PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data

1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	ADG/21/12671
1.3 Title of PCN	New Lead Frame design for TO247 2mm (Circle hole shape)
1.4 Product Category	STPSC20H12CWY STPSC31H12CWY
1.5 Issue date	2021-03-10

2. PCN Team

2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
2.2 Change responsibility	
2.2.1 Product Manager	Stephane CHAMARD
2.1.2 Marketing Manager	Philippe LEGER
2.1.3 Quality Manager	Jean-Paul REBRASSE

3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Materials	New direct material part number r (same supplier, different supplier or new supplier),(Lead frame dimensions)	ST Shenzhen - China - TO247 2mm

4. Description of change

	Old	New
4.1 Description	Lead Frame design with Oval hole shape	Lead Frame design with Circle hole shape
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No	

5. Reason / motivation for change

5.1 Motivation	Lead-Frame rationalization
5.2 Customer Benefit	QUALITY IMPROVEMENT

6. Marking of parts / traceability of change

6.1 Description	New Finished Good/Type print on carton labels.

7. Timing / schedule

7.1 Date of qualification results	2021-03-08
7.2 Intended start of delivery	2021-06-09
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation

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

9. Attachments (additional documentations)

12671 Public product.pdf
12671 TO247 2mm LF design Circle shape.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
	STPSC20H12CWY	

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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 : New Lead Frame design for TO247 2mm (Circle hole shape)
PCN Reference : ADG/21/12671

Subject : Public Products List

Dear Customer,

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

STPSC20H12CWY	STPSC31H12CWY	

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STMicroelectronics
ADG[1] – Discrete and Filter Division

(1) ADG: Automotive and Discrete Group

PCN
Product/Process Change Notification

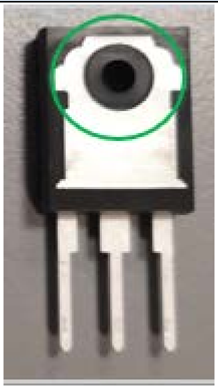
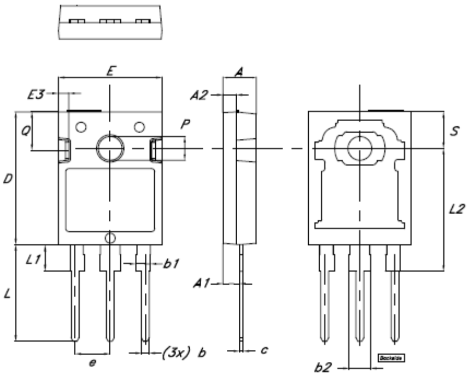
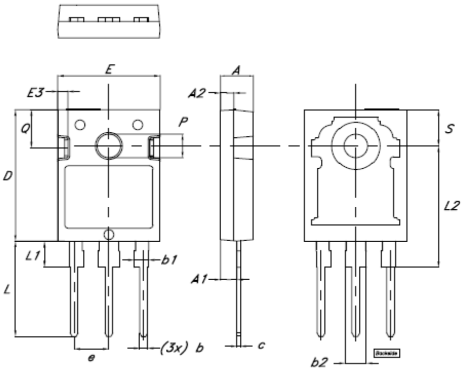
New Lead Frame design for TO247 2mm (Circle hole shape)

Notification number:	ADG/21/12671	**Issue Date**	09-Mar-2021
Issued by	Isabelle BALLON		

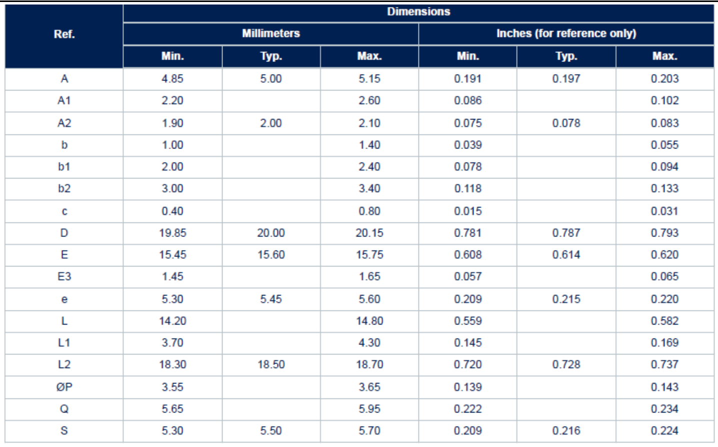
Product series affected by the change	STPSC20H12CWY STPSC31H12CWY
Type of change	Back-End realization

Description of the change

Lead-frame design improvement.

Current lead frame (Oval hole shape)	New lead frame (Circle hole shape)
	
Current Package Outline (Oval hole shape)	**New Package Outline (Circle hole shape)**
	

TO-247 2mm package dimensions: No change



Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.85	5.00	5.15	0.191	0.197	0.203
A1	2.20		2.60	0.086		0.102
A2	1.90	2.00	2.10	0.075	0.078	0.083
b	1.00		1.40	0.039		0.055
b1	2.00		2.40	0.078		0.094
b2	3.00		3.40	0.118		0.133
c	0.40		0.80	0.015		0.031
D	19.85	20.00	20.15	0.781	0.787	0.793
E	15.45	15.60	15.75	0.608	0.614	0.620
E3	1.45		1.65	0.057		0.065
e	5.30	5.45	5.60	0.209	0.215	0.220
L	14.20		14.80	0.559		0.582
L1	3.70		4.30	0.145		0.169
L2	18.30	18.50	18.70	0.720	0.728	0.737
ØP	3.55		3.65	0.139		0.143
Q	5.65		5.95	0.222		0.234
S	5.30	5.50	5.70	0.209	0.216	0.224

Reason for change

Lead-Frame rationalization.

Former versus changed product:	The changed products do not present modified electrical, dimensional or thermal parameters. Change of lead frame design without dimensional impact. No change of material/plating and frame suppliers. The footprint recommended by ST remains the same. There is no change in the packing modes and the standard delivery quantities either. The products remain in full compliance with the ST ECOPACK®2 grade (so called “halogen-free”).

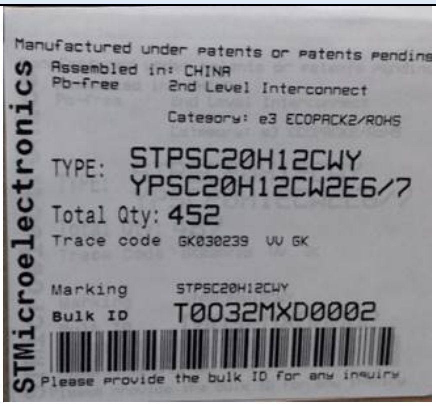
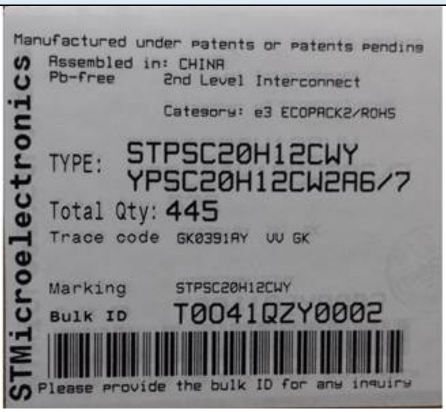
Disposition of former products

Until stock depletion and upon customers’ request.

Marking and traceability

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

Commercial part number (Order code)	Current Finished Good/Type	New Finished Good/Type
STPSC20H12CWY STPSC31H12CWY	YPSC20H12CW2E6/7 YPSC31H12CW2E/7	YPSC20H12CW2A6/7 YPSC31H12CW2A/7

Current Label (example)	New Label (example)
	

Manufactured under patents or patents pending
STMicroelectronics
Assembled in: CHINA
Pb-free 2nd Level Interconnect
Category: e3 ECOPACK2/ROHS
TYPE: STPSC20H12CWY
YPSC20H12CW2E6/7
Total Qty: 452
Trace code GK030239 VV GK
Marking STPSC20H12CWY
Bulk ID T0032MXD0002
Please provide the bulk ID for any inquiry

Manufactured under patents or patents pending
STMicroelectronics
Assembled in: CHINA
Pb-free 2nd Level Interconnect
Category: e3 ECOPACK2/ROHS
TYPE: STPSC20H12CWY
YPSC20H12CW2A6/7
Total Qty: 445
Trace code GK0391AY VV GK
Marking STPSC20H12CWY
Bulk ID T0041QZY0002
Please provide the bulk ID for any inquiry

Qualification complete date	08-Mar-2021

Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Rectifier	SiC	STPSC20H12CWY	Dec-2020
Rectifier	SiC	STPSC31H12CWY	Mar-2021

Change implementation schedule

Sales types	Estimated production start	Estimated first shipments
STPSC20H12CWY	**Mar-21**	**Jun-21**
STPSC31H12CWY	**Mar-21**	**Jun-21**

Comments:	Shipments can start earlier according to customer approval of the PCN.

Customer's feedback

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

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

Absence of additional response within 180 days of receipt of this PCN will constitute acceptance of the change.

Qualification program and results	21012QRP Attached

Qualification Report

New Lead Frame design for TO247 2mm (Circle hole shape)

General Information	
Product Line	*Rectifiers*
Product Description	*1200V Power Schottky Silicon Carbide Diode*
Product Perimeter	*STPSC20H12CWY* *STPSC31H12CWY*
Product Group	*ADG*
Product Division	*Discrete & Filter*
Packages	*TO-247 2mm*
Maturity level step	*QUALIFIED*

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

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	08-Mar-2021	9	Sara BHALLI	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.D1 (for Automotive products)	Failure Mechanism Based Stress Test Qualification for Discrete Semiconductors in Automotive Applications
AEC-Q005	Pb-Free Test Requirements
AEC-Q006	Qualification Requirements for Components Using Copper (Cu) Wire Interconnections
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

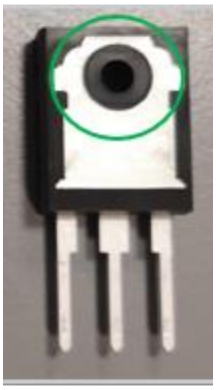
2 GLOSSARY

PD	Physical Dimensions
TR	Thermal Resistance
PC	Pre-Conditioning

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify new lead frame design of TO-247 2mm circle hole shape (oval hole shape before) used for STPSC20H12CWY and STPSC31H12CWY products. The reason of this change is due to Lead-Frame rationalization

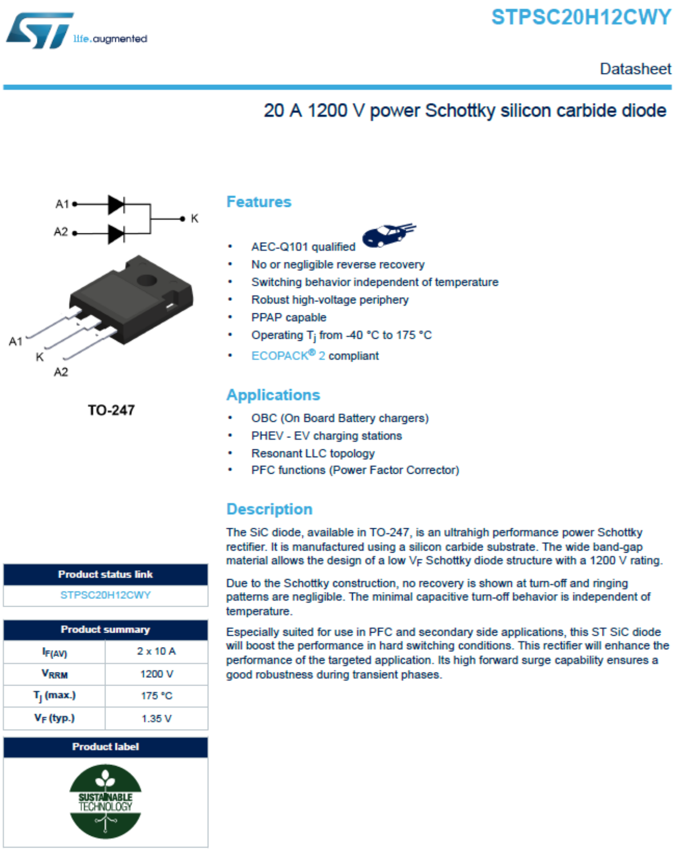
Item	Before change	After change
Lead Frame		

3.2 Conclusion

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

4 DEVICE CHARACTERISTICS

4.1 Device description



STPSC20H12CWY

Datasheet

20 A 1200 V power Schottky silicon carbide diode

TO-247

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

Applications

- OBC (On Board Battery chargers)
- PHEV - EV charging stations
- Resonant LLC topology
- PFC functions (Power Factor Corrector)

Description

The SiC diode, available in TO-247, 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.

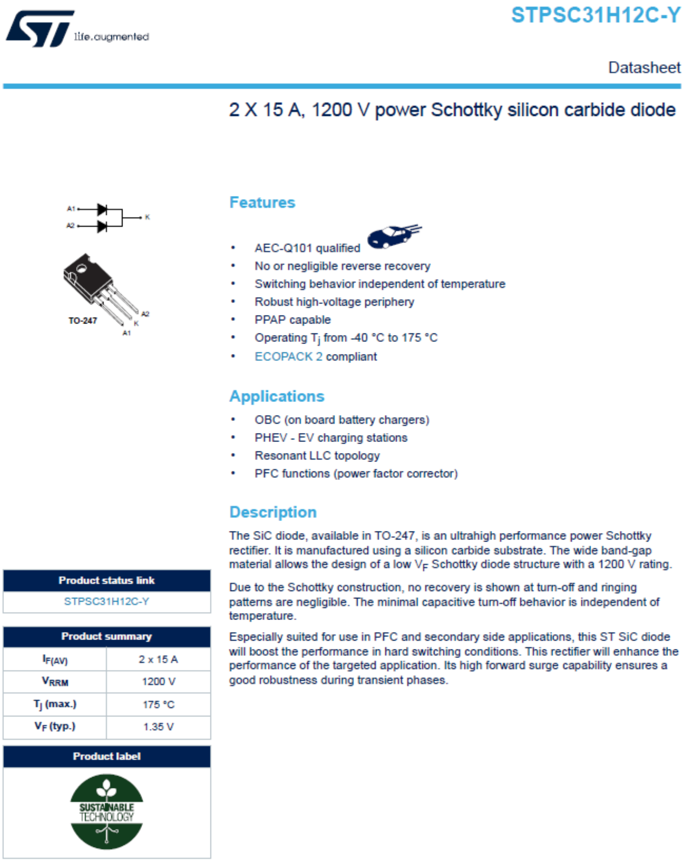
Due to the Schottky construction, no recovery is shown at turn-off and ringing patterns are negligible. The minimal capacitive turn-off behavior is independent of temperature.

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.

Product status link
STPSC20H12CWY

Product summary	
$I_{F(AV)}$	2 x 10 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Product label



STPSC31H12C-Y

Datasheet

2 X 15 A, 1200 V power Schottky silicon carbide diode

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

Applications

- OBC (on board battery chargers)
- PHEV - EV charging stations
- Resonant LLC topology
- PFC functions (power factor corrector)

Description

The SiC diode, available in TO-247, 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.

Product status link
STPSC31H12C-Y

Product summary	
$I_{F(AV)}$	2 x 15 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Product label

4.2 Construction Note

Wafer/Die fab. information	STPSC20H12CWY - STPSC31H12CWY
Wafer fab manufacturing location	ST CATANIA - ITALY
Technology / Process family	1200V Power Schottky Silicon Carbide Diode Automotive
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST CATANIA - ITALY
Assembly information	
Assembly site	ST SHENZHEN - CHINA
Package description	TO-247
Molding compound	ECOPACK®2 (“Halogen-free”) molding compound
Lead finishing material	Lead free (pure Tin)
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	STPSC20H12CWY	TO-247	ST CATANIA - ITALY	ST SHENZHEN - CHINA	Qualification lot (new lead frame design)
L2	STPSC20H12CWY				Old Lead Frame lot (old lead frame design)

5.2 Test plan

Stress	**Abrv**	**Reference**	**Lot**	**SS**	**Comments**	**Test plan**
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101			This test is to study the degradation mechanisms activated by the presence of humidity. As with TC, the dice are too far away from the design change to be affected by moisture. Tests on the old design can cover the new design. The composition of the lead frame remains unchanged.	
Intermittent Operational Life / Thermal Fatigue	IOL	MIL-STD-750 Method 1037			The purpose of this test is to stress bonding and soldering. Due to its location and dimensioning, the change does not result in a difference in TR. The test conditions of the IOL (same power dissipation), stressing the bonding and s soldering that are not changed, will be the same as in the old design.	
Physical Dimension	PD	JESD22B-100	L1 & L2	(2*30) 60		X
Hermeticity	HER	JESD22A-109			Required for hermetic packaged parts only.	
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L1 & L2	(2*5) 10	Required in case of process change.	X
Die Shear	DS	MIL-STD-750 Method 2017			No change for Die Attach and design rules.	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
Thermal Cycling	TC				The expected mode of failure is delamination. The distance between the change and the dice is too large to generate a difference between the old and the new design.	
Screwing Test	SCREW	ST 0063378	L1 & L2	(2*30) 60		X
short circuit reliability	SCR	AEC-Q101-006			Required for smart power parts only	

5.3 Results summary

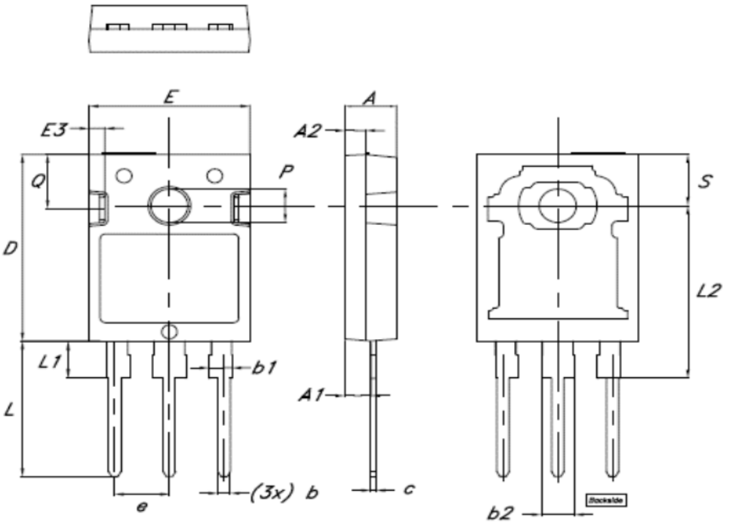
Test	PC	Std ref.	Conditions	Steps / Duration	SS	Failure/SS	
						L1	L2
PD	N	JESD22 B-100	-	-	(2*30) 60	0/30	0/30
						Refer to paragraph 6.1 in Annexes	
TR	N	ST Datasheet	Pre and Post change	-	(2*5) 10	0/5	0/5
						Refer to paragraph 6.2 in Annexes	
SCREW	N	ST 0063378	Torque=1N.m	FINAL TEST	(2*15) 30	0/15	0/15

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

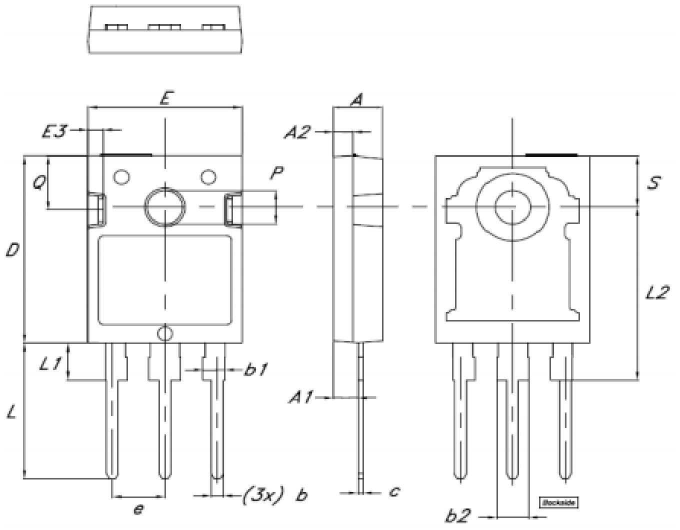
6.1 Physical Dimension

- **STPSC20H12CWY: Old Lead-Frame**



pcs	A	A1	b	b1	b2	c	D	E	E3	e	L	L1	L2	P	Q	S
Min Datasheet	4.85	2.20	1.00	2.00	3.00	0.40	19.85	15.45	1.45	5.30	14.20	3.70	18.30	3.55	5.65	5.30
Typ. Datasheet	5.00	2.51	1.23	2.13	3.14	0.51	20.03	15.57	1.54	5.44	14.49	3.99	18.51	3.61	5.84	5.50
Max. Datasheet	5.15	2.60	1.40	2.40	3.40	0.80	20.15	15.75	1.65	5.60	14.80	4.30	18.70	3.65	5.95	5.70
Average	5.00	2.51	1.23	2.13	3.14	0.51	20.03	15.57	1.54	5.44	14.49	3.99	18.51	3.61	5.84	5.50
min	4.97	2.48	1.21	2.09	3.11	0.49	19.99	15.53	1.50	5.41	14.42	3.95	18.46	3.60	5.81	5.48
max	5.03	2.53	1.26	2.15	3.16	0.55	20.06	15.60	1.57	5.47	14.54	4.03	18.55	3.61	5.88	5.53

- **STPSC20H12CWY: New Lead-Frame**



pce	A	A1	A2	b	b1	b2	c	D	E	E3	e	L	L1	L2	Diam P	Q	S
Min Datasheet	4.85	2.20	1.90	1.00	2.00	3.00	0.40	19.85	15.45	1.45	5.30	14.20	3.70	18.30	3.55	5.65	5.30
Typ. Datasheet	5.00		2.00					20.00	15.60		5.45						
Max. Datasheet	5.15	2.60	2.10	1.40	2.40	3.40	0.80	20.15	15.75	1.65	5.60	14.80	4.30	18.70	3.65	5.95	5.70
Average	4.99	2.59	1.92	1.21	2.07	3.09	0.51	20.03	15.55	1.53	5.40	14.54	4.06	18.54	3.63	5.84	5.46
MIN	4.96	2.55	1.85	1.19	2.01	3.06	0.50	19.99	15.51	1.49	5.33	14.44	4.03	18.47	3.60	5.75	5.43
MAX	5.01	2.60	1.99	1.23	2.12	3.11	0.51	20.06	15.56	1.57	5.44	14.61	4.09	18.63	3.65	5.90	5.49

6.2 Thermal Resistance

TEST	**Rth(j-c) STPSC20H12CWY Before change (L2)**	**Rth(j-c) STPSC20H12CWY After Change (L1)**
EQUIPMENT	RTH(PHASE11)	RTH(PHASE11)
Condition 1		
Min. Datasheet		
Typ. Datasheet	*0.70°C/W*	*0.70°C/W*
Max. Datasheet	*0.95°C/W*	*0.95°C/W*
Comments		
N	5	5
UNIT	°C/W	°C/W
Min	0,769	0,752
Max	0,797	0,814
Avg	0,785	0,788
Ecart Type	0,010	0,020
Cpk (*)	5,640	2,699

(*)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.

6.3 Tests description

Test name	Description	Purpose
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.
DS Die Shear	A sufficient force to shear the die from its mounting shall be applied to the die.	To establish the integrity of the semiconductor, die attachment to the package header or other substrate.