Public Products List

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

PCN Title : Process rationalization for SiC 1200V diodes at ST Catania die manufacturing plant

PCN Reference : ADG/22/13321

Subject : Public Products List

Dear Customer,

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

STPSC20H12G2Y-TR	STPSC10H12CWL	STPSC10H12G-TR
STPSC10H12B2-TR	STPSC20H12GY-TR	STPSC15H12G2Y-TR
STPSC15H12G2-TR	STPSC10H12G2-TR	STPSC10H12D
STPSC10H12WL	STPSC15H12WL	STPSC30H12CWL
STPSC20H12CWY	STPSC15H12DY	STPSC15H12D
STPSC20H12DY	STPSC20H12CWL	STPSC2H12D
STPSC20H12G-TR	STPSC20H12G2-TR	STPSC20H12WL
STPSC10H12DY	STPSC5H12D	STPSC20H12D
STPSC40H12CWL	STPSC10H12G2Y-TR	STPSC10H12GY-TR
STPSC2H12B2Y-TR		

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PCN
Product/Process Change Notification

Process rationalization for SiC 1200V diodes

at ST Catania die manufacturing plant

Notification number:	ADG/22/13321	**Issue Date**	06-Apr-2022
Issued by	Isabelle BALLON		
Product series affected by the change		Refer to attached table for involved Commercial Products	
Type of change		Front-End realization	

Description of the change

STMicroelectronics is extending process rationalization for top and back metal, and passivation at ST Catania die manufacturing plant on SiC 1200V Diodes.

Reason for change

In line with the commitment of ST Company to reinforce its leading position in the SiC Power Rectifiers market and to support strong SiC business increase, STMicroelectronics has decided to rationalize the manufacturing process of all SiC (Diodes metallization & passivation alignment versus SiC Mosfet).

Former versus changed product:	The changed products do not present modified electrical, dimensional, or thermal parameters, leaving unchanged the current information published in the products datasheets. This rationalization is part of Sustainability and ST Eco-design approach (engagement in Responsible Mineral Initiative). ST Sustainable Technology Brochure The Moisture Sensitivity Level of the parts (according to the IPC/JEDEC JSTD-020D standard) remains unchanged. There is no change in the packing modes and the standard delivery quantities either.

Disposition of former products

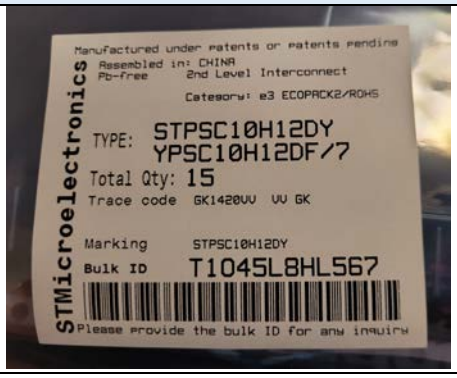
Shipments will be supported until stock depletion.

(1) ADG: Automotive and Discrete Group

Marking and traceability

Traceability of the change will be ensured by Finished Good/Type print on carton labels.

Commercial part number (Order code)	Former Finished Good (Type)	New Finished Good (Type)
No change (example: **STPSC10H12DY)**	Ending by **/x** (example: YPSC10H12DF/7)	Ending by **P/x** (example: YPSC10H12DP/7)

Former Label (example)	**New Label** (example)
	

Qualification completion date	14-Mar-2022

Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Rectifiers	SiC	STPSC10H12CWL	Week 20-2022
Rectifiers	SiC	STPSC10H12D	Week 17-2022
Rectifiers	SiC	STPSC10H12DY	Week 13-2022
Rectifiers	SiC	STPSC10H12WL	Week 17-2022
Rectifiers	SiC	STPSC15H12WL	Week 17-2022
Rectifiers	SiC	STPSC20H12CWY	Week 13-2022
Rectifiers	SiC	STPSC10H12G2Y-TR	Week 17-2022
Rectifiers	SiC	STPSC20H12G2Y-TR	Week 13-2022
Rectifiers	SiC	STPSC40H12CWL	Week 13-2022
Rectifiers	SiC	STPSC2H12B2Y-TR	Week 13-2022
Rectifiers	SiC	STPSC10H12B2-TR	Week 13-2022
Rectifiers	SiC	STPSC20H12CWL	Week 13-2022

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 on demand.

Change implementation schedule

Sales-types	Estimated production start	Estimated first shipments
All	**Week 15-2022**	**Week 26-2022**

Comments:	
Customer's feedback Please contact your local ST sales representative or quality contact for requests concerning this change notification.	
Qualification program and results	22009QRP Attached

(1) ADG: Automotive and Discrete Group

Involved Commercial part numbers
STPSC10H12B2-TR
STPSC10H12CWL
STPSC10H12D
STPSC10H12DY
STPSC10H12G-TR
STPSC10H12G2-TR
STPSC10H12G2Y-TR
STPSC10H12GY-TR
STPSC10H12WL
STPSC15H12D
STPSC15H12DY
STPSC15H12G2-TR
STPSC15H12G2Y-TR
STPSC15H12WL
STPSC20H12CWL
STPSC20H12CWY
STPSC20H12D
STPSC20H12DY
STPSC20H12G-TR
STPSC20H12G2-TR
STPSC20H12G2Y-TR
STPSC20H12GY-TR
STPSC20H12WL
STPSC2H12B2Y-TR
STPSC2H12D
STPSC30H12CWL
STPSC40H12CWL
STPSC5H12D

Specific devices not expressly listed above are included in this change.

Qualification Report

Qualification of Process rationalization for SiC 1200V diodes at ST CATANIA die manufacturing plant

General Information	
Product Line	*Rectifiers*
Product Description	*SiC 1200V*
Product Perimeter	*Refer to Involved products in page 4 report*
Product Group	*ADG*
Product Division	*Discrete & Filter*
Packages	*TO-220AC, TO-247, TO-247 LL, DO-247 LL, D²PAK, DPAK-HV*
Maturity level step	*QUALIFIED*

Locations	
Wafer Fab	*ST Microelectronics CATANIA - ITALY*
Assembly Plant	*ST Microelectronics SHENZHEN - CHINA SUBCONTRACTOR – CHINA- 998G*
Reliability Lab	*ST TOURS – FRANCE*
Reliability Assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	07-march-2022	21	Henri VIVANT	Julien MICHELON	Initial release

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

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
AEC-Q101 Rev.E (for Automotive products)	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications
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

2 GLOSSARY

DPA	Destructive Physical Analysis
GD	Generic Data
H3TRB	High Humidity High Temperature Reverse Bias
HTRB	High Temperature Reverse Bias
IOLT	Intermittent Operating Life Test
PC	Preconditioning
SS	Sample Size
TC	Temperature Cycling

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

STMicroelectronics is extending process rationalization for top and back metal, and passivation at ST Catania die manufacturing plant on SiC 1200V Diodes.

Table of involved products

Commercial Product	Product Family	Package	Assembly Location
STPSC10H12B2-TR	Power Schottky SiC	DPAK HV	Shenzhen – CHINA (3068)
STPSC2H12B2Y-TR			
STPSC10H12D		TO-220AC	
STPSC10H12DY			
STPSC15H12D			
STPSC15H12DY			
STPSC20H12D			
STPSC20H12DY			
STPSC2H12D			
STPSC5H12D			
STPSC10H12G-TR		D²PAK	
STPSC10H12G2-TR			
STPSC10H12G2Y-TR			
STPSC10H12GY-TR			
STPSC15H12G2-TR			
STPSC15H12G2Y-TR			
STPSC20H12G-TR			
STPSC20H12G2-TR			
STPSC20H12G2Y-TR			
STPSC20H12GY-TR			
STPSC20H12CWY		TO-247	
STPSC10H12WL		DO-247LL	Subcontractor – CHINA (998G)
STPSC15H12WL			
STPSC20H12WL			
STPSC30H12CWL		TO-247LL	
STPSC40H12CWL			
STPSC10H12CWL			
STPSC20H12CWL			

The reliability test methodology used follows the JESD47: « Stress Test driven Qualification Methodology » and AEC-Q101 revE guidelines (for Automotive products).

The reliability tests ensuing are:

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

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

3.2 Conclusion

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

4 DEVICE CHARACTERISTICS

4.1 Device description

Refer to product datasheet(s).
Example here below

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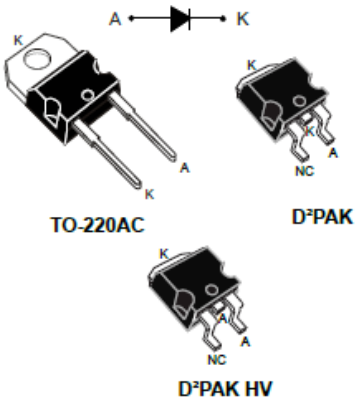
STPSC20H12-Y

Datasheet

Automotive 1200 V, 20 A, silicon carbide power Schottky diode



Product label
SUSTAINABLE TECHNOLOGY

Product status link
STPSC20H12-Y

Product summary	
$I_{F(AV)}$	20 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- PPAP capable
- Operating T_j from -40 °C to 175 °C
- D²PAK HV creepage distance (anode to cathode) = 5.38 mm min.
- ECOPACK compliant

Applications

- On board charger

Description

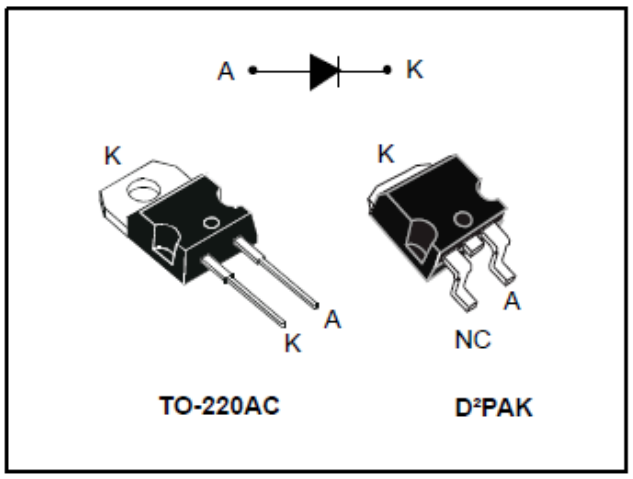
The SiC diode is an ultra high performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide band gap material allows the design of a Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in PFC applications, the STPSC20H12-Y will boost performance in hard switching conditions. Its high forward surge capability ensures good robustness during transient phases.

STPSC10H12-Y

Automotive grade 1200 V power Schottky silicon carbide diode

Datasheet - production data



Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- PPAP capable
- Operating T_j from -40 °C to 175 °C
- ECOPACK®2 compliant

Description

The SiC diode, available in TO-220AC and D²PAK, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low V_F Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.
Especially suited for use in PFC and secondary side applications, this ST SiC diode will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	10 A
V_{RRM}	1200 V
T_j(max.)	175 °C
V_F(typ.)	1.35 V

STPSC2H12-Y

Datasheet

Automotive 1200 V, 2 A power Schottky silicon carbide diode

DPAK HV 2L

Product label

Product status link

STPSC2H12-Y

Product summary

$I_{F(AV)}$	2 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Features

- AEC-Q101 qualified
- PPAP capable
- No or negligible reverse recovery
- High forward surge capability
- Operating T_j from -40 °C to 175 °C
- Creepage distance of 3 mm as per IEC 60664-1
- ECOPACK2 compliant component

Applications

- Bootstrap function of SiC MOS-FETS
- Snubber diode
- Switching diode

Description

The SiC diode is an ultra-high performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide band gap material allows the design of a Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in boot strap, snubber circuits, or clamping functions of SiC MOS-FETs, the STPSC2H12-Y diode will help designers getting the best possible performance of their controlled switches in all conditions. This rectifier will enhance the performance of the targeted application.

Its improved creepage distance ensures the compatibility with industrial and automotive creepage standards.

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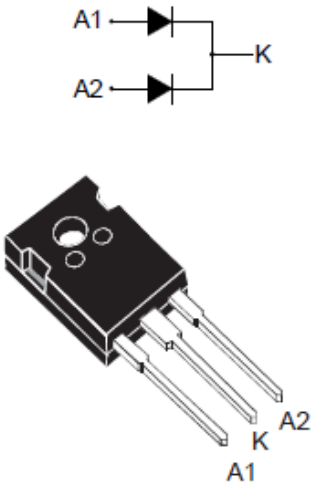
STPSC40H12C

1200 V power Schottky silicon carbide diode

Datasheet - production data



TO-247 LL

Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating T_j from -40 °C to 175 °C
- ECOPACK®2 compliant

Description

The SiC diode, available in TO-247 LL, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low V_F Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in PFC and secondary side applications, this ST SiC diode will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	2 x 20 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

4.2 Construction Note

	STPSC10H12DY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	TO-220AC
Final testing information	
Testing location	ST SHENZHEN - CHINA

	STPSC20H12CWY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	TO-247
Final testing information	
Testing location	ST SHENZHEN - CHINA

	STPSC40H12CWL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	TO-247
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC20H12G2Y-TR
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	D2PAK
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC20H12CWL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	TO-247
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC2H12B2Y
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	DPAK
Final testing information	
Testing location	ST SHENZHEN - CHINA

5 TESTS PLAN AND RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Wafer fab location	Assy plant Location	Comments
L1	STPSC20H12G2Y-TR	D2PAK HV	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 1
L2	STPSC40H12CWL	TO-247LL	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 2
L3	STPSC10H12DY	TO-220AC	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 3
L4	STPSC20H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 4
L5	STPSC40H12CWL	TO-247LL	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 5
L6	STPSC2H12B2Y	DPAK HV	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 6
GD1	STPSC30H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Generic data for Thermal Cycling, HTRB, H3TRB, IOLT
GD2	STPSC30H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Generic data for H3TRB

GD: Test vehicles used for similarity.

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	J-STD-020 JESD22-A113	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			Not applicable for PTH and WLCSP without coating	
External Visual	EV	JESD22B-101	All qualification parts tested per the requirements of the appropriate device specification.		Done during Assembly → Test & Finish inspection	x
Parametric Verification	PV	User specification	L1 L3 L5 L6	4*30		X
High Temperature Reverse Bias	HTRB	MIL-STD-750-1 M1038 Method A	L1 L2 L3 L5 GD1	5*77 (385)	WBI after HTRB applicable only for dissimilar metal (wire/meta) in case of no Cu wire	X
AC blocking voltage	ACBV	MIL-STD-750-1 M1040 Test condition A			Required for Thyristor only. Alternative to HTRB	
High Temperature Forward Bias	HTFB	JESD22 A-108			Not required, applicable only to LEDS Alternative to HTRB	
High Temperature Operating Life	HTOL				Covered by HTRB or ACBV	
Steady State Operational	SSOP	MIL-STD-750-1 M1038 Test condition B			Required for Voltage Regulator (Zener) only.	
High Temperature Gate Bias	HTGB	JESD 22A-108			Required for Power MOSFET – IGBT only.	
High Temperature Storage Life	HTSL	JESD22 A-103			Covered by HTRB	
Temperature Humidity Storage	THS	JESD22 A-118			Covered by H3TRB	
Temperature Cycling	TC	JESD22A-104	L1 L2 L3 L4 L5 GD1	6*77 (462)		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for Power MOSFET – IGBT only.	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
Temperature Cycling Delamination Test	TCDT	JESD22A-104 J-STD-035			Required for Power MOSFET - IGBT only. Alternative to TCHT	
Wire Bond Integrity	WBI	MIL-STD-750 Method 2037			For dissimilar metal bonding systems only	
Unbiased Highly Accelerated Stress Test	UHAST	JESD22A-118 or A101			Required for SCR/TRIAC RECTIFIER and Protection devices	
Autoclave	AC	JESD22A-102			Alternative to UHAST	
Highly Accelerated Stress Test	HAST	JESD22A-110			Covered by H3TRB (same failure mechanisms activation).	
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	L1 L2 L3 L5 GD1 GD2	5*77 1*10 (395)	Alternative to HAST	X
High Temperature High Humidity Bias	HTHHB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOL	MIL-STD-750 Method 1037	L1 L2 L3 L5 GD1	5*77 (385)	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			For power devices. Not required for Transient Voltage Suppressor (TVS) parts Perform PTC if $\Delta Tj>100°C$ cannot be achieved with IOL Alternative to IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1 L3 L6	3*30 (90)		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1 L3 L6	3*30 (90)		X
Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1 GD1	2*2	After H3TRB and TC	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)			Not applicable for SMD pitch < 0.5mm, package size >	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
					5.5*12.5mm and die paddle > 2.5*3.5mm	
Solderability	SD	J-STD-002 JESD22B102				
Dead Bug Test	DBT	ST Internal specification			Mandatory for SMD package Data collection for PTH package	
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate			Required in case of process change. Not applicable to protection device as no limit specified in the datasheet	
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			Covered during workability trials	
Bond Shear	BS	AEC-Q101-003			Covered during workability trials	
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 Power MOSFET - IGBT only.	
Short Circuit Reliability Characterization	SCR	AEC-Q101-006			Required for smart power parts only	
Whisker Growth Evaluation	WG	AEC-Q005 JESD201				
Early Life Failure Rate	ELFR	JESD74			Recommended for new techno development in case of identified failure mechanism	
Functional Test (in rush, di/dt...)	FT	Internal specification				
Repetitive Surge	RS	Internal specification			Required for protection devices only.	

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)	PC sec	MIL-STD750-1 Method1037			AQG324 test for Modules	
Power Cycling (minutes)	PC min	MIL-STD750-1 Method1037			AQG324 test for Modules	
Mechanical shock	MS	IEC 600068-2-27			AQG324 test for Modules	
Vibration	V	IEC60068-2-6			AQG324 test for Modules	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps		Results/Lot Fail/S.S.						
						Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	GD1	GD2
Parametric Verifications	NA	ST datasheet	Over part temperature range	120	-		Refer to paragraph 6.1 in Annexes						
ESD	NA	AEC-Q101	HBM	90	-		Refer to paragraph 6.1 in Annexes						
			CDM	90	-		Refer to paragraph 6.1 in Annexes						
External Visual Inspection	NA	JESD22 B-101	-	-	-		All qualification parts submitted for testing passed External & Visual inspection during manufacturing process						
Pre and Post Electrical Test	NA	ST datasheet	I_R, V_F parameters following product datasheet	-			Pass						
PC	Y	JESD22 A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	180	-		Pass						
HTRB		JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature = 175°C Tension=1200V	231		0/77	0/77	0/77					
TC	Y	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	385	1000cy	0/77	0/77	0/77	0/77			0/77	
H3TRB	N	JESD22-A101	Humidity (HR)=85% Temperature=85°C Voltage=100V	385	1000h	0/77	0/77	0/77		0/77		0/77	
DPA	Y	ST 0060102 AEC Q101	After TC 1000h	4	-	0/2						0/2	
IOLT	Y	MIL-STD 750 Method 1037	Delta Tj=125°C	308	500h		0/77	0/77		0/77		0/77	
			Delta Tj=100°C	77	500h	0/77							
				77	1000h	0/77							

Note 1: These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances. Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers."

6 ANNEXES

6.1 Parametric Verification

- **Results on STPSC2H12B2Y-TR product**

Characterization report for STPSC2H12B2Y-TR

Date : 30/09/2021
Ref : 21872A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=2A	IF=2A	IF=2A	IF=2A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*1uA*	*6uA*			*1.35V*	*1.75V*	
Max. Datasheet		*12uA*	*80uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	nA	nA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	4,000	12,500	288,000	577,900	1,273	1,295	1,582	1,683
Max	96,200	99,900	623,900	1159,000	1,300	1,344	1,740	1,872
Avg.	54,803	33,407	362,990	708,560	1,285	1,328	1,693	1,814

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=5mA	IR=5mA	IR=5mA	IR=5mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1404,000	1434,000	1473,000	1482,000
Max	1460,000	1476,000	1515,000	1523,000
Avg.	1445,433	1466,933	1505,767	1514,433

- ## Results on STPSC10H12DY product

Characterization report STPSC10H12DY

Date : 13/01/2022
Ref : 22027A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=10A	IF=10A	IF=10A	IF=10A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*5uA*	*30uA*			*1.35V*	*1.75V*	
Max. Datasheet		*60uA*	*400uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	uA	uA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	11,900	45,500	0,736	1,717	1,310	1,346	1,691	1,809
Max	223,500	347,900	2,199	4,159	1,340	1,409	1,883	2,030
Avg.	77,697	157,223	1,195	2,476	1,329	1,384	1,806	1,941

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=5mA	IR=5mA	IR=5mA	IR=5mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1380,000	1405,000	1466,000	1471,000
Max	1459,000	1476,000	1523,000	1532,000
Avg.	1436,167	1453,100	1504,833	1515,367

- ## Results on STPSC20H12G2Y-TR product

Characterization report for STPSC20H12G2Y-TR

Date : 21/09/2021
Ref : 21869A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=20A	IF=20A	IF=20A	IF=20A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*10uA*	*60uA*			*1.35V*	*1.50V*	
Max. Datasheet		*120uA*	*800uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	uA	uA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	119,899996	198,900	1,629	3,679	1,265	1,284	1,544	1,634
Max	4779,9997	7400,000	18,170	24,620	1,291	1,340	1,722	1,849
Avg.	536,3733202	987,607	4,795	8,486	1,275	1,306	1,616	1,721

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=2.4mA	IR=2.4mA	IR=2.4mA	IR=2.4mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1354,000	1366,000	1417,000	1430,000
Max	1489,000	1506,000	1545,000	1552,000
Avg.	1420,167	1435,133	1479,600	1490,367

- **Results on STPSC40H12CWL product**

Characterization report for STPSC40H12CWL						
Date : 21/09/2021						
Ref : 21946A						
Lab : ST Tours Characterization Lab						
TEST	**IR**	**IR**	**IR**	**VF**	**VF**	**VF**
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	-40°C	25°C	150°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=20A	IF=20A	IF=20A
Condition 3						
Min. Datasheet						
Typ. Datasheet		*10uA*	*60uA*		*1.35V*	*1.75V*
Max. Datasheet		*120uA*	*800uA*		*1.50V*	*2.25V*
Commentaires						
UNIT	nA	nA	uA	V	V	V
N	Covered by STPSC20H12G2Y-TR (same dice)	60	60	Covered by STPSC20H12G2Y-TR (same dice)	60	60
Min		1,629	1,859		1,299	1,563
Max		18,170	13,3		1,349	1,735
Avg.		4,795	3,407716682		1,3295	1,6691

TEST	**VR**	**VR**	**VR**
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C
Condition 2	IR=2.4mA	IR=2.4mA	IR=2.4mA
Condition 3			
Min. Datasheet	*1200V*	*1200V*	*1200V*
Typ. Datasheet			
Max. Datasheet			
Commentaires			
UNIT	V	V	V
N	Covered by STPSC20H12G2Y-TR (same dice)	60	60
Min		1,299	1436
Max		1,349	1543
Avg.		1,3295	1510,183333

6.2 ESD

- **Results on STPSC20H12G2Y-TR product**

TEST	**ESD_CDM**	**ESD_HBM**
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	>8.0
Max	>1.0	>8.0

- **Results on STPSC2H12B2Y-TR product**

TEST	ESD_CDM	ESD_HBM
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	6
Max	>1.0	6

- **Results on STPSC10H12DY product**

TEST	ESD_CDM	ESD_HBM
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	>8.0
Max	>1.0	>8.0

6.3 Assembly Tests

Wire pull Test

	Conditions	Sample Size	Failure / SS
STPSC20H12G2Y-TR	Min 300g	10 Wires	0/10
STPSC10H12DY	Min 350g	10 Wires	0/10
STPSC2H12B2Y-TR	Min 180g	10 Wires	0/10
STPSC40H12CWL	Min 350g	30 Wires	0/30

Ball / Wedge Shear Test

	Conditions	Sample Size	Failure / SS
STPSC20H12G2Y-TR	Min 500g	10 Wires	0/10
STPSC10H12DY	Min 700g	10 Wires	0/10
STPSC40H12CWL	Min 700g	30 Wires	0/30

6.4 Tests description

Test name	Description	Purpose
	Die Oriented	
HTRB High Temperature Reverse Bias	HTRB : High Temperature Reverse Bias HTFB / HTGB : High Temperature Forward (Gate) Bias The device is stressed in static configuration, trying to satisfy as much as possible the following conditions: - low power dissipation; - max. supply voltage compatible with diffusion process and internal circuitry limitations.	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.
	Package Oriented	
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.
H3TRB High Humidity High Temperature Reverse 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.
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, not gradually, to the device for the time necessary to achieve a delta case temperature 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.
DPA Destructive Physical Analysis	Specific construction analysis on random parts that have successfully completed THB or TC.	To investigate on reliability stresses impact on delamination, corrosion and product construction integrity.

Qualification Report

Qualification of Process rationalization for SiC 1200V diodes at ST CATANIA die manufacturing plant

General Information	
Product Line	*Rectifiers*
Product Description	*SiC 1200V*
Product Perimeter	*Refer to Involved products in page 4 report*
Product Group	*ADG*
Product Division	*Discrete & Filter*
Packages	*TO-220AC, TO-247, TO-247 LL, DO-247 LL, D²PAK, DPAK-HV*
Maturity level step	*QUALIFIED*

Locations	
Wafer Fab	*ST Microelectronics CATANIA - ITALY*
Assembly Plant	*ST Microelectronics SHENZHEN - CHINA SUBCONTRACTOR – CHINA- 998G*
Reliability Lab	*ST TOURS – FRANCE*
Reliability Assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	07-march-2022	21	Henri VIVANT	Julien MICHELON	Initial release

Note: This report is a summary of the qualification trials performed in good faith by STMicroelectronics in order to evaluate the potential risks during the product life using a set of defined test methods.
This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.

TABLE OF CONTENTS

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
AEC-Q101 Rev.E (for Automotive products)	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications
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

2 GLOSSARY

DPA	Destructive Physical Analysis
GD	Generic Data
H3TRB	High Humidity High Temperature Reverse Bias
HTRB	High Temperature Reverse Bias
IOLT	Intermittent Operating Life Test
PC	Preconditioning
SS	Sample Size
TC	Temperature Cycling

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

STMicroelectronics is extending process rationalization for top and back metal, and passivation at ST Catania die manufacturing plant on SiC 1200V Diodes.

Table of involved products

Commercial Product	Product Family	Package	Assembly Location
STPSC10H12B2-TR	Power Schottky SiC	DPAK HV	Shenzhen – CHINA (3068)
STPSC2H12B2Y-TR			
STPSC10H12D		TO-220AC	
STPSC10H12DY			
STPSC15H12D			
STPSC15H12DY			
STPSC20H12D			
STPSC20H12DY			
STPSC2H12D			
STPSC5H12D			
STPSC10H12G-TR		D²PAK	
STPSC10H12G2-TR			
STPSC10H12G2Y-TR			
STPSC10H12GY-TR			
STPSC15H12G2-TR			
STPSC15H12G2Y-TR			
STPSC20H12G-TR			
STPSC20H12G2-TR			
STPSC20H12G2Y-TR			
STPSC20H12GY-TR			
STPSC20H12CWY		TO-247	
STPSC10H12WL		DO-247LL	Subcontractor – CHINA (998G)
STPSC15H12WL			
STPSC20H12WL			
STPSC30H12CWL		TO-247LL	
STPSC40H12CWL			
STPSC10H12CWL			
STPSC20H12CWL			

The reliability test methodology used follows the JESD47: « Stress Test driven Qualification Methodology » and AEC-Q101 revE guidelines (for Automotive products).

The reliability tests ensuing are:

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

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

3.2 Conclusion

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

4 DEVICE CHARACTERISTICS

4.1 Device description

Refer to product datasheet(s).
Example here below

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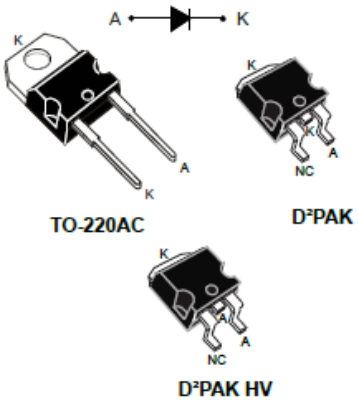
STPSC20H12-Y

Datasheet

Automotive 1200 V, 20 A, silicon carbide power Schottky diode



Product label
SUSTAINABLE TECHNOLOGY

Product status link
STPSC20H12-Y

Product summary	
$I_{F(AV)}$	20 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- PPAP capable
- Operating T_j from -40 °C to 175 °C
- D²PAK HV creepage distance (anode to cathode) = 5.38 mm min.
- ECOPACK compliant

Applications

- On board charger

Description

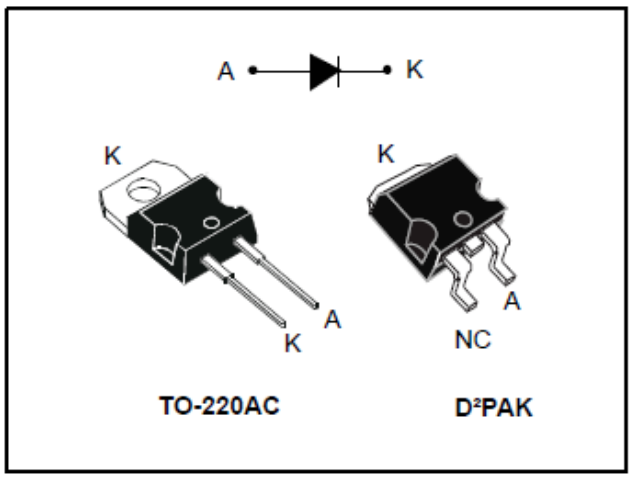
The SiC diode is an ultra high performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide band gap material allows the design of a Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in PFC applications, the STPSC20H12-Y will boost performance in hard switching conditions. Its high forward surge capability ensures good robustness during transient phases.

STPSC10H12-Y

Automotive grade 1200 V power Schottky silicon carbide diode

Datasheet - production data



Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- PPAP capable
- Operating T_j from -40 °C to 175 °C
- ECOPACK®2 compliant

Description

The SiC diode, available in TO-220AC and D²PAK, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low V_F Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.
Especially suited for use in PFC and secondary side applications, this ST SiC diode will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	10 A
V_{RRM}	1200 V
T_j(max.)	175 °C
V_F(typ.)	1.35 V

STPSC2H12-Y

Datasheet

Automotive 1200 V, 2 A power Schottky silicon carbide diode

DPAK HV 2L

Product label

Product status link

STPSC2H12-Y

Product summary

$I_{F(AV)}$	2 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Features

- AEC-Q101 qualified
- PPAP capable
- No or negligible reverse recovery
- High forward surge capability
- Operating T_j from -40 °C to 175 °C
- Creepage distance of 3 mm as per IEC 60664-1
- ECOPACK2 compliant component

Applications

- Bootstrap function of SiC MOS-FETS
- Snubber diode
- Switching diode

Description

The SiC diode is an ultra-high performance power Schottky diode. It is manufactured using a silicon carbide substrate. The wide band gap material allows the design of a Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in boot strap, snubber circuits, or clamping functions of SiC MOS-FETs, the STPSC2H12-Y diode will help designers getting the best possible performance of their controlled switches in all conditions. This rectifier will enhance the performance of the targeted application.

Its improved creepage distance ensures the compatibility with industrial and automotive creepage standards.

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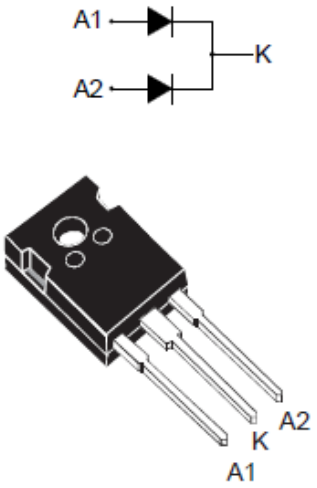
STPSC40H12C

1200 V power Schottky silicon carbide diode

Datasheet - production data



TO-247 LL

Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating T_j from -40 °C to 175 °C
- ECOPACK®2 compliant

Description

The SiC diode, available in TO-247 LL, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low V_F Schottky diode structure with a 1200 V rating. Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

Especially suited for use in PFC and secondary side applications, this ST SiC diode will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	2 x 20 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

4.2 Construction Note

	STPSC10H12DY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	TO-220AC
Final testing information	
Testing location	ST SHENZHEN - CHINA

	STPSC20H12CWY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	TO-247
Final testing information	
Testing location	ST SHENZHEN - CHINA

	STPSC40H12CWL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	TO-247
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC20H12G2Y-TR
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	D2PAK
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC20H12CWL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	Subcontractor – CHINA (998G)
Package description	TO-247
Final testing information	
Testing location	Subcontractor – CHINA (998G)

	STPSC2H12B2Y
Wafer/Die fab. information	
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	SiC Power Schottky Rectifier
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	DPAK
Final testing information	
Testing location	ST SHENZHEN - CHINA

5 TESTS PLAN AND RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Wafer fab location	Assy plant Location	Comments
L1	STPSC20H12G2Y-TR	D2PAK HV	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 1
L2	STPSC40H12CWL	TO-247LL	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 2
L3	STPSC10H12DY	TO-220AC	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 3
L4	STPSC20H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 4
L5	STPSC40H12CWL	TO-247LL	ST CATANIA ITALY	Subcontractor – CHINA (998G)	Qualification lot 5
L6	STPSC2H12B2Y	DPAK HV	ST CATANIA ITALY	ST SHENZHEN CHINA	Qualification lot 6
GD1	STPSC30H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Generic data for Thermal Cycling, HTRB, H3TRB, IOLT
GD2	STPSC30H12CWY	TO-247	ST CATANIA ITALY	ST SHENZHEN CHINA	Generic data for H3TRB

GD: Test vehicles used for similarity.

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	J-STD-020 JESD22-A113	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			Not applicable for PTH and WLCSP without coating	
External Visual	EV	JESD22B-101	All qualification parts tested per the requirements of the appropriate device specification.		Done during Assembly → Test & Finish inspection	x
Parametric Verification	PV	User specification	L1 L3 L5 L6	4*30		X
High Temperature Reverse Bias	HTRB	MIL-STD-750-1 M1038 Method A	L1 L2 L3 L5 GD1	5*77 (385)	WBI after HTRB applicable only for dissimilar metal (wire/meta) in case of no Cu wire	X
AC blocking voltage	ACBV	MIL-STD-750-1 M1040 Test condition A			Required for Thyristor only. Alternative to HTRB	
High Temperature Forward Bias	HTFB	JESD22 A-108			Not required, applicable only to LEDS Alternative to HTRB	
High Temperature Operating Life	HTOL				Covered by HTRB or ACBV	
Steady State Operational	SSOP	MIL-STD-750-1 M1038 Test condition B			Required for Voltage Regulator (Zener) only.	
High Temperature Gate Bias	HTGB	JESD 22A-108			Required for Power MOSFET – IGBT only.	
High Temperature Storage Life	HTSL	JESD22 A-103			Covered by HTRB	
Temperature Humidity Storage	THS	JESD22 A-118			Covered by H3TRB	
Temperature Cycling	TC	JESD22A-104	L1 L2 L3 L4 L5 GD1	6*77 (462)		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for Power MOSFET – IGBT only.	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
Temperature Cycling Delamination Test	TCDT	JESD22A-104 J-STD-035			Required for Power MOSFET - IGBT only. Alternative to TCHT	
Wire Bond Integrity	WBI	MIL-STD-750 Method 2037			For dissimilar metal bonding systems only	
Unbiased Highly Accelerated Stress Test	UHAST	JESD22A-118 or A101			Required for SCR/TRIAC RECTIFIER and Protection devices	
Autoclave	AC	JESD22A-102			Alternative to UHAST	
Highly Accelerated Stress Test	HAST	JESD22A-110			Covered by H3TRB (same failure mechanisms activation).	
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	L1 L2 L3 L5 GD1 GD2	5*77 1*10 (395)	Alternative to HAST	X
High Temperature High Humidity Bias	HTHHB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOL	MIL-STD-750 Method 1037	L1 L2 L3 L5 GD1	5*77 (385)	For power devices. Not required for Transient Voltage Suppressor (TVS) parts	X
Power and Temperature Cycle	PTC	JED22A-105			For power devices. Not required for Transient Voltage Suppressor (TVS) parts Perform PTC if $\Delta Tj>100°C$ cannot be achieved with IOL Alternative to IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1 L3 L6	3*30 (90)		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1 L3 L6	3*30 (90)		X
Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1 GD1	2*2	After H3TRB and TC	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)			Not applicable for SMD pitch < 0.5mm, package size >	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
					5.5*12.5mm and die paddle > 2.5*3.5mm	
Solderability	SD	J-STD-002 JESD22B102				
Dead Bug Test	DBT	ST Internal specification			Mandatory for SMD package Data collection for PTH package	
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate			Required in case of process change. Not applicable to protection device as no limit specified in the datasheet	
Wire Bond Strength	WBS	MIL-STD-750 Method 2037			Covered during workability trials	
Bond Shear	BS	AEC-Q101-003			Covered during workability trials	
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 Power MOSFET - IGBT only.	
Short Circuit Reliability Characterization	SCR	AEC-Q101-006			Required for smart power parts only	
Whisker Growth Evaluation	WG	AEC-Q005 JESD201				
Early Life Failure Rate	ELFR	JESD74			Recommended for new techno development in case of identified failure mechanism	
Functional Test (in rush, di/dt...)	FT	Internal specification				
Repetitive Surge	RS	Internal specification			Required for protection devices only.	

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)	PC sec	MIL-STD750-1 Method1037			AQG324 test for Modules	
Power Cycling (minutes)	PC min	MIL-STD750-1 Method1037			AQG324 test for Modules	
Mechanical shock	MS	IEC 600068-2-27			AQG324 test for Modules	
Vibration	V	IEC60068-2-6			AQG324 test for Modules	

5.3 Results summary

Test	PC	Std ref.	Conditions	Total	Steps		Results/Lot Fail/S.S.						
						Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	GD1	GD2
Parametric Verifications	NA	ST datasheet	Over part temperature range	120	-		Refer to paragraph 6.1 in Annexes						
ESD	NA	AEC-Q101	HBM	90	-		Refer to paragraph 6.1 in Annexes						
			CDM	90	-		Refer to paragraph 6.1 in Annexes						
External Visual Inspection	NA	JESD22 B-101	-	-	-		All qualification parts submitted for testing passed External & Visual inspection during manufacturing process						
Pre and Post Electrical Test	NA	ST datasheet	I_R, V_F parameters following product datasheet	-			Pass						
PC	Y	JESD22 A-113	Drying 24hrs; 125°C Storage 168hrs; 85°C;85%RH IR reflow 3 times	180	-		Pass						
HTRB		JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature = 175°C Tension=1200V	231		0/77	0/77	0/77					
TC	Y	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-55°C	385	1000cy	0/77	0/77	0/77	0/77			0/77	
H3TRB	N	JESD22-A101	Humidity (HR)=85% Temperature=85°C Voltage=100V	385	1000h	0/77	0/77	0/77		0/77		0/77	
DPA	Y	ST 0060102 AEC Q101	After TC 1000h	4	-	0/2						0/2	
IOLT	Y	MIL-STD 750 Method 1037	Delta Tj=125°C	308	500h		0/77	0/77		0/77		0/77	
			Delta Tj=100°C	77	500h	0/77							
				77	1000h	0/77							

Note 1: These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances. Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers."

6 ANNEXES

6.1 Parametric Verification

- **Results on STPSC2H12B2Y-TR product**

Characterization report for STPSC2H12B2Y-TR

Date : 30/09/2021
Ref : 21872A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=2A	IF=2A	IF=2A	IF=2A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*1uA*	*6uA*			*1.35V*	*1.75V*	
Max. Datasheet		*12uA*	*80uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	nA	nA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	4,000	12,500	288,000	577,900	1,273	1,295	1,582	1,683
Max	96,200	99,900	623,900	1159,000	1,300	1,344	1,740	1,872
Avg.	54,803	33,407	362,990	708,560	1,285	1,328	1,693	1,814

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=5mA	IR=5mA	IR=5mA	IR=5mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1404,000	1434,000	1473,000	1482,000
Max	1460,000	1476,000	1515,000	1523,000
Avg.	1445,433	1466,933	1505,767	1514,433

- ## Results on STPSC10H12DY product

Characterization report STPSC10H12DY

Date : 13/01/2022
Ref : 22027A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=10A	IF=10A	IF=10A	IF=10A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*5uA*	*30uA*			*1.35V*	*1.75V*	
Max. Datasheet		*60uA*	*400uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	uA	uA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	11,900	45,500	0,736	1,717	1,310	1,346	1,691	1,809
Max	223,500	347,900	2,199	4,159	1,340	1,409	1,883	2,030
Avg.	77,697	157,223	1,195	2,476	1,329	1,384	1,806	1,941

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=5mA	IR=5mA	IR=5mA	IR=5mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1380,000	1405,000	1466,000	1471,000
Max	1459,000	1476,000	1523,000	1532,000
Avg.	1436,167	1453,100	1504,833	1515,367

- ## Results on STPSC20H12G2Y-TR product

Characterization report for STPSC20H12G2Y-TR

Date : 21/09/2021
Ref : 21869A
Lab : ST Tours Characterization Lab

TEST	IR	IR	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C	-40°C	25°C	150°C	175°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=20A	IF=20A	IF=20A	IF=20A
Condition 3								
Min. Datasheet								
Typ. Datasheet		*10uA*	*60uA*			*1.35V*	*1.50V*	
Max. Datasheet		*120uA*	*800uA*			*1.50V*	*2.25V*	
Commentaires								
UNIT	nA	nA	uA	uA	V	V	V	V
N	30	30	30	30	30	30	30	30
Min	119,899996	198,900	1,629	3,679	1,265	1,284	1,544	1,634
Max	4779,9997	7400,000	18,170	24,620	1,291	1,340	1,722	1,849
Avg.	536,3733202	987,607	4,795	8,486	1,275	1,306	1,616	1,721

TEST	VR	VR	VR	VR
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	175°C
Condition 2	IR=2.4mA	IR=2.4mA	IR=2.4mA	IR=2.4mA
Condition 3				
Min. Datasheet	*1200V*	*1200V*	*1200V*	*1200V*
Typ. Datasheet				
Max. Datasheet				
Commentaires				
UNIT	V	V	V	V
N	30	30	30	30
Min	1354,000	1366,000	1417,000	1430,000
Max	1489,000	1506,000	1545,000	1552,000
Avg.	1420,167	1435,133	1479,600	1490,367

- **Results on STPSC40H12CWL product**

Characterization report for STPSC40H12CWL						
Date : 21/09/2021						
Ref : 21946A						
Lab : ST Tours Characterization Lab						
TEST	**IR**	**IR**	**IR**	**VF**	**VF**	**VF**
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C	-40°C	25°C	150°C
Condition 2	VR=1.2kV	VR=1.2kV	VR=1.2kV	IF=20A	IF=20A	IF=20A
Condition 3						
Min. Datasheet						
Typ. Datasheet		*10uA*	*60uA*		*1.35V*	*1.75V*
Max. Datasheet		*120uA*	*800uA*		*1.50V*	*2.25V*
Commentaires						
UNIT	nA	nA	uA	V	V	V
N	Covered by STPSC20H12G2Y-TR (same dice)	60	60	Covered by STPSC20H12G2Y-TR (same dice)	60	60
Min		1,629	1,859		1,299	1,563
Max		18,170	13,3		1,349	1,735
Avg.		4,795	3,407716682		1,3295	1,6691

TEST	**VR**	**VR**	**VR**
EQUIPMENT	TESEC_881TT_TEST292	TESEC_881TT_TEST292	TESEC_881TT_TEST292
Condition 1	-40°C	25°C	150°C
Condition 2	IR=2.4mA	IR=2.4mA	IR=2.4mA
Condition 3			
Min. Datasheet	*1200V*	*1200V*	*1200V*
Typ. Datasheet			
Max. Datasheet			
Commentaires			
UNIT	V	V	V
N	Covered by STPSC20H12G2Y-TR (same dice)	60	60
Min		1,299	1436
Max		1,349	1543
Avg.		1,3295	1510,183333

6.2 ESD

- **Results on STPSC20H12G2Y-TR product**

TEST	**ESD_CDM**	**ESD_HBM**
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	>8.0
Max	>1.0	>8.0

- **Results on STPSC2H12B2Y-TR product**

TEST	ESD_CDM	ESD_HBM
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	6
Max	>1.0	6

- **Results on STPSC10H12DY product**

TEST	ESD_CDM	ESD_HBM
EQUIPMENT	ESD-CDM TEST SYSTEM	ESS6008
Condition 1	25°C	25°C
Comments	AEC-Q101	AEC-Q101
Units qty	30	30
UNIT	KV	KV
Min	>1.0	>8.0
Max	>1.0	>8.0

6.3 Assembly Tests

Wire pull Test

	Conditions	Sample Size	Failure / SS
STPSC20H12G2Y-TR	Min 300g	10 Wires	0/10
STPSC10H12DY	Min 350g	10 Wires	0/10
STPSC2H12B2Y-TR	Min 180g	10 Wires	0/10
STPSC40H12CWL	Min 350g	30 Wires	0/30

Ball / Wedge Shear Test

	Conditions	Sample Size	Failure / SS
STPSC20H12G2Y-TR	Min 500g	10 Wires	0/10
STPSC10H12DY	Min 700g	10 Wires	0/10
STPSC40H12CWL	Min 700g	30 Wires	0/30

6.4 Tests description

Test name	Description	Purpose
	Die Oriented	
HTRB High Temperature Reverse Bias	HTRB : High Temperature Reverse Bias HTFB / HTGB : High Temperature Forward (Gate) Bias The device is stressed in static configuration, trying to satisfy as much as possible the following conditions: - low power dissipation; - max. supply voltage compatible with diffusion process and internal circuitry limitations.	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.
	Package Oriented	
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.
H3TRB High Humidity High Temperature Reverse 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.
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, not gradually, to the device for the time necessary to achieve a delta case temperature 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.
DPA Destructive Physical Analysis	Specific construction analysis on random parts that have successfully completed THB or TC.	To investigate on reliability stresses impact on delamination, corrosion and product construction integrity.