCO
Product perimeter	STPS3H100UFY, STTH208UFY, STTH110UFY, STTH112UFY, STTH1L06UFY, STTH1R06UFY, STTH2L06UFY, STTH2R06UFY, STTH3L06UFY, STTH3R06UFY, STTH310UFY	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	
Product division	Discrete & Filter	PASS	
Package	SMB Flat		
Maturity level step	QUALIFIED		

## DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Dec-2021	17	Christophe GOIN	Aude DROMEL	Initial release. Linked to PCN 13171.

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
<b>AEC-Q101 Rev.E</b>	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications
<b>AEC-Q006</b>	Qualification Requirements For Components Using Copper (Cu) Wire Interconnections
<b>AEC-Q005</b>	Pb-Free Test Requirements
<b>JESD 47</b>	Stress-Test-Driven Qualification of Integrated Circuits
<b>JESD 94</b>	Application specific qualification using knowledge based test methodology
<b>JESD 22</b>	Reliability test methods for packaged devices
<b>MIL-STD-750C</b>	Test method for semiconductor devices

## 2 GLOSSARY

<b>SS</b>	Sample Size
<b>GD</b>	Generic Data
<b>ESD</b>	Electro-Static Discharge
<b>PC</b>	Pre-Conditioning
<b>MSL</b>	Moisture Sensitivity Level
<b>HTRB</b>	High Temperature Reverse Bias
<b>T<sub>j</sub></b>	Junction Temperature
<b>TC</b>	Temperature Cycling
<b>H3TRB</b>	High Humidity High Temperature Reverse Bias
<b>DPA</b>	Destructive Physical Analysis (after TC and H3TRB)
<b>IOLT</b>	Intermittent Operating Life Test
<b>UHAST</b>	Unbiased Highly Accelerated Stress Test
<b>RSH</b>	Resistance to Solder Heat
<b>DS</b>	Die Shear
<b>SD</b>	Solderability tests
<b>WG</b>	Tin Whiskers Growth
<b>BS</b>	Bond Shear
<b>WBS</b>	Wire Bond Strength

### **3 RELIABILITY EVALUATION OVERVIEW**

#### **3.1 Objectives**

The objective of this report is to qualify a new assembly line for rectifiers housed in SMB Flat package (wire) in ST Bouskoura - MOROCCO.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
STPS3H100UFY	Power Schottky Diode	Ultrafast Diode	ST Bouskoura - MOROCCO
STTH110UFY			
STTH112UFY			
STTH1L06UFY			
STTH1R06UFY			
STTH208UFY			
STTH2L06UFY			
STTH2R06UFY			
STTH310UFY			
STTH3L06UFY			
STTH3R06UFY			

The reliability test methodology used follows the JESD47: « Stress Test riven Qualification Methodology », AECQ-101 RevE and AEC-Q006 guidelines.

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.

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.

Reliability tests results are fully compliant with AEC-Q101 RevE and AEC-Q006 standards.

## 4 DEVICE CHARACTERISTICS

### 4.1 Construction Note

STPS3H100UFY	
<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	ST Bouskoura – Morocco
Package description	SMB Flat
Molding compound	ECOPACK®3
Lead finishing	Lead free (Pure Tin)
<b>Final testing information</b>	
Testing location	ST Bouskoura – Morocco

STTHxxxUFY	
<b>Wafer/Die fab. information</b>	
Wafer fab manufacturing location	ST Tours - France
Technology / Process family	Ultrafast Rectifier
<b>Wafer Testing (EWS) information</b>	
Electrical testing manufacturing location	ST Tours - France
<b>Assembly information</b>	
Assembly site	ST Bouskoura – Morocco
Package description	SMB Flat
Molding compound	ECOPACK®3
Lead finishing	Lead free (Pure Tin)
<b>Final testing information</b>	
Testing location	ST Bouskoura – Morocco

## 5 TESTS PLAN

### 5.1 Test vehicles

Lot #	Part Number	Package	Comments
L1	STPS3H100UFY	SMB Flat	Qualification lot 1
L2	STTH112UFY		Qualification lot 2
L3	STTH1L06UFY		Qualification lot 3
L4	STTH310UFY		Qualification lot 4
GD1	STPS3H100UFNY	SMB Flat	Generic data for SD
GD2	Dummies	SMB Flat	Generic data for whiskers

Detailed results in below chapter will refer to these references.

## 5.2 Test plan

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
Pre and Post-Stress Electrical Test	TEST	User specification or supplier's standard specification	All qualification parts tested per the requirements of the appropriate device specification			X
Pre-conditioning	PC	JESD22A-113	All qualification parts tested per the requirements of the appropriate device specification		As per targeted MSL	X
MSL research	MSL	J-STD-020	L1, L2, L3, L4	198		X
External Visual	EV	JESD22B-101	All qualification parts tested per the requirements of the appropriate device specification		Done during Assembly → Test & Finish inspection	X
Parametric Verification	PV	User specification	L1, L2, L3	90		X
High Temperature Storage Life	HTSL	JESD22B-101			Covered by HTRB	
Temperature Humidity Storage	THS	JESD22 A-118			Covered by H3TRB	
High Temperature Gate Bias	HTGB	JESD22A-108			Required for PowerMOSFET – IGBT only.	
High Temperature Reverse Bias	HTRB	JESD22A-108	L1, L2, L4	231		X
High Temperature Forward Bias	HTFB	JESD22A-108			Not required, applicable only to LEDs	
High Temperature Operating Life Test	HTOL	JESD22A-108			Covered by HTRB.	
Steady State Operational	SSOP	MIL-STD-750-1 M1038 Test B			Required for Voltage Regulator (Zener) only.	
AC blocking voltage	ACBV	MIL-STD-750-1 M1040 Test A			Required for Thyristor only.	
Temperature Cycling	TC	JESD22A-104	L1, L2, L3	231		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for PowerMOSFET – IGBT only.	
Temperature Cycling Delamination Test	TCDT	JESD22A-104 J-STD-035			Required for PowerMOSFET – IGBT only.	
Wire Bond Integrity	WBI	MIL-STD-750 Method 2037			For dissimilar metal bonding systems only	
Unbiased Highly Accelerated Stress Test	UHAST	JESD22A-118	L1, L3, L4	231		X
Autoclave	AC	JESD22A-102			Not recommended	
Highly Accelerated Stress Test	HAST	JESD22A-110			Covered by H3TRB	
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	L1, L3, L4	231		X
High Temperature High Humidity Bias	HTHBB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOL / TF	MIL-STD-750 Method 1037	L1, L3, L4	231	For power devices.	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1, L2, L3	90		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1, L2, L3	90		X

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1	4	After H3TRB and TC. For automotive products only	X
Physical Dimension	PD	JESD22B-100	GD	30		X
Terminal Strength	TS	MIL-STD-750 Method 2036			Required for leaded parts only	
Resistance to Solvents	RTS	JESD22B-107			Not applicable for Laser Marking	
Constant Acceleration	CA	MIL-STD-750 Method 2006			Required for hermetic packaged parts only.	
Vibration Variable Frequency	VVF	JESD22B-103			Required for hermetic packaged parts only.	
Mechanical Shock	MS	JESD22 B-104			Required for hermetic packaged parts only.	
Hermeticity	HER	JESD22A-109			Required for hermetic packaged parts only.	
Resistance to Solder Heat	RSH	JESD22 A-111 (SMD) B-106 (PTH)	L3	30	Not applicable for SMD pitch < 0.5mm, package size > 5.5*12.5mm and die paddle > 2.5*3.5mm	X
Solderability	SD	J-STD-002 JESD22B102	GD1	60		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate			Required in case of process change.	
Wire Bond Strength	WBS	MIL-STD-750 Method 2037	L1, L2, L3, L4	120		X
Bond Shear	BS	AEC-Q101-003	L1, L2, L3, L4	120		X
Die Shear	DS	MIL-STD-750 Method 2017	L1, L2, L3, L4	120		X
Unclamped Inductive Switching	UIS	AEC-Q101-004 section 2			Required for Power MOS and internally clamped IGBTs only	
Dielectric Integrity	DI	AEC-Q101-004 section 3			Required for PowerMOSFET – IGBT only.	
Short Circuit Reliability Characterization	SCR	AEC-Q101-006			Required for smart power parts only	
Whisker Growth Evaluation	WG	AEC-Q005 JESD201	GD2	120		X
Early Life Failure Rate	ELFR	JESD74			Recommended for new techno development in case of identified failure mechanism	
Low Temperature Storage	LTS	JESD-22 A119: 209			AQG324 test for Modules	
Thermal shock test	TST	JESD22-A104			AQG324 test for Modules	
Power Cycling (seconds)	PCsec	MIL-STD750-1 Method1037			AQG324 test for Modules	
Power Cycling (minutes)	PCmin	MIL-STD750-1 Method1037			AQG324 test for Modules	
Mechanical shock	MS	IEC 60068-2-27			AQG324 test for Modules	
Vibration	V	IEC60068-2-6			AQG324 test for Modules	

## AEC-Q006 Test requirements For Components Using Copper (Cu) Wire Interconnections

Qualification Step		Stress test		TC		H3TRB		IOLT		HTRB	
		SS	Lots	SS	Lots	SS	Lots	SS	Lots	SS	Lots
T0	CSAM @ T0	3x22	L1, L2, L3	3x22	L1, L2, L4	3x22	L1, L2, L4				
PC	Preconditioning MSL1	3x77	L1, L2, L3	3x77	L1, L2, L4	3x77	L1, L2, L4				
	CSAM	3x22	L1, L2, L3	3x22	L1, L2, L4	3x22	L1, L2, L4				
Stress x1	ATE Test	3x77	L1, L2, L3	3x77	L1, L2, L4	3x77	L1, L2, L4	3x77	L1, L2, L4		
	CSAM	3x22	L1, L2, L3	3x22 <sup>(6)</sup>	-						
	Ball + Stitch/Wedge pull	3x3 <sup>(7)</sup>	-	3x3 <sup>(7)</sup>	-						
	Ball shear	3x3 <sup>(7)</sup>	-	3x3 <sup>(7)</sup>	-						
	Cross section	3x1 <sup>(7)</sup>	-	3x1 <sup>(7)</sup>	-			3x1	L1, L2, L4		
Stress x2	ATE Test	3x70	L1, L2, L3	3x70	L1, L2, L4	3x77	L1, L2, L4	3x76	L1, L2, L4		
	CSAM	3x22	L1, L2, L3	3x22	L1, L2, L4						
	Ball + Stitch/Wedge pull	3x2	L1, L2, L3	3x2	L1, L2, L4						
	Ball shear	3x2	L1, L2, L3	3x2	L1, L2, L4						
	Cross section	3x1	L1, L2, L3	3x1	L1, L2, L4			3x1	L1, L2, L4		

As per AEC-Q006:

(6) Skip this step if you are performing to 2X. Include this step if you are performing per case 5 of Table 2.

(7) If agreed, sample for this test can be set aside unless an issue is found at 2X.

## 5.1 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
Parametric Verifications		ST datasheet	Over part temperature range	90	-	Refer to paragraph 6.1 in Annexes					
ESD		AEC-Q101-001 AEC-Q101-005	HBM CDM	90 90	-	Refer to paragraph 6.1 in Annexes					
Physical Dimension		JESD22B-100	-	30	-	Refer to paragraph 6.2 in Annexes					
External Visual Inspection		JESD22 B-101	-	1185	-	All qualification parts submitted for testing passed External & Visual inspection during manufacturing process					
Pre and Post Electrical Test		ST datasheet	$I_R$ , $V_F$ parameters following product datasheet	1185	-	0/1185					
PC		JESD22 A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	924	-	0/924					
MSL1 research	N	JESD22 A-113	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	198	168h	0/66	0/22	0/66	0/44		
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A AEC-Q006	Junction Temperature=105°C Voltage=100V	77	1000h	0/77					
					CS	0/1					
					2000h	0/76					
					CS	0/1					
			Junction Temperature=145°C Voltage=1200V	77	1000h		0/77				
					CS		0/1				
					2000h		0/76				
					CS		0/1				
			Junction Temperature=140°C Voltage=1000V	77	1000h				0/77		
					CS			0/1			
					2000h				0/76		
					CS				0/1		
TC	Y	JESD22-A104 AEC-Q006	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	231	CSAM T0	0/22	0/22	0/22			
					PC MSL1	0/77	0/77	0/77			
					CSAM PC	0/22	0/22	0/22			
					1000cy	0/77	0/77	0/77			
					CSAM 1kcy	0/22	0/22	0/22			
					2000cy	0/72	0/72	0/72			
					CSAM 2kcy	0/22	0/22	0/22			
					Ball Shear	0/2	0/2	0/2			
					Wire Pull	0/2	0/2	0/2			
					Stitch Pull	0/2	0/2	0/2			
					Cross-section	0/1	0/1	0/1			
			AEC-Q101 DPA after TC		2	-	0/2				

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
H3TRB	Y	JESD22-A101 AEC-Q006	Humidity (HR)=85% Temperature=85°C Voltage=80V	77	CSAM T0	0/22					
					PC MSL1	0/77					
					CSAM PC	0/22					
					1000h	0/77					
					2000h	0/72					
					CSAM 2000h	0/22					
					Ball Shear	0/2					
					Wire Pull	0/2					
					Stitch Pull	0/2					
					Cross-section	0/1					
IOLT	Y	MIL-STD 750 Method 1037 AEC-Q006	Humidity (HR)=85% Temperature=85°C Voltage=100V	154	CSAM T0		0/22	0/22			
					PC MSL1		0/77	0/77			
					CSAM PC		0/22	0/22			
					1000h		0/77	0/77			
					2000h		0/72	0/72			
					CSAM 2000h		0/22	0/22			
					Ball Shear		0/2	0/2			
					Wire Pull		0/2	0/2			
					Stitch Pull		0/2	0/2			
					Cross-section		0/1	0/1			
uHAST	Y	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	231	96h	0/77	0/77	0/77			
RSH	N	JESD22A-111 (SMD)	Temperature=260°C Time (on)=10s	30	-			0/30			

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 1	Lot 2	Lot 3	Lot 4	GD1	GD2
DS	N	MIL-STD-750 Method 2017	Post change	120	-	0/30	030	0/30	0/30		
WBS	N	MIL-STD-750 Method 2037	10 bonds from minimum 5 parts	120	-	0/30	030	0/30	0/30		
BS	N	AEC-Q101-003	10 bonds from minimum 5 parts	120	-	0/30	030	0/30	0/30		
SD	N	JESD22 B-102	Steam Ageing SnAgCu 245°C	10	-					0/10	
			Steam Ageing SnPb 220°C	10	-					0/10	
			Dry Ageing SnAgCu 245°C	10	-					0/10	
			Dry Ageing SnPb 220°C	10	-					0/10	
WG	N	AEC-Q005 JESD201	Pb free reflow TC -40°C/85°C	24	-						0/24
			Pb free reflow THS 55°C / RH = 85%	24	-						0/24
			No reflow THS 30°C / RH = 60%	24	-						0/24
			SnPb reflow TC -40°C/85°C	24	-						0/24
			SnPb reflow THS 55°C / RH = 85%	24	-						0/24

## 6 ANNEXES

### 6.1 Parametric Verifications & ESD

Results on STPS3H100UFY product:

TEST	VF	VF	VF	VF	VF	VF	VF	VF	ESD HBM	ESD CDM
EQUIPMENT	TESEC_881TT_TEST292								ESD-CDM	ESS6008
Condition 1	-40°C	-40°C	25°C	25°C	125°C	125°C	150°C	150°C	25°C	25°C
Condition 2	IF=3A	IF=6A	IF=3A	IF=6A	IF=3A	IF=6A	IF=3A	IF=6A		
Condition 3										
Min. Datasheet										
Typ. Datasheet					0.63V	0.71V				
Max. Datasheet			0.84V	0.94V	0.68V	0.80V				
Comments									AEC-Q101	AEC-Q101
UNIT	V	V	V	V	V	V	V	V	KV	KV
N	30	30	30	30	30	30	30	30	30	30
Min	0.867	1.086	0.784	0.875	0.640	0.738	0.602	0.706	>1.0	>8.0
Max	0.889	1.154	0.793	0.884	0.649	0.748	0.612	0.715	>1.0	>8.0
Avg	0.881	1.131	0.789	0.879	0.644	0.744	0.607	0.711		

TEST	IR	IR	IR	IR	VBR	VBR	VBR	VBR	RTH
EQUIPMENT	TESEC_881TT_TEST292								MESU1150
Condition 1	-40°C	25°C	125°C	150°C	-40°C	25°C	125°C	150°C	
Condition 2	VR=100V	VR=100V	VR=100V	VR=100V					
Condition 3									
Min. Datasheet					100V	100V			
Typ. Datasheet			0.4mA						15°C/W
Max. Datasheet		1uA		3.3mA					
Comments									
UNIT		nA	uA	mA	V	V	V	V	°C/W
N	No value due to frost issues	30	30	30	30	30	30	30	10
Min		138.300	249.800	1.059	119.300	127.700	139.100	127.300	9.825
Max		217.600	337.400	1.445	123.000	131.900	144.600	135.500	10.950
Avg		152.710	271.217	1.151	122.190	130.867	143.107	133.630	10.236

Results on STTH1L06UFY product:

TEST	VF	VF	VF	IR	IR	IR
EQUIPMENT	TESEC_881TT_TEST292					
Condition 1	-40°C	24°C	150°C	-40°C	24°C	150°C
Condition 2	IF=1A	IF=1A	IF=1A		VR=600V	VR=600V
Condition 3						
Min. Datasheet						
Typ. Datasheet			0.9V			10uA
Max. Datasheet		1.4V	1.15V	1uA	1uA	75uA
Comments						
UNIT	V	V	V	nA	nA	uA
N	30	30	30	30	30	30
Min	1.220	1.130	0.913	No value due to frost issues	1.629	1.777
Max	1.261	1.169	0.938		7.027	2.257
Avg	1.240	1.148	0.924		3.527	2.019

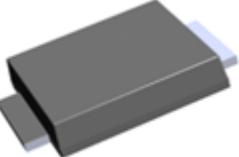
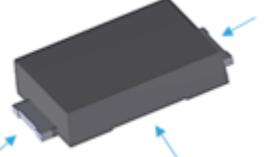
TEST	VBR	VBR	VBR	RTH	ESD HBM	ESD CDM
EQUIPMENT	TESEC_881TT_TEST292					
Condition 1	-40°C	24°C	150°C		25°C	25°C
Condition 2						
Condition 3						
Min. Datasheet	600V	600V	600V			
Typ. Datasheet				21°C/W		
Max. Datasheet						
Comments					AEC-Q101	AEC-Q101
UNIT	V	V	V	°C/W	KV	KV
N	30	30	30	10	30	30
Min	675.900	722.700	794.100	12.030	6	>1
Max	688.400	736.000	813.300	13.240	6	>1
Avg	681.397	728.613	802.787	12.519	6	

Results on STTH112UFY product:

TEST	VF	VF	VF	VF	IR	IR	IR	IR
EQUIPMENT	TESEC_881TT_TEST292							
Condition 1	-40°C	24°C	125°C	150°C	-40°C	24°C	125°C	150°C
Condition 2	IF=1A	IF=1A	IF=1A	IF=1A		VR=1.2kV	VR=1.2kV	VR=1.2kV
Condition 3								
Min. Datasheet								
Typ. Datasheet				1.10V			1uA	
Max. Datasheet		1.900V		1.55V		5.0uA	50uA	
Comments								
UNIT	V	V	V	V	nA	nA	uA	uA
N	30	30	30	30	30	30	30	30
Min	1.417	1.324	1.121	1.077	No value due to frost issues	0.000	1.001	4.647
Max	1.608	1.489	1.224	1.169		125.000	1.659	7.041
Avg	1.534	1.429	1.191	1.140		31.993	1.185	5.496

TEST	VBR	VBR	VBR	VR	RTH	ESD CDM	ESD HBM	
EQUIPMENT	TESEC_881TT_TEST292						ESD-CDM	ESS6008
Condition 1	-40°C	24°C	125°C	150°C		24°C	25°C	
Condition 2								
Condition 3								
Min. Datasheet	1200V	1200V	1200V	1200V				
Typ. Datasheet					20°C/W			
Max. Datasheet								
Comments						AEC-Q101	AEC-Q101	
UNIT	V	V	V	V	°C/W	KV	KV	
N	30	30	30	30	10	30	30	
Min	1330.000	1398.000	1504.000	1506.000	10.580	>1	2	
Max	1448.000	1520.000	1632.000	1631.000	11.290	>1	2	
Avg	1419.267	1490.733	1600.300	1596.567	10.930		2	

## 6.2 Physical Dimensions

Former SMB Flat Package			New SMB Flat Package																																																																																																																		
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## 6.3 Tests description

Test name	Description	Purpose
<b>PC</b> 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.
<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>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>WBS</b> Wire Bond Strength	To apply the specified stress to the bond, lead wire, or terminal.	To measure bond strength, evaluate bond strength distributions, or to determine compliance with specified bond strength requirements of the applicable acquisition document. This test may be applied to the wire-to-die bond, wire-to-substrate bond, or the wire-to-package lead bond inside the package of wire-connected microelectronic devices bonded by soldering, thermo-compression, ultrasonic, or related techniques
<b>BS</b> Bond Shear	This test establishes a procedure for determining the strength of the interface between a gold ball bond and a die bonding surface, or an aluminum wedge/stitch bond and a die or package bonding surface, on either pre-encapsulation or post-encapsulation components. This strength measurement is extremely important in determining two features: 1) the integrity of the metallurgical bond which has been formed. 2) the reliability of gold and aluminum wire bonds to die or package bonding surfaces. This test method can be used only when the ball height and diameter for ball bonds, or the wire height (1.25 mil and larger at the compressed bond area) for wedge/stitch bonds, are large enough and adjacent interfering structures are far enough away to allow suitable placement and clearance (e.g., above the bonding	To check the integrity of the metallurgical bond.

Test name	Description	Purpose
<b>DPA</b> Destructive Physical Analysis	Specific construction analysis on random parts that have successfully completed H3TRB or TC.	To investigate on reliability stresses impact on delamination, corrosion and product construction integrity.
<b>DS</b> Die Shear	A sufficient force to shear the die from its mounting shall be applied to the die.	To establish the integrity of the semiconductor die attachment to the package header or other substrate.
<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>WG</b> Tin Whiskers Growth	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