

PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data

1.1 Company	 STMicroelectronics International N.V
1.2 PCN No.	ADG/23/14357
1.3 Title of PCN	Molding compound replacement for SOD123Flat & SOD128Flat in subcontractor in Malaysia for Rectifiers and Protection diodes
1.4 Product Category	STPSxxxxZF / STPSxxxxZFY STTHxxxxZF / STTHxxxxZFY STPSTxxxxZF / STPSTxxxxZFY STPSxxxxAF / STPSxxxxAFY STPSTxxxxAF / STPSTxxxxAFY STTHxxxxAF / STTHxxxxAFY SMxFxxAY
1.5 Issue date	2023-12-08

2. PCN Team

2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
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2.2 Change responsibility	
2.2.1 Product Manager	Stephane CHAMARD
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
Materials	New direct material part number (same supplier, different supplier or new supplier), Mold compound	Subcontractor in Malaysia

4. Description of change

	Old	New
4.1 Description	Resin supply by Kyocera Singapore	Resin supply by Kyocera Japan
4.2 Anticipated Impact on form, fit, function, quality, reliability or processability?	No	

5. Reason / motivation for change

5.1 Motivation	Molding compound discontinuation from current resin supplier.
5.2 Customer Benefit	SERVICE CONTINUITY

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. New Finished Good ending with "J"
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7. Timing / schedule

7.1 Date of qualification results	2023-11-28
7.2 Intended start of delivery	2024-04-26
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation

8.1 Description	14357 Qualification Reports.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2023-12-08

9. Attachments (additional documentations)

14357 Public product.pdf
 14357 PCN SOD123Flat & SOD128Flat new molding compound at subco.pdf
 14357 Qualification Reports.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
	STPS1L40ZF	
	STPS1L40ZFY	
	STPS1L60ZF	
	STPS1L60ZFY	
	STPS2H100AFY	
	STPS2H100ZF	
	STPS2H100ZFY	
	STPS2L40ZFY	
	STPS2L60ZF	
	STPS360AF	
	STPS360AFY	
	STPS3H100AF	
	STPS3H100AFY	
	STPS5H100AF	
	STPS5H100AFY	
	STPST1H100AF	
	STPST1H100AFY	
	STPST1H100ZF	
	STPST1H100ZFY	
	STPST2H100AF	
	STPST2H100AFY	
	STPST2H100ZF	
	STPST2H100ZFY	
	STPST3H100AF	
	STPST3H100AFY	
	STPST5H100AF	
	STPST5H100AFY	
	STTH1R02ZF	
	STTH1R02ZFY	
	STTH1R06AF	
	STTH1R06AFY	
	STTH2R02AFY	
	STTH3R02AFY	

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PCN

Product/Process Change Notification

Molding compound replacement for SOD123Flat & SOD128Flat in subcontractor in Malaysia for Rectifiers and Protection diodes

Notification number:	ADG/23/14357	Issue Date	30-Nov-2023		
Issued by	Sophie da Silva				
Product series affected by the change	STPSxxxxZF / STPSxxxxZFY STTHxxxxZF / STTHxxxxZFY STPSTxxxxZF / STPSTxxxxZFY STPSxxxxAF / STPSxxxxAFY STPSTxxxxAF / STPSTxxxxAFY STTHxxxxAF / STTHxxxxAFY SMxFxxAY Refer to attached table for involved Commercial Products.				
Type of change	Back-End realization				
Description of the change	<p>Molding compound replacement for SOD123Flat & SOD128Flat packages for Rectifiers and Protection diodes manufactured in subcontractor in Malaysia.</p> <p>This new molding compound is produced by the same supplier, the same reference but different manufacturing plant.</p>				
Reason for change	<p>Molding compound discontinuation from current resin supplier, produced in Singapore.</p>				
Former versus changed product:	<p>The changed products do not present modified electrical, dimensional, or thermal parameters, leaving unchanged the current information published in the products datasheets.</p> <p>The footprint recommended by ST remains the same.</p> <p>There is no change in the packing modes and the standard delivery quantities either.</p> <p>The products remain in full compliance with the ST ECOPACK®2 grade (so called “halogen-free”).</p>				

(¹) ADG: Automotive and Discrete Group

Disposition of former products

Delivery of current products will be done until stock depletion.

Marking and traceability

Traceability of the change will be ensured by Finished Good/Type print on carton labels.
 New Finished Good ending with “**J**” as per below:

Commercial part number/Order code (Examples)	Former Finished Good/Type (Examples)	New Finished Good/Type (Examples)
STTH1R02ZFY	YSTTH1R02ZF/I	YSTTH1R02ZF J /I
STPS2H100ZFY	YSTPS2H100ZF%I	YSTPS2H100ZF J %I
STPST2H100ZF	PST2H100ZF%I	PST2H100ZF J %I
STTH1R06AFY	YTH1R06AF/I	YTH1R06AF J /I
SM6F36AY	ASM6F36AY-I	ASM6F36AY J -I
STPS5H100AFY	YPS5H100AF%I	YPS5H100AF J %I

Qualification completion date	28-Nov-2023
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Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Rectifiers	Power Schottky	STPS1L60ZFY	Week 01-2024
Rectifiers	Power Schottky	STPS2H100ZF	Week 01-2024
Rectifiers	Power Schottky	STPS2H100ZFY	Week 01-2024
Rectifiers	Power Schottky	STPS360AFY	Week 01-2024
Rectifiers	Power Schottky	STPS3H100AFY	Week 01-2024
Rectifiers	Power Schottky	STPS5H100AFY	Week 01-2024
Rectifiers	Ultrafast	STTH1R02ZF	Week 01-2024
Rectifiers	Ultrafast	STTH1R02ZFY	Week 01-2024
Rectifiers	Ultrafast	STTH2R02AFY	Week 01-2024
Protection	TVS	SM6F31AY	Week 01-2024

For sample(s) request, please inform FSE (Field Sales Engineer) in order to insert corresponding **Non-Standard Samples Order** (a single Commercial Product for each request) with **PCN reference** as additional information.

Other samples are available upon request.

Change implementation schedule

Sales-types	Estimated production start	Estimated first shipments
All	Jun-2024	Jul-2024

(¹) ADG: Automotive and Discrete Group

Comments	With early PCN acceptance, possible shipment starting Apr-2024.
Customer's feedback	
<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>	
Qualification program and results	23033QRP Attached 23034QRP Attached

Involved Commercial part numbers	
SM6F10AY	STPS2L40ZFY
SM6F11AY	STPS2L60ZFY
SM6F12AY	STPS360AF
SM6F13AY	STPS360AFY
SM6F14AY	STPS3H100AF
SM6F15AY	STPS3H100AFY
SM6F16AY	STPS5H100AF
SM6F18AY	STPS5H100AFY
SM6F20AY	STPST1H100AF
SM6F22AY	STPST1H100AFY
SM6F23AY	STPST1H100ZF
SM6F24AY	STPST1H100ZFY
SM6F26AY	STPST2H100AF
SM6F28AY	STPST2H100AFY
SM6F30AY	STPST2H100ZF
SM6F31AY	STPST2H100ZFY
SM6F33AY	STPST3H100AF
SM6F36AY	STPST3H100AFY
SM6F5.0AY	STPST5H100AF
SM6F6.0AY	STPST5H100AFY
SM6F6.5AY	STTH1R02ZF
SM6F8.5AY	STTH1R02ZF
STPS1L40ZF	STTH1R02ZFY
STPS1L40ZFY	STTH1R02ZFY
STPS1L60ZF	STTH1R06AF
STPS1L60ZFY	STTH1R06AFY
STPS2H100AFY	STTH2R02AFY
STPS2H100ZF	STTH3R02AFY
STPS2H100ZFY	

Qualification Report

Molding compound replacement for SOD123Flat & SOD128Flat packages in Malaysia subcontractor for Rectifiers and Protection diodes – Automotive grade

General Information		Locations	
Product Line	Rectifiers & Protection	Wafer fab	Tours 6 – France Ang Mo Kio - Singapore
Product Description	Ultrafast, Power Schottky & Power Schottky Trench Diodes, TVS	Assembly plant	Subcontractor 9961 – Malaysia
Product perimeter	STPSxxxxZFY / STTHxxxxZFY STPSTxxxxZFY STPSxxxxAFY / STPSTxxxxAFY STTHxxxxAFY / SMxFxxAY	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	PASS
Product division	Discrete & Filter		
Package	SOD123-FLAT, SOD128-FLAT		
Maturity level step	30		

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Nov-2023	20	Yann TURIN	Christophe Goin <small>Digital signature of Christophe Goin Date: 2023.11.23 14:59:36 +01'00'</small>	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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TABLE OF CONTENTS

1	APPLICABLE AND REFERENCE DOCUMENTS	3
2	GLOSSARY	3
3	RELIABILITY EVALUATION OVERVIEW.....	4
3.1	OBJECTIVES.....	4
3.2	CONCLUSION.....	5
4	DEVICE CHARACTERISTICS	6
4.1	DEVICE DESCRIPTION.....	6
4.2	CONSTRUCTION NOTE.....	10
5	TESTS RESULTS SUMMARY	11
5.1	TEST VEHICLES	11
5.2	TEST PLAN	12
5.3	RESULTS SUMMARY	14
6	ANNEXES	16
6.1	PARAMETRIC VERIFICATIONS	16
6.2	PHYSICAL DIMENSIONS.....	18
6.3	TESTS DESCRIPTION	20

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
AEC-Q101 Rev E	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications

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
GD	Generic Data
SD	Solderability test
MSL	Moisture Sensitivity Level
WG	Whiskers Growth
T_j	Junction Temperature
BS	Bond Shear
WBS	Wire Bond Strength
RSH	Resistance to Soldering Heat
DPA	Destructive Physical Analysis (after TC and THB)

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify new molding compound source for SOD123-FLAT and SOD128-FLAT packages.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
SM6F10AY SM6F11AY SM6F12AY SM6F13AY SM6F14AY SM6F15AY SM6F16AY SM6F18AY SM6F20AY SM6F22AY SM6F23AY SM6F24AY SM6F26AY SM6F28AY SM6F30AY SM6F31AY SM6F33AY SM6F36AY SM6F5.0AY SM6F6.0AY SM6F6.5AY SM6F8.5AY	TVS	SOD128-FLAT	
STPS1L40ZFY STPS1L60ZFY STPS2H100ZFY STPS2L40ZFY STPS2L60ZFY	Power Schottky	SOD123-FLAT	Subcontractor 996I – Malaysia
STPS2H100AFY STPS360AFY STPS3H100AFY STPS5H100AFY		SOD128-FLAT	
STPST1H100ZFY STPST2H100ZFY	Power Schottky Trench	SOD123-FLAT	
STPST1H100AFY STPST2H100AFY STPST3H100AFY STPST5H100AFY		SOD128-FLAT	
STTH1R02ZFY STTH1R02ZFY	Ultrafast	SOD123-FLAT	
STTH1R06AFY STTH2R02AFY STTH3R02AFY		SOD128-FLAT	

The reliability test methodology used follows the ST 0061692 & AEC Q101 Rev. E specifications.

The following reliability tests ensuing are:

- TC and IOLT (only for rectifiers) 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, Solderability to check compatibility of package with customer assembly.
- WG to check lead-finishing quality.

For some tests, similarity methodology is used. See 5.2 "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

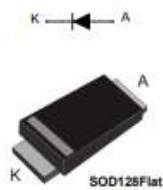
4.1 Device description

Refer to ST specification (some examples below):

**STPST3H100-Y**

Datasheet

Automotive 100 V - 3 A power Schottky trench diode



Features



- AEC-Q101 qualified
- PPAP capable
- ST trench process
- High junction temperature capability
- Low forward voltage drop
- Low recovery charges
- Reduces conduction, reverse and switching losses
- Flat package
- ECOPACK² compliant

Applications

- DC/DC converter
- Auxiliary power supply
- High switching frequency converter
- Flyback topology
- Reverse polarity protection
- Freewheeling function

Description



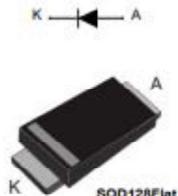
This 3 A, 100 V rectifier is based on ST trench technology that achieves the best in class V_F/I_R trade-off for a given silicon surface.

Integrated in flat packages, this STPST3H100-Y trench device is intended to be used in high frequency miniature switched mode power supplies such as adaptors. It is also an ideal candidate for auxiliary power supply in telecom, server, lighting or smart metering and can be the perfect companion device to our VIPer products.

Product status link	
STPST3H100-Y	

Product summary	
$I_{F(AV)}$	3 A
V_{RRM}	100 V
T_j (max.)	175 °C
V_F (typ.)	0.600 V

Automotive 600 V, 1 A, turbo 2 ultrafast rectifier

**Features**

- AEC-Q101 qualified
- Ultrafast recovery
- V_{RRM} 600 V up to -40 °C
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- PPAP capable
- ECOPACK®2 compliant component

Applications

- Reverse polarity protection
- Clamping function
- Boost diode
- PFC

Description

The **STTH1R06AFY** is an ultrafast recovery power rectifier dedicated to energy recovery in automotive application housed in SOD128Flat to improve space saving. It is especially designed for clamping function in energy recovery block.

The compromise between forward voltage drop and recovery time offers optimized performance.

Product status	
STTH1R06AFY	
Product summary	
$I_{F(AV)}$	1 A
V_{RRM}	600 V
t_{rr}	30 ns
T_j	175 °C
$V_F(\text{typ.})$	1.08 V

Automotive 600 W TVS in SOD128 Flat

Features



SOD128 Flat



Unidirectional



- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000 μ s) and 4 kW (8/20 μ s)
- Stand-off voltage range from 5 V to 36 V
- Unidirectional type
- Low leakage current: 0.2 μ A at 25 °C and 1 μ A at 85 °C
- Operating T_j max: 175 °C
- High power capability at 175 °C (T_j max.) up to 240 W (10/1000 μ s)
- Lead finishing: matte tin plating

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
 - 4 kV
- ISO10605, IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO10605 - C = 330 pF, R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO7637-2 (Not applicable to parts with stand-off voltage lower than battery voltage)
 - Pulse 1: V_S = -150 V
 - Pulse 2a: V_S = +112 V
 - Pulse 3a: V_S = -220 V
 - Pulse 3b: V_S = +150 V

Product status link

SM6FY	SM6F5.0AY , SM6F6.0AY , SM6F6.5AY , SM6F8.5AY , SM6F10AY , SM6F11AY , SM6F13AY , SM6F12AY , SM6F14AY , SM6F15AY , SM6F16AY , SM6F18AY , SM6F20AY , SM6F22AY , SM6F23AY , SM6F24AY , SM6F26AY , SM6F28AY , SM6F30AY , SM6F31AY , SM6F33AY , SM6F36AY
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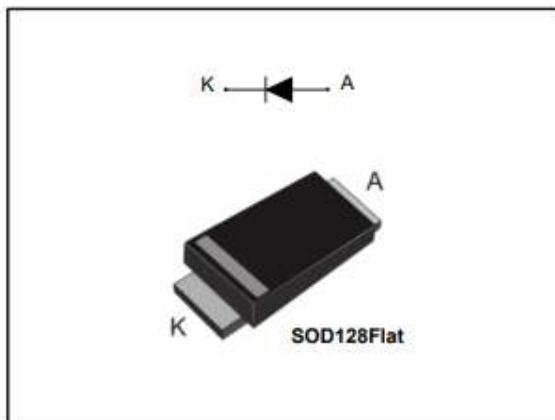
Description

The SM6FY series are designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability.

Automotive high voltage power Schottky rectifier

Datasheet - production data

**Description**

This high voltage Schottky barrier rectifier device is packaged in SOD128Flat and designed for high frequency miniature switched mode power supplies and for board DC to DC converters for automotive applications.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	5 A
V_{RRM}	100 V
$T_j(\text{max.})$	175 °C
$V_F(\text{typ.})$	0.51 V

Features

- Negligible switching losses
- High junction temperature capability
- Low leakage current
- Good trade-off between leakage current and forward voltage drop
- Avalanche specification
- ECOPACK® compliant component
- AEC-Q101
- PPAP capable
- V_{RRM} guaranteed from -40 to +175 °C

4.2 Construction Note

STPSxxxxZFY - STPSxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STTHxxxxZFY - STTHxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	Rectifiers
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STPSTxxxxZFY - STPSTxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky Trench
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

SMxFxxAY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	TVS
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

5 TESTS RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L11	STPST2H100ZF	SOD 123	Qualification lot
L13	STTH1R06AFY	SOD 128	Qualification lot
L20	SM6F36AY	SOD 128	Qualification lot
L19	STTH1R02ZFY	SOD 123	Qualification lot
L15	STPS2H100ZF	SOD 123	Qualification lot
L17	STPS5H100AFY	SOD 128	Qualification lot
GD1	Dummies	SOD 128	Generic data for whiskers test

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 Not applicable for PTH and WLCSP without coating	X
MSL research	MSL	J-STD-020	L20, L19, L17	90	Not applicable for PTH and WLCSP without coating	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	All qualification parts tested per the requirements of the appropriate device specification			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	L13, L20, L11, L15	308		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	L13, L20, L17, L15	308		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	L20, L19, L17, L15	308		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	L11, L20, L19, L17, L15	385		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	L13, L17, L15	231	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005			For automotive products only See Annexe 6.1	X

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L13, L19	4	After H3TRB and TC. For automotive products only	X
Physical Dimension	PD	JESD22B-100	GD	60	See Annexe 6.2	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)	L20, L17, L15	90	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	L13, L15	120		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L13, L20, L11	25	Required in case of process change. See Annex 6.1 – RTH column	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			NA for products with clip	
Bond Shear	BS	AEC-Q101-003			NA for products with clip	
Die Shear	DS	MIL-STD-750 Method 2017			Not Applicable to parts with solder paste die attach	
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	GD1	45		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	
Repetitive Surge	RS	Internal Specification			Only for TVS products	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 20	Lot 17
Parametric Verifications		ST datasheet	Over part temperature range		-	Refer to paragraph 6.1 in Annexes					
External Visual Inspection		JESD22 B-101	-		-	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	1885	-	0/1885					
PC		JESD22A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	1412	-	0/1412					
MSL1 research	Y	J-STD-020	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	90	-		0/30			0/30	0/30
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=130°C Temperature=115°C Voltage=80V	308	1000h	0/77		0/77			
			Junction Temperature=175°C Temperature=170°C Voltage=600V		1000h			0/77			
			Junction Temperature=175°C Temperature=170°C Voltage=36V		1000h				0/77		
TC	Y	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	308	1000cy			0/77	0/77	0/77	0/77
RSH	Y	JESD22A-111 (SMD) / JESD22B-106 (PTH)	Temperature=260°C Time (on)=10s	90	-		0/30		0/30	0/30	0/30
H3TRB	Y	JESD22-A101	Humidity (HR)=85% Temperature=85°C Voltage=80V	385	1000h	0/77		0/77			0/77
			Humidity (HR)=85% Temperature=85°C Voltage=100V		1000h		0/77				
			Humidity (HR)=85% Temperature=85°C Voltage=36V		1000h				0/77		
uHAST	Y	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	308	96h		0/77	0/77		0/77	0/77
IOLT	Y	MIL-STD 750 Method 1037	Delta T_j =125°C Intensity (If)=0.8A Time (off)=120s Time (on)=120s	231	500h				0/77		
			Delta T_j =125°C Intensity (If)=1.45A Time (off)=120s Time (on)=120s		500h			0/77			
			Delta T_j =125°C Intensity (If)=2.1A Time (off)=120s Time (on)=120s		500h					0/77	
DPA	Y	ST 0060102 AEC Q101	Post TC or H3TRB	4	-		0/2		0/2		

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 20	Lot 17
SD	N	J-STD-002	Dry Aging=16Hrs Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C	120	Visual Inspection			0/15	0/15		
			Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15		
			Dry Aging=16Hrs Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C		Visual Inspection			0/15	0/15		
			Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15		

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.		
						GD 1		
Whiskers	N	JESD201	No reflow THS 30°C/60%RH	45	4000h	0/9		
			Reflow SnPb 215°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 215°C TC -40°C – 85°C		1500cy	0/9		
			Reflow SnPb 260°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 260°C TC -40°C – 85°C		1500cy	0/9		

6 ANNEXES

6.1 Parametric Verifications

- Results on STTH1R06AFY product:

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC_AMK				
Condition 1	-40°C	25°C	150°C	25°C	150°C
Condition 2				VR=600V	VR=600V
Min. Datasheet	600V	600V	600V		
Typ. Datasheet					10uA
Max. Datasheet				1uA	75uA
Comments					
UNIT	V	V	V	nA	uA
N	20	20	20	20	20
Min	646.000	677.100	738.500	0.000	2.514
Max	688.300	732.500	798.500	31.300	3.290
Avg.	672.345	714.925	779.625	3.506	2.873

TEST	VF	VF	RTH(J-L)	ESD_HBM	ESD_CDM
EQUIPMENT	TESEC_AMK			ESS6008	ESD-CDM TEST SYSTEM
Condition 1	25°C	150°C		25°C	25°C
Condition 2	IF=1A	IF=1A			
Min. Datasheet					
Typ. Datasheet		1.08V			
Max. Datasheet	1.9V	1.4V	24°C/W		
Comments				AEC-Q101	AEC-Q101
UNIT	V	V	°C/W	KV	KV
N	20	20	10	30	30
Min	1.374	1.028	14.900	4	>1.0
Max	1.544	1.121	16.190	4	>1.0
Avg.	1.477	1.086	15.651	4	

- Results on STPS2H100ZF product:

TEST	VF	VF	VF	VF	IR	IR
EQUIPMENT	TESEC_AMK					
Condition 1	24°C	24°C	125°C	125°C	24°C	125°C
Condition 2	IF=2A	IF=4A	IF=2A	IF=4A	VR=100V	VR=100V
Min. Datasheet						
Typ. Datasheet			0.65V	0.75V		0.2mA
Max. Datasheet	0.86V	0.96V	0.7V	0.83V	1uA	0.5mA
Comments						
UNIT	V	V	V	V	nA	uA
N	20	20	20	20	20	20
Min	0.786	0.853	0.635	0.707	78.020	123.700
Max	0.791	0.861	0.642	0.716	126.600	170.300
Avg.	0.789	0.857	0.640	0.713	90.865	136.840

TEST	VR	VR	VR	RTH(J-L)	ESD_HBM	ESD_CDM
EQUIPMENT	TESEC_AMK			AMK_RTH_Phase12	ESS6008	ESD-CDM TEST SYSTEM
Condition 1	-40°C	24°C	125°C		25°C	25°C
Condition 2						
Min. Datasheet	100V	100V	100V			
Typ. Datasheet						
Max. Datasheet				20°C/W		
Comments					AEC-Q101	AEC-Q101
UNIT	V	V	V	°C/W	KV	KV
N	20	20	20	10	30	30
Min	118.500	125.700	137.700	13.180	6	>1.0
Max	120.300	127.300	139.500	15.680	6	>1.0
Avg.	119.365	126.435	138.650	14.176	6	

- Results on SM6F36AY product:

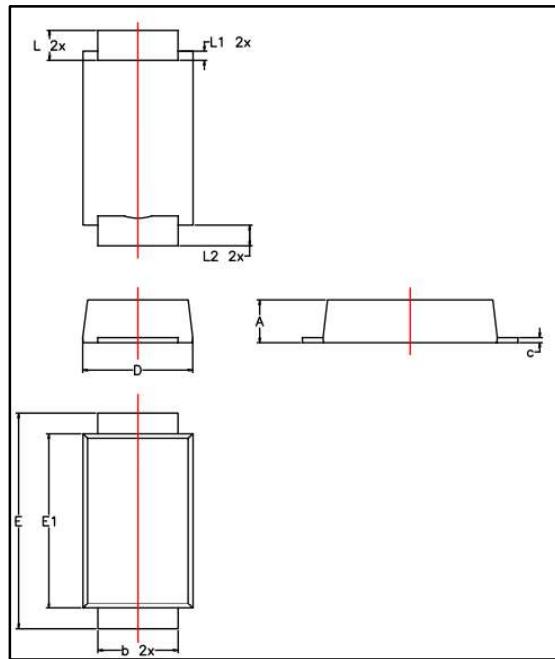
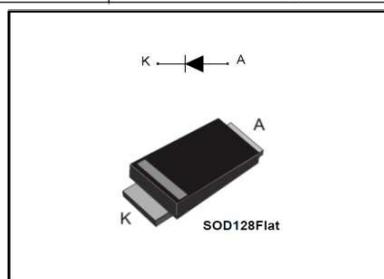
TEST	IR	IR	VR	ESD_HBM	ESD_CDM	RTH(J-L)
EQUIPMENT	TSA_491			ESS6008	ESD-CDM TEST SYSTEM	RTH(PHASE12)_TEST417
Condition 1	25°C	85°C	25°C	25°C	25°C	BARRE_ANALYSIS_TECH=S.U.
Condition 2	VR=36V	VR=36V	IR=1000µA			BARRE_ST=S.U.
Min. Datasheet			40V			
Typ. Datasheet			42.1V			
Max. Datasheet	200nA	1uA	44.2V			
Comments				AEC-Q101	AEC-Q101	
UNIT	nA	nA	V	KV	KV	°C/W
N	20	20	20	30	30	5
Min	3.383	3.478	40.810	>8.0	>1.0	10.870
Max	83.790	7.295	42.710	>8.0	>1.0	12.490
Avg.	9.677	4.847	41.589			11.878

TEST	VCL_10_1000	RD	VCL_8_20	RD	ALPHA_T
EQUIPMENT	VC6700	TESTS_CALCULES	ARETI	TESTS_CALCULES	
Condition 1	25°C	25°C	25°C	25°C	IR=1mA
Condition 2	IPP=10.3A	IF1=5.2A	IPP=52A	IF1=26A	TJ1=25°C
Condition 3	TP=1000us	IF2=10.3A	TP=20us	IF2=52A	TJ2=85°C
Condition 4	TR=10us	VF1=10 - VCL_10_1000 V	TR=8us	VF1=16 - VCL_8_20 V	
Min. Datasheet					1E-4/°C
Typ. Datasheet					1E-4/°C
Max. Datasheet	58.1V	1.350Ohm	76V	0.612Ohm	101E-4/°C
Comments					
UNIT	V	Ohm	V	Ohm	1E-4/°C
N	10	10	10	10	20
Min	50.650	0.796	53.870	0.215	9.145
Max	53.540	1.061	54.400	0.246	9.445
Avg.	51.940	0.974	54.080	0.233	9.287

6.2 Physical Dimensions

Dimensional report for SOD128 Flat package

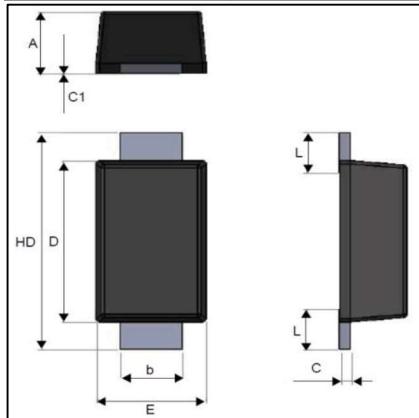
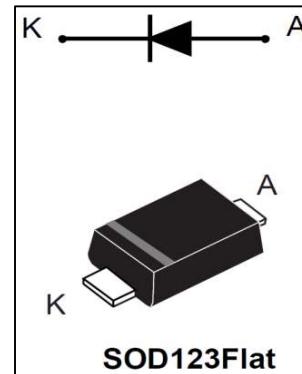
Ref.	Dimensions	
	Millimeters	
	Min.	Max.
A	0.93	1.03
b	1.69	1.81
c	0.10	0.22
D	2.30	2.50
E	4.60	4.80
E1	3.70	3.90
L	0.55	0.85
L1	0.30 typ.	
L2	0.45 typ.	



Dimensions in mm	A	b	c	D	E	E1	L	L1	L2
Measurement done on 30 units									
Min	0.937	1.691	0.150	2.313	4.666	3.782	0.711	0.248	0.426
Avg.	0.955	1.712	0.160	2.401	4.685	3.817	0.743	0.277	0.466
Max	0.979	1.737	0.171	2.421	4.697	3.830	0.793	0.314	0.506
LSL	0.930	1.690	0.100	2.300	4.600	3.700	0.550		
Typ.								0.300	0.450
USL	1.030	1.810	0.220	2.500	4.800	3.900	0.850		

Dimensional report for SOD123 Flat package

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	0.86	0.98	1.10
b	0.80	0.90	1.00
c	0.08	0.15	0.25
c1	0.00		0.10
D	2.50	2.60	2.70
E	1.50	1.60	1.80
HD	3.30	3.50	3.70
L	0.45	0.65	0.85



Dimensions in mm	A	b	c	c1	D	E	HD	L
	Measurement done on 30 units							
Min	0.944	0.902	0.135	0.022	2.603	1.573	3.445	0.632
Avg.	0.964	0.914	0.149	0.033	2.619	1.593	3.501	0.667
Max	0.989	0.929	0.167	0.044	2.648	1.672	3.586	0.707
LSL	0.860	0.800	0.080	0.000	2.500	1.500	3.300	0.450
Typ.	0.980	0.900	0.150		2.600	1.600	3.500	0.650
USL	1.100	1.000	0.250	0.100	2.700	1.800	3.700	0.850

6.3 Tests description

Test name	Description	Purpose
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop-corn" effect and delamination.
HTRB 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.
H3TRB 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.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
UHAST 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.
IOLT 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.
RSH 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.
DPA 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.
SD 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.
WG 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.

Qualification Report

*Molding compound replacement for SOD123Flat &
SOD128Flat packages in Malaysia subcontractor for
Rectifiers and Protection diodes*

General Information		Locations	
Product Line	Rectifiers	Wafer fab	Tours 6 – France Ang Mo Kio - Singapore
Product Description	Ultrafast, Power Schottky & Power Schottky Trench Diodes	Assembly plant	Subcontractor 9961 – Malaysia
Product perimeter	STPSxxxxZF / STTHxxxxZF STPSTxxxxZF STPSxxxxAF / STPSTxxxxAF STTHxxxxAF	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	PASS
Product division	Discrete & Filter		
Package	SOD123-FLAT, SOD128-FLAT		
Maturity level step	30		

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Nov-2023	20	Yann TURIN	Christophe Goin <small>Digital signature by Christophe Goin Date: 2023.11.23 15:00:44 +01'00'</small>	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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TABLE OF CONTENTS

1 APPLICABLE AND REFERENCE DOCUMENTS	3
2 GLOSSARY	3
3 RELIABILITY EVALUATION OVERVIEW.....	4
3.1 OBJECTIVES.....	4
3.2 CONCLUSION.....	4
4 DEVICE CHARACTERISTICS	5
4.1 DEVICE DESCRIPTION.....	5
4.2 CONSTRUCTION NOTE.....	8
5 TESTS RESULTS SUMMARY	9
5.1 TEST VEHICLES	9
5.2 TEST PLAN	10
5.3 RESULTS SUMMARY	12
6 ANNEXES	14
6.1 PARAMETRIC VERIFICATIONS	14
6.2 PHYSICAL DIMENSIONS.....	16
6.3 TESTS DESCRIPTION	18

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
GD	Generic Data
SD	Solderability test
MSL	Moisture Sensitivity Level
WG	Whiskers Growth
T_j	Junction Temperature
BS	Bond Shear
WBS	Wire Bond Strength
RSH	Resistance to Soldering Heat

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify new molding compound source for SOD123-FLAT and SOD128-FLAT packages.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
STPS1L40ZF STPS1L60ZF STPS2H100ZF	Power Schottky	SOD123-FLAT	Subcontractor 996I – Malaysia
STPS360AF STPS3H100AF STPS5H100AF		SOD128-FLAT	
STPST1H100ZF STPST2H100ZF	Power Schottky Trench	SOD123-FLAT	Subcontractor 996I – Malaysia
STPST2H100AF STPST1H100AF STPST3H100AF STPST5H100AF		SOD128-FLAT	
STTH1R02ZF STTH1R02ZF	Ultrafast	SOD123-FLAT	
STTH1R06AF		SOD128-FLAT	

The reliability test methodology used follows the ST 0061692 specification.

The following reliability tests ensuing are:

- TC and IOLT (only for rectifiers) 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, Solderability to check compatibility of package with customer assembly.
- WG to check lead-finishing quality.

For some tests, similarity methodology is used. See 5.2 "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

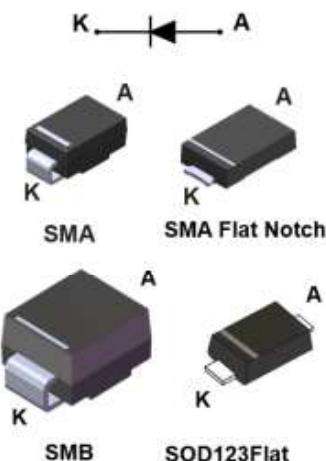
4.1 Device description

Refer to ST specification (some examples below):

**STPS1L40**

Datasheet

40 V, 1 A low drop power Schottky rectifier



Features

- Very small conduction losses
- Negligible switching losses
- Low forward voltage drop
- Surface mount miniature packages
- Avalanche rated
- ECOPACK² compliant

Applications

- Reverse polarity protection
- Set-top box power supply
- TV power supply
- Battery charger

Description

Single chip Schottky rectifiers suited to switched mode power supplies and high frequency DC to DC converters.

Packaged in SMA, SMA Flat Notch, SMB and SOD123Flat, the **STPS1L40** is ideal for use in surface mounting and used in low voltage, high frequency inverters, free-wheeling and polarity protection applications.

Product status	
STPS1L40	
Product summary	
Symbol	Value
$I_{F(AV)}$	1 A
V_{RRM}	40 V
$T_{j(max.)}$	175 °C
$V_F(typ.)$	0.37 V

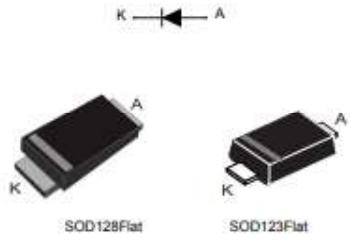


STPST1H100

Datasheet

100 V - 1 A power Schottky trench rectifier

Features



- High junction temperature capability
- Low forward voltage drop
- Low recovery charges
- Reduces conduction, reverse and switching losses
- Avalanche tested
- Flat packages
- ECOPACK2 compliant

Applications

- DC/DC converter
- LED lighting
- Flyback topology
- Auxiliary power supply
- Switch mode power supply (SMPS)



Product label



Product status link

[STPST1H100](#)

Description

This 1 A, 100 V rectifier is based on ST trench technology that achieves the best-in-class V_F/I_R trade-off for a given silicon surface.

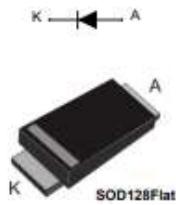
Integrated in flat and space-saving packages, this STPST1H100 trench rectifier is intended to be used in high frequency miniature switched mode power supplies. It is also an ideal candidate for auxiliary power supply in telecom, server, or smart metering. ST trench rectifiers are adapted to freewheeling, OR-ring or reverse polarity protection applications, and can be the perfect companion device to our transistors, drivers, or ST VIPer products.

Product summary

$I_F(AV)$	1 A
V_{RRM}	100 V
T_j (max.)	175 °C
V_F (typ.)	0.580 V



600 V, 1 A, turbo 2 ultrafast rectifier



Features

- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- ECOPACK2 compliant component

Applications

- Clamping function
- Boost diode
- PFC

Description

The STTH1R06AF is an ultrafast recovery power rectifier housed in SOD128Flat to improve space saving.

It is especially designed for clamping function in energy recovery block or boost diode in power correction circuitry.

The compromise between forward voltage drop and recovery time offers optimized performance.

Product status	
STTH1R06AF	

Product summary	
$I_{F(AV)}$	1 A
V_{RRM}	600 V
t_{rr}	30 ns
T_j	175 °C
$V_F(\text{typ.})$	1.08 V

4.2 Construction Note

STPSxxxxZF - STPSxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STTHxxxxZF - STTHxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	Rectifiers
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STPSTxxxxZF - STPSTxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky Trench
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

5 TESTS RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L11	STPST2H100ZF	SOD 123	Qualification lot
L13	STTH1R06AFY	SOD 128	Qualification lot
L19	STTH1R02ZFY	SOD 123	Qualification lot
L15	STPS2H100ZF	SOD 123	Qualification lot
L17	STPS5H100AFY	SOD 128	Qualification lot
GD1	Dummies	SOD 128	Generic data for whiskers test

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 Not applicable for PTH and WLCSP without coating	X
MSL research	MSL	J-STD-020	L19, L17	60	Not applicable for PTH and WLCSP without coating	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	All qualification parts tested per the requirements of the appropriate device specification			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	L13, L11, L15	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	L13, L17, L15	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	L19, L17, L15	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	L11, L19, L17, L15	308		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	L13, L17, L15	231	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005			For automotive products only	

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4			After H3TRB and TC. For automotive products only	
Physical Dimension	PD	JESD22B-100	GD	60	See Annexe 6.2	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)	L17, L15	60	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	L13, L15	120		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L13, L11	20	Required in case of process change. See Annex 6.1 – RTH column	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			NA for products with clip	
Bond Shear	BS	AEC-Q101-003			NA for products with clip	
Die Shear	DS	MIL-STD-750 Method 2017			Not Applicable to parts with solder paste die attach	
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	GD1	45		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	
Repetitive Surge	RS	Internal Specification			Only for TVS products	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.				
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 17
Parametric Verifications		ST datasheet	Over part temperature range		-	Refer to paragraph 6.1 in Annexes				
External Visual Inspection		JESD22 B-101	-		-	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	1352	-	0/1352				
PC		JESD22A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C; 85%RH IR reflow 3 times	1412	-	0/1121				
MSL1 research	Y	J-STD-020	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	60	-		0/30			0/30
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=130°C	231	1000h	0/77		0/77		
			Temperature=115°C Voltage=80V		1000h				0/77	
			Junction Temperature=175°C		1000h					
TC	Y	JESD22-A104	Temperature=170°C	231	500cy			0/77	0/77	0/77
			Voltage=600V							
			Temperature=175°C							
RSH	Y	JESD22A-111 (SMD) / JESD22B-106 (PTH)	Temperature=170°C	60	-			0/30		0/30
			Voltage=36V							
			Temperature (high)=150°C							
H3TRB	Y	JESD22-A101	Temperature (low)=-55°C	308	500h	0/77		0/77		0/77
			Humidity (HR)=85%		500h					
			Temperature=85°C							
uHAST	Y	JESD22 A-118	Voltage=80V	231	500h					
			Humidity (HR)=85%							
			Pressure=2.3bar							
IOLT	Y	MIL-STD 750 Method 1037	Temperature=130°C	231	96h		0/77	0/77		0/77
			Delta T_j =125°C		500h				0/77	
			Intensity (If)=0.8A							
			Time (off)=120s							
			Time (on)=120s							
			Delta T_j =125°C							
			Intensity (If)=1.45A		500h			0/77		
			Time (off)=120s							
			Time (on)=120s		500h					0/77

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.				
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 17
SD	N	J-STD-002	Dry Aging=16Hrs Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C	120	Visual Inspection			0/15	0/15	
			Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15	
			Dry Aging=16Hrs Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C		Visual Inspection			0/15	0/15	
			Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15	

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot		
						Fail/S.S.		
Whiskers	N	JESD201	No reflow THS 30°C/60%RH	45	4000h	0/9		
			Reflow SnPb 215°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 215°C TC -40°C – 85°C		1500cy	0/9		
			Reflow SnPb 260°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 260°C TC -40°C – 85°C		1500cy	0/9		

6 ANNEXES

6.1 Parametric Verifications

- Results on STTH1R06AFY product:

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC_AMK				
Condition 1	-40°C	25°C	150°C	25°C	150°C
Condition 2				VR=600V	VR=600V
Min. Datasheet	600V	600V	600V		
Typ. Datasheet					10uA
Max. Datasheet				1uA	75uA
Comments					
UNIT	V	V	V	nA	uA
N	20	20	20	20	20
Min	646.000	677.100	738.500	0.000	2.514
Max	688.300	732.500	798.500	31.300	3.290
Avg.	672.345	714.925	779.625	3.506	2.873

TEST	VF	VF	RTH(J-L)
EQUIPMENT	TESEC_AMK		
Condition 1	25°C	150°C	
Condition 2	IF=1A	IF=1A	
Min. Datasheet			
Typ. Datasheet		1.08V	
Max. Datasheet	1.9V	1.4V	24°C/W
Comments			
UNIT	V	V	°C/W
N	20	20	10
Min	1.374	1.028	14.900
Max	1.544	1.121	16.190
Avg.	1.477	1.086	15.651

- Results on STPS2H100ZF product:

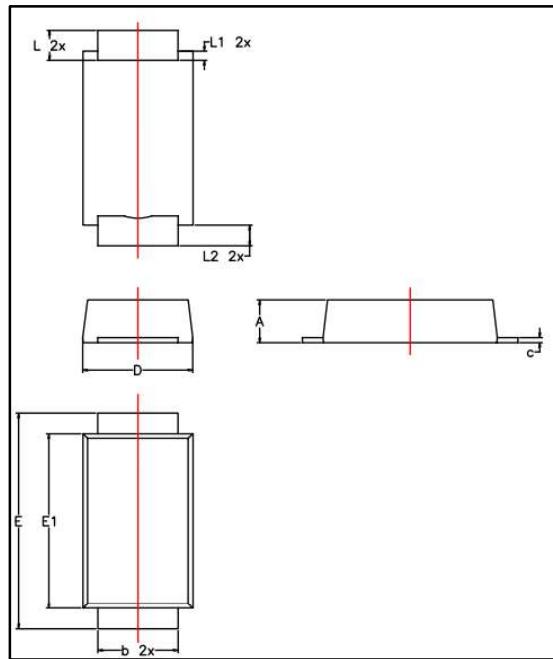
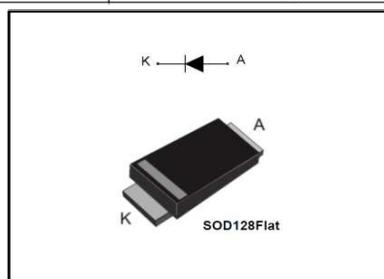
TEST	VF	VF	VF	VF	IR	IR
EQUIPMENT	TESEC_AMK					
Condition 1	24°C	24°C	125°C	125°C	24°C	125°C
Condition 2	IF=2A	IF=4A	IF=2A	IF=4A	VR=100V	VR=100V
Min. Datasheet						
Typ. Datasheet			0.65V	0.75V		0.2mA
Max. Datasheet	0.86V	0.96V	0.7V	0.83V	1uA	0.5mA
Comments						
UNIT	V	V	V	V	nA	uA
N	20	20	20	20	20	20
Min	0.786	0.853	0.635	0.707	78.020	123.700
Max	0.791	0.861	0.642	0.716	126.600	170.300
Avg.	0.789	0.857	0.640	0.713	90.865	136.840

TEST	VR	VR	VR	RTH(J-L)
EQUIPMENT	TESEC_AMK			AMK_RTH_Phase12
Condition 1	-40°C	24°C	125°C	
Condition 2				
Min. Datasheet	100V	100V	100V	
Typ. Datasheet				
Max. Datasheet				20°C/W
Comments				
UNIT	V	V	V	°C/W
N	20	20	20	10
Min	118.500	125.700	137.700	13.180
Max	120.300	127.300	139.500	15.680
Avg.	119.365	126.435	138.650	14.176

6.2 Physical Dimensions

Dimensional report for SOD128 Flat package

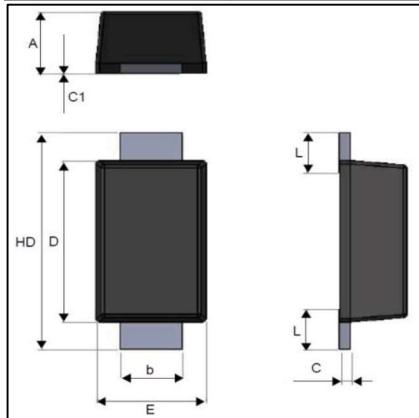
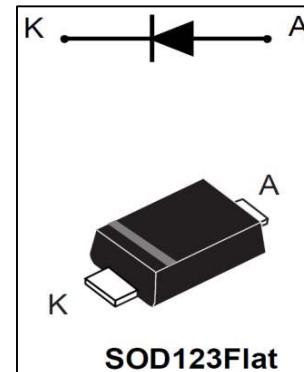
Ref.	Dimensions	
	Millimeters	
	Min.	Max.
A	0.93	1.03
b	1.69	1.81
c	0.10	0.22
D	2.30	2.50
E	4.60	4.80
E1	3.70	3.90
L	0.55	0.85
L1	0.30 typ.	
L2	0.45 typ.	



Dimensions in mm	A	b	c	D	E	E1	L	L1	L2
Measurement done on 30 units									
Min	0.937	1.691	0.150	2.313	4.666	3.782	0.711	0.248	0.426
Avg.	0.955	1.712	0.160	2.401	4.685	3.817	0.743	0.277	0.466
Max	0.979	1.737	0.171	2.421	4.697	3.830	0.793	0.314	0.506
LSL	0.930	1.690	0.100	2.300	4.600	3.700	0.550		
Typ.								0.300	0.450
USL	1.030	1.810	0.220	2.500	4.800	3.900	0.850		

Dimensional report for SOD123 Flat package

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	0.86	0.98	1.10
b	0.80	0.90	1.00
c	0.08	0.15	0.25
c1	0.00		0.10
D	2.50	2.60	2.70
E	1.50	1.60	1.80
HD	3.30	3.50	3.70
L	0.45	0.65	0.85



Dimensions in mm	A	b	c	c1	D	E	HD	L
Measurement done on 30 units								
Min	0.944	0.902	0.135	0.022	2.603	1.573	3.445	0.632
Avg.	0.964	0.914	0.149	0.033	2.619	1.593	3.501	0.667
Max	0.989	0.929	0.167	0.044	2.648	1.672	3.586	0.707
LSL	0.860	0.800	0.080	0.000	2.500	1.500	3.300	0.450
Typ.	0.980	0.900	0.150		2.600	1.600	3.500	0.650
USL	1.100	1.000	0.250	0.100	2.700	1.800	3.700	0.850

6.3 Tests description

Test name	Description	Purpose
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop-corn" effect and delamination.
HTRB 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.
H3TRB 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.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
UHAST 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.
IOLT 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.
RSH 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.
SD 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.
WG 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 : Molding compound replacement for SOD123Flat & SOD128Flat in subcontractor in Malaysia for Rectifiers and

Protection diodes

PCN Reference : ADG/23/14357

Subject : Public Products List

Dear Customer,

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

SM6F6.5AY	STPS5H100AF	STPST1H100AFY
STTH1R06AF	STPST1H100ZFY	SM6F28AY
SM6F12AY	SM6F36AY	SM6F20AY
STPS2L40ZFY	SM6F24AY	STPS2H100ZFY
SM6F14AY	SM6F26AY	SM6F5.0AY
STPST2H100ZFY	STPST2H100AF	SM6F30AY
STTH1R02ZF	STPS2H100ZF	STPS360AFY
STPST2H100AFY	SM6F8.5AY	SM6F6.0AY
STPS2L60ZFY	SM6F16AY	STTH1R02ZFY
STPST5H100AFY	STPST3H100AF	STPS2H100AFY
STTH1R06AFY	STPS1L60ZFY	SM6F18AY
STPS1L40ZFY	SM6F33AY	SM6F23AY
STPS1L40ZF	SM6F13AY	SM6F15AY
SM6F31AY	STTH3R02AFY	STPST1H100ZF
STPS1L60ZF	STPS360AF	STPST3H100AFY
STPST5H100AF	STPS3H100AF	STTH2R02AFY
STPS3H100AFY	STPST2H100ZF	SM6F11AY
STPST1H100AF	SM6F10AY	SM6F22AY
STPS5H100AFY		

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Qualification Report

Molding compound replacement for SOD123Flat & SOD128Flat packages in Malaysia subcontractor for Rectifiers and Protection diodes – Automotive grade

General Information		Locations	
Product Line	Rectifiers & Protection	Wafer fab	Tours 6 – France Ang Mo Kio - Singapore
Product Description	Ultrafast, Power Schottky & Power Schottky Trench Diodes, TVS	Assembly plant	Subcontractor 9961 – Malaysia
Product perimeter	STPSxxxxZFY / STTHxxxxZFY STPSTxxxxZFY STPSxxxxAFY / STPSTxxxxAFY STTHxxxxAFY / SMxFxxAY	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	PASS
Product division	Discrete & Filter		
Package	SOD123-FLAT, SOD128-FLAT		
Maturity level step	30		

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Nov-2023	20	Yann TURIN	Christophe Goin <small>Digital signature of Christophe Goin Date: 2023.11.23 14:59:36 +01'00'</small>	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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TABLE OF CONTENTS

1	APPLICABLE AND REFERENCE DOCUMENTS	3
2	GLOSSARY	3
3	RELIABILITY EVALUATION OVERVIEW.....	4
3.1	OBJECTIVES.....	4
3.2	CONCLUSION.....	5
4	DEVICE CHARACTERISTICS	6
4.1	DEVICE DESCRIPTION.....	6
4.2	CONSTRUCTION NOTE.....	10
5	TESTS RESULTS SUMMARY	11
5.1	TEST VEHICLES	11
5.2	TEST PLAN	12
5.3	RESULTS SUMMARY	14
6	ANNEXES	16
6.1	PARAMETRIC VERIFICATIONS	16
6.2	PHYSICAL DIMENSIONS.....	18
6.3	TESTS DESCRIPTION	20

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
AEC-Q101 Rev E	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications

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
GD	Generic Data
SD	Solderability test
MSL	Moisture Sensitivity Level
WG	Whiskers Growth
T_j	Junction Temperature
BS	Bond Shear
WBS	Wire Bond Strength
RSH	Resistance to Soldering Heat
DPA	Destructive Physical Analysis (after TC and THB)

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify new molding compound source for SOD123-FLAT and SOD128-FLAT packages.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
SM6F10AY SM6F11AY SM6F12AY SM6F13AY SM6F14AY SM6F15AY SM6F16AY SM6F18AY SM6F20AY SM6F22AY SM6F23AY SM6F24AY SM6F26AY SM6F28AY SM6F30AY SM6F31AY SM6F33AY SM6F36AY SM6F5.0AY SM6F6.0AY SM6F6.5AY SM6F8.5AY	TVS	SOD128-FLAT	
STPS1L40ZFY STPS1L60ZFY STPS2H100ZFY STPS2L40ZFY STPS2L60ZFY	Power Schottky	SOD123-FLAT	Subcontractor 996I – Malaysia
STPS2H100AFY STPS360AFY STPS3H100AFY STPS5H100AFY		SOD128-FLAT	
STPST1H100ZFY STPST2H100ZFY	Power Schottky Trench	SOD123-FLAT	
STPST1H100AFY STPST2H100AFY STPST3H100AFY STPST5H100AFY		SOD128-FLAT	
STTH1R02ZFY STTH1R02ZFY	Ultrafast	SOD123-FLAT	
STTH1R06AFY STTH2R02AFY STTH3R02AFY		SOD128-FLAT	

The reliability test methodology used follows the ST 0061692 & AEC Q101 Rev. E specifications.

The following reliability tests ensuing are:

- TC and IOLT (only for rectifiers) 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, Solderability to check compatibility of package with customer assembly.
- WG to check lead-finishing quality.

For some tests, similarity methodology is used. See 5.2 “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

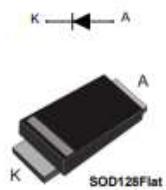
4.1 Device description

Refer to ST specification (some examples below):

**STPST3H100-Y**

Datasheet

Automotive 100 V - 3 A power Schottky trench diode



Features



- AEC-Q101 qualified
- PPAP capable
- ST trench process
- High junction temperature capability
- Low forward voltage drop
- Low recovery charges
- Reduces conduction, reverse and switching losses
- Flat package
- ECOPACK² compliant

Applications

- DC/DC converter
- Auxiliary power supply
- High switching frequency converter
- Flyback topology
- Reverse polarity protection
- Freewheeling function

Description



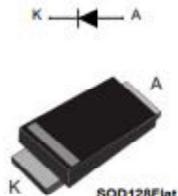
This 3 A, 100 V rectifier is based on ST trench technology that achieves the best in class V_F/I_R trade-off for a given silicon surface.

Integrated in flat packages, this STPST3H100-Y trench device is intended to be used in high frequency miniature switched mode power supplies such as adaptors. It is also an ideal candidate for auxiliary power supply in telecom, server, lighting or smart metering and can be the perfect companion device to our VIPer products.

Product status link	
STPST3H100-Y	

Product summary	
$I_{F(AV)}$	3 A
V_{RRM}	100 V
T_j (max.)	175 °C
V_F (typ.)	0.600 V

Automotive 600 V, 1 A, turbo 2 ultrafast rectifier

**Features**

- AEC-Q101 qualified
- Ultrafast recovery
- V_{RRM} 600 V up to -40 °C
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- PPAP capable
- ECOPACK®2 compliant component

Applications

- Reverse polarity protection
- Clamping function
- Boost diode
- PFC

Description

The **STTH1R06AFY** is an ultrafast recovery power rectifier dedicated to energy recovery in automotive application housed in SOD128Flat to improve space saving. It is especially designed for clamping function in energy recovery block.

The compromise between forward voltage drop and recovery time offers optimized performance.

Product status	
STTH1R06AFY	
Product summary	
$I_{F(AV)}$	1 A
V_{RRM}	600 V
t_{rr}	30 ns
T_j	175 °C
V_F (typ.)	1.08 V

Automotive 600 W TVS in SOD128 Flat

Features



SOD128 Flat



Unidirectional



- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000 μ s) and 4 kW (8/20 μ s)
- Stand-off voltage range from 5 V to 36 V
- Unidirectional type
- Low leakage current: 0.2 μ A at 25 °C and 1 μ A at 85 °C
- Operating T_j max: 175 °C
- High power capability at 175 °C (T_j max.) up to 240 W (10/1000 μ s)
- Lead finishing: matte tin plating

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
 - 4 kV
- ISO10605, IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO10605 - C = 330 pF, R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO7637-2 (Not applicable to parts with stand-off voltage lower than battery voltage)
 - Pulse 1: V_S = -150 V
 - Pulse 2a: V_S = +112 V
 - Pulse 3a: V_S = -220 V
 - Pulse 3b: V_S = +150 V

Product status link

SM6FY	SM6F5.0AY , SM6F6.0AY , SM6F6.5AY , SM6F8.5AY , SM6F10AY , SM6F11AY , SM6F13AY , SM6F12AY , SM6F14AY , SM6F15AY , SM6F16AY , SM6F18AY , SM6F20AY , SM6F22AY , SM6F23AY , SM6F24AY , SM6F26AY , SM6F28AY , SM6F30AY , SM6F31AY , SM6F33AY , SM6F36AY
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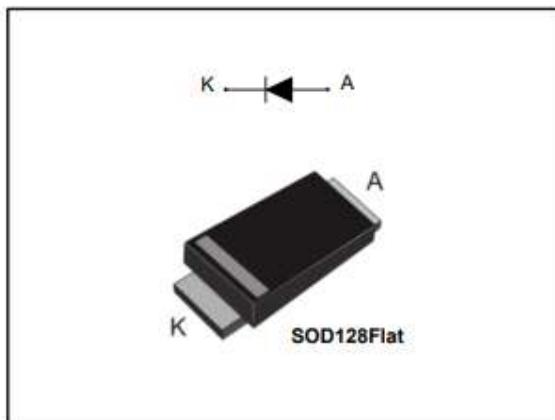
Description

The SM6FY series are designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability.

Automotive high voltage power Schottky rectifier

Datasheet - production data

**Description**

This high voltage Schottky barrier rectifier device is packaged in SOD128Flat and designed for high frequency miniature switched mode power supplies and for board DC to DC converters for automotive applications.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	5 A
V_{RRM}	100 V
$T_j(\text{max.})$	175 °C
$V_F(\text{typ.})$	0.51 V

Features

- Negligible switching losses
- High junction temperature capability
- Low leakage current
- Good trade-off between leakage current and forward voltage drop
- Avalanche specification
- ECOPACK® compliant component
- AEC-Q101
- PPAP capable
- V_{RRM} guaranteed from -40 to +175 °C

4.2 Construction Note

STPSxxxxZFY - STPSxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STTHxxxxZFY - STTHxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	Rectifiers
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STPSTxxxxZFY - STPSTxxxxAFY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky Trench
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

SMxFxxAY	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	TVS
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

5 TESTS RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L11	STPST2H100ZF	SOD 123	Qualification lot
L13	STTH1R06AFY	SOD 128	Qualification lot
L20	SM6F36AY	SOD 128	Qualification lot
L19	STTH1R02ZFY	SOD 123	Qualification lot
L15	STPS2H100ZF	SOD 123	Qualification lot
L17	STPS5H100AFY	SOD 128	Qualification lot
GD1	Dummies	SOD 128	Generic data for whiskers test

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 Not applicable for PTH and WLCSP without coating	X
MSL research	MSL	J-STD-020	L20, L19, L17	90	Not applicable for PTH and WLCSP without coating	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	All qualification parts tested per the requirements of the appropriate device specification			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	L13, L20, L11, L15	308		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	L13, L20, L17, L15	308		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	L20, L19, L17, L15	308		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	L11, L20, L19, L17, L15	385		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	L13, L17, L15	231	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005			For automotive products only See Annexe 6.1	X

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L13, L19	4	After H3TRB and TC. For automotive products only	X
Physical Dimension	PD	JESD22B-100	GD	60	See Annexe 6.2	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)	L20, L17, L15	90	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	L13, L15	120		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L13, L20, L11	25	Required in case of process change. See Annex 6.1 – RTH column	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			NA for products with clip	
Bond Shear	BS	AEC-Q101-003			NA for products with clip	
Die Shear	DS	MIL-STD-750 Method 2017			Not Applicable to parts with solder paste die attach	
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	GD1	45		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	
Repetitive Surge	RS	Internal Specification			Only for TVS products	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 20	Lot 17
Parametric Verifications		ST datasheet	Over part temperature range		-	Refer to paragraph 6.1 in Annexes					
External Visual Inspection		JESD22 B-101	-		-	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	1885	-	0/1885					
PC		JESD22A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	1412	-	0/1412					
MSL1 research	Y	J-STD-020	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	90	-		0/30			0/30	0/30
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=130°C Temperature=115°C Voltage=80V	308	1000h	0/77		0/77			
			Junction Temperature=175°C Temperature=170°C Voltage=600V		1000h			0/77			
			Junction Temperature=175°C Temperature=170°C Voltage=36V		1000h				0/77		
TC	Y	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	308	1000cy			0/77	0/77	0/77	0/77
RSH	Y	JESD22A-111 (SMD) / JESD22B-106 (PTH)	Temperature=260°C Time (on)=10s	90	-		0/30		0/30	0/30	0/30
H3TRB	Y	JESD22-A101	Humidity (HR)=85% Temperature=85°C Voltage=80V	385	1000h	0/77		0/77			0/77
			Humidity (HR)=85% Temperature=85°C Voltage=100V		1000h		0/77				
			Humidity (HR)=85% Temperature=85°C Voltage=36V		1000h				0/77		
uHAST	Y	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	308	96h		0/77	0/77		0/77	0/77
IOLT	Y	MIL-STD 750 Method 1037	Delta T_j =125°C Intensity (If)=0.8A Time (off)=120s Time (on)=120s	231	500h				0/77		
			Delta T_j =125°C Intensity (If)=1.45A Time (off)=120s Time (on)=120s		500h			0/77			
			Delta T_j =125°C Intensity (If)=2.1A Time (off)=120s Time (on)=120s		500h					0/77	
DPA	Y	ST 0060102 AEC Q101	Post TC or H3TRB	4	-	0/2		0/2			

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.					
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 20	Lot 17
SD	N	J-STD-002	Dry Aging=16Hrs Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C	120	Visual Inspection			0/15	0/15		
			Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15		
			Dry Aging=16Hrs Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C		Visual Inspection			0/15	0/15		
			Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15		

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.		
						GD 1		
Whiskers	N	JESD201	No reflow THS 30°C/60%RH	45	4000h	0/9		
			Reflow SnPb 215°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 215°C TC -40°C – 85°C		1500cy	0/9		
			Reflow SnPb 260°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 260°C TC -40°C – 85°C		1500cy	0/9		

6 ANNEXES

6.1 Parametric Verifications

- Results on STTH1R06AFY product:

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC_AMK				
Condition 1	-40°C	25°C	150°C	25°C	150°C
Condition 2				VR=600V	VR=600V
Min. Datasheet	600V	600V	600V		
Typ. Datasheet					10uA
Max. Datasheet				1uA	75uA
Comments					
UNIT	V	V	V	nA	uA
N	20	20	20	20	20
Min	646.000	677.100	738.500	0.000	2.514
Max	688.300	732.500	798.500	31.300	3.290
Avg.	672.345	714.925	779.625	3.506	2.873

TEST	VF	VF	RTH(J-L)	ESD_HBM	ESD_CDM
EQUIPMENT	TESEC_AMK			ESS6008	ESD-CDM TEST SYSTEM
Condition 1	25°C	150°C		25°C	25°C
Condition 2	IF=1A	IF=1A			
Min. Datasheet					
Typ. Datasheet		1.08V			
Max. Datasheet	1.9V	1.4V	24°C/W		
Comments				AEC-Q101	AEC-Q101
UNIT	V	V	°C/W	KV	KV
N	20	20	10	30	30
Min	1.374	1.028	14.900	4	>1.0
Max	1.544	1.121	16.190	4	>1.0
Avg.	1.477	1.086	15.651	4	

- Results on STPS2H100ZF product:

TEST	VF	VF	VF	VF	IR	IR
EQUIPMENT	TESEC_AMK					
Condition 1	24°C	24°C	125°C	125°C	24°C	125°C
Condition 2	IF=2A	IF=4A	IF=2A	IF=4A	VR=100V	VR=100V
Min. Datasheet						
Typ. Datasheet			0.65V	0.75V		0.2mA
Max. Datasheet	0.86V	0.96V	0.7V	0.83V	1uA	0.5mA
Comments						
UNIT	V	V	V	V	nA	uA
N	20	20	20	20	20	20
Min	0.786	0.853	0.635	0.707	78.020	123.700
Max	0.791	0.861	0.642	0.716	126.600	170.300
Avg.	0.789	0.857	0.640	0.713	90.865	136.840

TEST	VR	VR	VR	RTH(J-L)	ESD_HBM	ESD_CDM
EQUIPMENT	TESEC_AMK			AMK_RTH_Phase12	ESS6008	ESD-CDM TEST SYSTEM
Condition 1	-40°C	24°C	125°C		25°C	25°C
Condition 2						
Min. Datasheet	100V	100V	100V			
Typ. Datasheet						
Max. Datasheet				20°C/W		
Comments					AEC-Q101	AEC-Q101
UNIT	V	V	V	°C/W	KV	KV
N	20	20	20	10	30	30
Min	118.500	125.700	137.700	13.180	6	>1.0
Max	120.300	127.300	139.500	15.680	6	>1.0
Avg.	119.365	126.435	138.650	14.176	6	

- Results on SM6F36AY product:

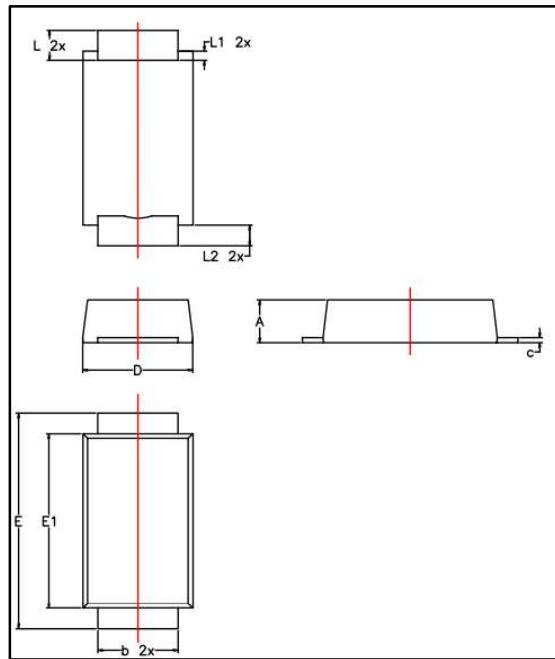
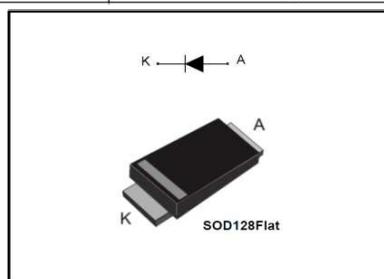
TEST	IR	IR	VR	ESD_HBM	ESD_CDM	RTH(J-L)
EQUIPMENT	TSA_491			ESS6008	ESD-CDM TEST SYSTEM	RTH(PHASE12)_TEST417
Condition 1	25°C	85°C	25°C	25°C	25°C	BARRE_ANALYSIS_TECH=S.U.
Condition 2	VR=36V	VR=36V	IR=1000µA			BARRE_ST=S.U.
Min. Datasheet			40V			
Typ. Datasheet			42.1V			
Max. Datasheet	200nA	1uA	44.2V			
Comments				AEC-Q101	AEC-Q101	
UNIT	nA	nA	V	KV	KV	°C/W
N	20	20	20	30	30	5
Min	3.383	3.478	40.810	>8.0	>1.0	10.870
Max	83.790	7.295	42.710	>8.0	>1.0	12.490
Avg.	9.677	4.847	41.589			11.878

TEST	VCL_10_1000	RD	VCL_8_20	RD	ALPHA_T
EQUIPMENT	VC6700	TESTS_CALCULES	ARETI	TESTS_CALCULES	
Condition 1	25°C	25°C	25°C	25°C	IR=1mA
Condition 2	IPP=10.3A	IF1=5.2A	IPP=52A	IF1=26A	TJ1=25°C
Condition 3	TP=1000us	IF2=10.3A	TP=20us	IF2=52A	TJ2=85°C
Condition 4	TR=10us	VF1=10 - VCL_10_1000 V	TR=8us	VF1=16 - VCL_8_20 V	
Min. Datasheet					1E-4/°C
Typ. Datasheet					1E-4/°C
Max. Datasheet	58.1V	1.350Ohm	76V	0.612Ohm	101E-4/°C
Comments					
UNIT	V	Ohm	V	Ohm	1E-4/°C
N	10	10	10	10	20
Min	50.650	0.796	53.870	0.215	9.145
Max	53.540	1.061	54.400	0.246	9.445
Avg.	51.940	0.974	54.080	0.233	9.287

6.2 Physical Dimensions

Dimensional report for SOD128 Flat package

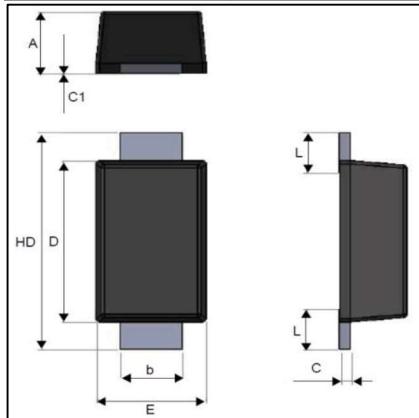
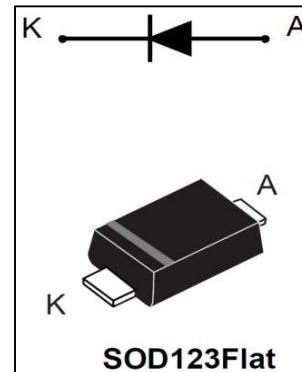
Ref.	Dimensions	
	Millimeters	
	Min.	Max.
A	0.93	1.03
b	1.69	1.81
c	0.10	0.22
D	2.30	2.50
E	4.60	4.80
E1	3.70	3.90
L	0.55	0.85
L1	0.30 typ.	
L2	0.45 typ.	



Dimensions in mm	A	b	c	D	E	E1	L	L1	L2
Measurement done on 30 units									
Min	0.937	1.691	0.150	2.313	4.666	3.782	0.711	0.248	0.426
Avg.	0.955	1.712	0.160	2.401	4.685	3.817	0.743	0.277	0.466
Max	0.979	1.737	0.171	2.421	4.697	3.830	0.793	0.314	0.506
LSL	0.930	1.690	0.100	2.300	4.600	3.700	0.550		
Typ.								0.300	0.450
USL	1.030	1.810	0.220	2.500	4.800	3.900	0.850		

Dimensional report for SOD123 Flat package

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	0.86	0.98	1.10
b	0.80	0.90	1.00
c	0.08	0.15	0.25
c1	0.00		0.10
D	2.50	2.60	2.70
E	1.50	1.60	1.80
HD	3.30	3.50	3.70
L	0.45	0.65	0.85



Dimensions in mm	A	b	c	c1	D	E	HD	L
Measurement done on 30 units								
Min	0.944	0.902	0.135	0.022	2.603	1.573	3.445	0.632
Avg.	0.964	0.914	0.149	0.033	2.619	1.593	3.501	0.667
Max	0.989	0.929	0.167	0.044	2.648	1.672	3.586	0.707
LSL	0.860	0.800	0.080	0.000	2.500	1.500	3.300	0.450
Typ.	0.980	0.900	0.150		2.600	1.600	3.500	0.650
USL	1.100	1.000	0.250	0.100	2.700	1.800	3.700	0.850

6.3 Tests description

Test name	Description	Purpose
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop-corn" effect and delamination.
HTRB 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.
H3TRB 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.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
UHAST 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.
IOLT 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.
RSH 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.
DPA 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.
SD 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.
WG 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.

Qualification Report

*Molding compound replacement for SOD123Flat &
SOD128Flat packages in Malaysia subcontractor for
Rectifiers and Protection diodes*

General Information		Locations	
Product Line	Rectifiers	Wafer fab	Tours 6 – France Ang Mo Kio - Singapore
Product Description	Ultrafast, Power Schottky & Power Schottky Trench Diodes	Assembly plant	Subcontractor 9961 – Malaysia
Product perimeter	STPSxxxxZF / STTHxxxxZF STPSTxxxxZF STPSxxxxAF / STPSTxxxxAF STTHxxxxAF	Reliability Lab	ST TOURS - FRANCE
Product Group	ADG	Reliability assessment	PASS
Product division	Discrete & Filter		
Package	SOD123-FLAT, SOD128-FLAT		
Maturity level step	30		

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	23-Nov-2023	20	Yann TURIN	Christophe Goin <small>Digital signature by Christophe Goin Date: 2023.11.23 15:00:44 +01'00'</small>	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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TABLE OF CONTENTS

1 APPLICABLE AND REFERENCE DOCUMENTS	3
2 GLOSSARY	3
3 RELIABILITY EVALUATION OVERVIEW.....	4
3.1 OBJECTIVES.....	4
3.2 CONCLUSION.....	4
4 DEVICE CHARACTERISTICS	5
4.1 DEVICE DESCRIPTION.....	5
4.2 CONSTRUCTION NOTE.....	8
5 TESTS RESULTS SUMMARY	9
5.1 TEST VEHICLES	9
5.2 TEST PLAN	10
5.3 RESULTS SUMMARY	12
6 ANNEXES	14
6.1 PARAMETRIC VERIFICATIONS	14
6.2 PHYSICAL DIMENSIONS.....	16
6.3 TESTS DESCRIPTION	18

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
GD	Generic Data
SD	Solderability test
MSL	Moisture Sensitivity Level
WG	Whiskers Growth
T _j	Junction Temperature
BS	Bond Shear
WBS	Wire Bond Strength
RSH	Resistance to Soldering Heat

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify new molding compound source for SOD123-FLAT and SOD128-FLAT packages.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
STPS1L40ZF STPS1L60ZF STPS2H100ZF	Power Schottky	SOD123-FLAT	Subcontractor 996I – Malaysia
STPS360AF STPS3H100AF STPS5H100AF		SOD128-FLAT	
STPST1H100ZF STPST2H100ZF	Power Schottky Trench	SOD123-FLAT	Subcontractor 996I – Malaysia
STPST2H100AF STPST1H100AF STPST3H100AF STPST5H100AF		SOD128-FLAT	
STTH1R02ZF STTH1R02ZF	Ultrafast	SOD123-FLAT	
STTH1R06AF		SOD128-FLAT	

The reliability test methodology used follows the ST 0061692 specification.

The following reliability tests ensuing are:

- TC and IOLT (only for rectifiers) 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, Solderability to check compatibility of package with customer assembly.
- WG to check lead-finishing quality.

For some tests, similarity methodology is used. See 5.2 "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

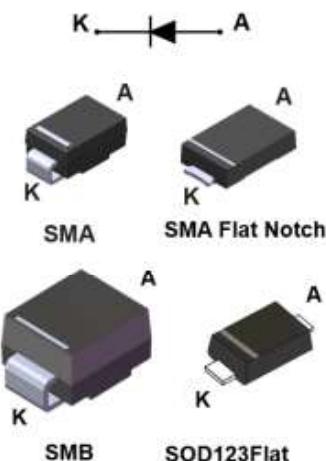
4.1 Device description

Refer to ST specification (some examples below):

**STPS1L40**

Datasheet

40 V, 1 A low drop power Schottky rectifier



Features

- Very small conduction losses
- Negligible switching losses
- Low forward voltage drop
- Surface mount miniature packages
- Avalanche rated
- ECOPACK² compliant

Applications

- Reverse polarity protection
- Set-top box power supply
- TV power supply
- Battery charger

Description

Single chip Schottky rectifiers suited to switched mode power supplies and high frequency DC to DC converters.

Packaged in SMA, SMA Flat Notch, SMB and SOD123Flat, the **STPS1L40** is ideal for use in surface mounting and used in low voltage, high frequency inverters, free-wheeling and polarity protection applications.

Product status	
STPS1L40	
Product summary	
Symbol	Value
$I_{F(AV)}$	1 A
V_{RRM}	40 V
$T_{j(max.)}$	175 °C
$V_F(typ.)$	0.37 V

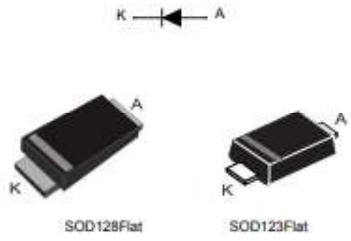


STPST1H100

Datasheet

100 V - 1 A power Schottky trench rectifier

Features



- High junction temperature capability
- Low forward voltage drop
- Low recovery charges
- Reduces conduction, reverse and switching losses
- Avalanche tested
- Flat packages
- ECOPACK2 compliant

Applications

- DC/DC converter
- LED lighting
- Flyback topology
- Auxiliary power supply
- Switch mode power supply (SMPS)



Product label



Product status link

[STPST1H100](#)

Description

This 1 A, 100 V rectifier is based on ST trench technology that achieves the best-in-class V_F/I_R trade-off for a given silicon surface.

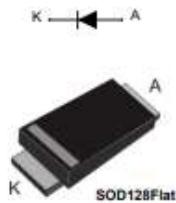
Integrated in flat and space-saving packages, this STPST1H100 trench rectifier is intended to be used in high frequency miniature switched mode power supplies. It is also an ideal candidate for auxiliary power supply in telecom, server, or smart metering. ST trench rectifiers are adapted to freewheeling, OR-ring or reverse polarity protection applications, and can be the perfect companion device to our transistors, drivers, or ST VIPer products.

Product summary

$I_F(AV)$	1 A
V_{RRM}	100 V
T_j (max.)	175 °C
V_F (typ.)	0.580 V



600 V, 1 A, turbo 2 ultrafast rectifier



Features

- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- ECOPACK2 compliant component

Applications

- Clamping function
- Boost diode
- PFC

Description

The STTH1R06AF is an ultrafast recovery power rectifier housed in SOD128Flat to improve space saving.

It is especially designed for clamping function in energy recovery block or boost diode in power correction circuitry.

The compromise between forward voltage drop and recovery time offers optimized performance.

Product status	
STTH1R06AF	

Product summary	
$I_{F(AV)}$	1 A
V_{RRM}	600 V
t_{rr}	30 ns
T_j	175 °C
$V_F(\text{typ.})$	1.08 V

4.2 Construction Note

STPSxxxxZF - STPSxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STTHxxxxZF - STTHxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Tours - France
Technology / Process family	Rectifiers
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Tours - France
Assembly information	
Assembly site	Subcontractor – Malaysia (996I)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – Malaysia (996I)

STPSTxxxxZF - STPSTxxxxAF	
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio - Singapore
Technology / Process family	Power Schottky Trench
Wafer Testing (EWS) information	
Electrical testing manufacturing location	Ang Mo Kio - Singapore
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	SOD123-Flat, SOD128-Flat
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

5 TESTS RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L11	STPST2H100ZF	SOD 123	Qualification lot
L13	STTH1R06AFY	SOD 128	Qualification lot
L19	STTH1R02ZFY	SOD 123	Qualification lot
L15	STPS2H100ZF	SOD 123	Qualification lot
L17	STPS5H100AFY	SOD 128	Qualification lot
GD1	Dummies	SOD 128	Generic data for whiskers test

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 Not applicable for PTH and WLCSP without coating	X
MSL research	MSL	J-STD-020	L19, L17	60	Not applicable for PTH and WLCSP without coating	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	All qualification parts tested per the requirements of the appropriate device specification			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	L13, L11, L15	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	L13, L17, L15	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	L19, L17, L15	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	L11, L19, L17, L15	308		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	L13, L17, L15	231	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005			For automotive products only	

Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4			After H3TRB and TC. For automotive products only	
Physical Dimension	PD	JESD22B-100	GD	60	See Annexe 6.2	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)	L17, L15	60	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	L13, L15	120		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L13, L11	20	Required in case of process change. See Annex 6.1 – RTH column	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			NA for products with clip	
Bond Shear	BS	AEC-Q101-003			NA for products with clip	
Die Shear	DS	MIL-STD-750 Method 2017			Not Applicable to parts with solder paste die attach	
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	GD1	45		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	
Repetitive Surge	RS	Internal Specification			Only for TVS products	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.				
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 17
Parametric Verifications		ST datasheet	Over part temperature range		-	Refer to paragraph 6.1 in Annexes				
External Visual Inspection		JESD22 B-101	-		-	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	1352	-	0/1352				
PC		JESD22A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C; 85%RH IR reflow 3 times	1412	-	0/1121				
MSL1 research	Y	J-STD-020	MSL=1, Reflow=3 Temperature=85°C Humidity (HR)=85%	60	-		0/30			0/30
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=130°C	231	1000h	0/77		0/77		
			Temperature=115°C Voltage=80V		1000h				0/77	
			Junction Temperature=175°C		1000h					
TC	Y	JESD22-A104	Temperature=170°C	231	500cy			0/77	0/77	0/77
			Voltage=600V							
			Temperature=175°C							
RSH	Y	JESD22A-111 (SMD) / JESD22B-106 (PTH)	Temperature=170°C	60	-			0/30		0/30
			Voltage=36V							
			Temperature (high)=150°C							
H3TRB	Y	JESD22-A101	Temperature (low)=-55°C	308	500h	0/77		0/77		0/77
			Humidity (HR)=85%		500h					
			Temperature=85°C							
uHAST	Y	JESD22 A-118	Voltage=80V	231	500h					
			Humidity (HR)=85%							
			Pressure=2.3bar							
IOLT	Y	MIL-STD 750 Method 1037	Temperature=130°C	231	96h		0/77	0/77		0/77
			Delta T_j =125°C		500h				0/77	
			Intensity (If)=0.8A							
			Time (off)=120s							
			Time (on)=120s							
			Delta T_j =125°C							
			Intensity (If)=1.45A		500h			0/77		
			Time (off)=120s							
			Time (on)=120s		500h					0/77

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.				
						Lot 11	Lot 19	Lot 15	Lot 13	Lot 17
SD	N	J-STD-002	Dry Aging=16Hrs Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C	120	Visual Inspection			0/15	0/15	
			Metal (solder)=SnPb No Data Dream=1 No Elec Measurement=1 Temperature=220°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15	
			Dry Aging=16Hrs Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C		Visual Inspection			0/15	0/15	
			Metal (solder)=SnAgCu No Data Dream=1 No Elec Measurement=1 Temperature=245°C Wet Aging=8Hrs		Visual Inspection			0/15	0/15	

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot		
						Fail/S.S.		
Whiskers	N	JESD201	No reflow THS 30°C/60%RH	45	4000h	0/9		
			Reflow SnPb 215°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 215°C TC -40°C – 85°C		1500cy	0/9		
			Reflow SnPb 260°C THS 55°C/85%RH		4000h	0/9		
			Reflow SnPb 260°C TC -40°C – 85°C		1500cy	0/9		

6 ANNEXES

6.1 Parametric Verifications

- Results on STTH1R06AFY product:

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC_AMK				
Condition 1	-40°C	25°C	150°C	25°C	150°C
Condition 2				VR=600V	VR=600V
Min. Datasheet	600V	600V	600V		
Typ. Datasheet					10uA
Max. Datasheet				1uA	75uA
Comments					
UNIT	V	V	V	nA	uA
N	20	20	20	20	20
Min	646.000	677.100	738.500	0.000	2.514
Max	688.300	732.500	798.500	31.300	3.290
Avg.	672.345	714.925	779.625	3.506	2.873

TEST	VF	VF	RTH(J-L)
EQUIPMENT	TESEC_AMK		
Condition 1	25°C	150°C	
Condition 2	IF=1A	IF=1A	
Min. Datasheet			
Typ. Datasheet		1.08V	
Max. Datasheet	1.9V	1.4V	24°C/W
Comments			
UNIT	V	V	°C/W
N	20	20	10
Min	1.374	1.028	14.900
Max	1.544	1.121	16.190
Avg.	1.477	1.086	15.651

- Results on STPS2H100ZF product:

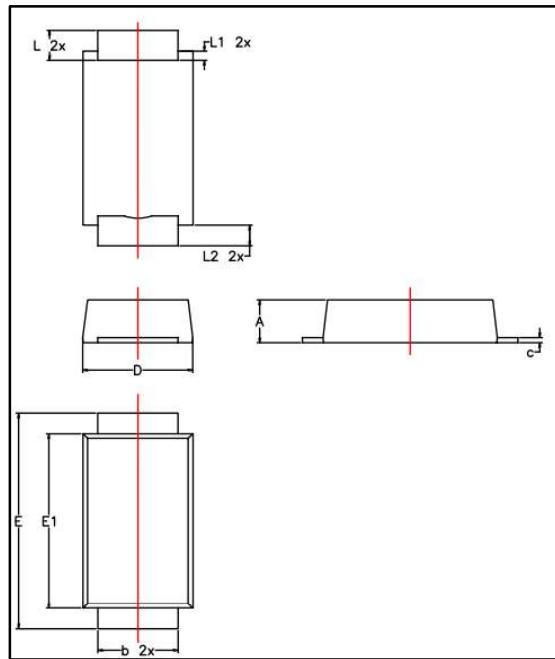
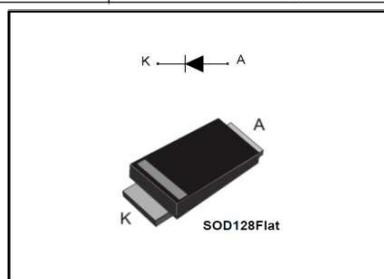
TEST	VF	VF	VF	VF	IR	IR
EQUIPMENT	TESEC_AMK					
Condition 1	24°C	24°C	125°C	125°C	24°C	125°C
Condition 2	IF=2A	IF=4A	IF=2A	IF=4A	VR=100V	VR=100V
Min. Datasheet						
Typ. Datasheet			0.65V	0.75V		0.2mA
Max. Datasheet	0.86V	0.96V	0.7V	0.83V	1uA	0.5mA
Comments						
UNIT	V	V	V	V	nA	uA
N	20	20	20	20	20	20
Min	0.786	0.853	0.635	0.707	78.020	123.700
Max	0.791	0.861	0.642	0.716	126.600	170.300
Avg.	0.789	0.857	0.640	0.713	90.865	136.840

TEST	VR	VR	VR	RTH(J-L)
EQUIPMENT	TESEC_AMK			AMK_RTH_Phase12
Condition 1	-40°C	24°C	125°C	
Condition 2				
Min. Datasheet	100V	100V	100V	
Typ. Datasheet				
Max. Datasheet				20°C/W
Comments				
UNIT	V	V	V	°C/W
N	20	20	20	10
Min	118.500	125.700	137.700	13.180
Max	120.300	127.300	139.500	15.680
Avg.	119.365	126.435	138.650	14.176

6.2 Physical Dimensions

Dimensional report for SOD128 Flat package

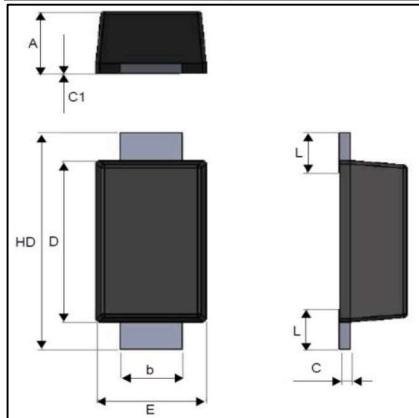
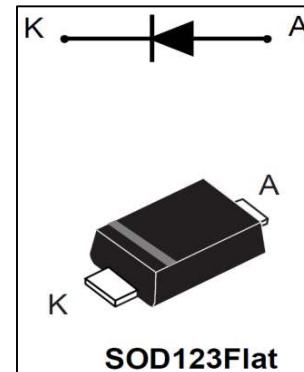
Ref.	Dimensions	
	Millimeters	
	Min.	Max.
A	0.93	1.03
b	1.69	1.81
c	0.10	0.22
D	2.30	2.50
E	4.60	4.80
E1	3.70	3.90
L	0.55	0.85
L1	0.30 typ.	
L2	0.45 typ.	



Dimensions in mm	A	b	c	D	E	E1	L	L1	L2
Measurement done on 30 units									
Min	0.937	1.691	0.150	2.313	4.666	3.782	0.711	0.248	0.426
Avg.	0.955	1.712	0.160	2.401	4.685	3.817	0.743	0.277	0.466
Max	0.979	1.737	0.171	2.421	4.697	3.830	0.793	0.314	0.506
LSL	0.930	1.690	0.100	2.300	4.600	3.700	0.550		
Typ.								0.300	0.450
USL	1.030	1.810	0.220	2.500	4.800	3.900	0.850		

Dimensional report for SOD123 Flat package

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	0.86	0.98	1.10
b	0.80	0.90	1.00
c	0.08	0.15	0.25
c1	0.00		0.10
D	2.50	2.60	2.70
E	1.50	1.60	1.80
HD	3.30	3.50	3.70
L	0.45	0.65	0.85



Dimensions in mm	A	b	c	c1	D	E	HD	L
Measurement done on 30 units								
Min	0.944	0.902	0.135	0.022	2.603	1.573	3.445	0.632
Avg.	0.964	0.914	0.149	0.033	2.619	1.593	3.501	0.667
Max	0.989	0.929	0.167	0.044	2.648	1.672	3.586	0.707
LSL	0.860	0.800	0.080	0.000	2.500	1.500	3.300	0.450
Typ.	0.980	0.900	0.150		2.600	1.600	3.500	0.650
USL	1.100	1.000	0.250	0.100	2.700	1.800	3.700	0.850

6.3 Tests description

Test name	Description	Purpose
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop-corn" effect and delamination.
HTRB 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.
H3TRB 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.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
UHAST 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.
IOLT 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.
RSH 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.
SD 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.
WG 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.