PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	ADG/21/12832
1.3 Title of PCN	Transfer of Assembly & Test manufacturing activity for Rectifiers housed in DO-247LL & TO-247LL packages
1.4 Product Category	STTH30AC06CWL STTH31AC06SWL STTH60AC06CWL STTH30RQ06WL STTH60RQ06CWL STTH60RQ06WL STPSC20065CWL STPSC10H12CWL STPSC10H12WL STPSC15H12WL STPSC20H12CWL STPSC20H12WL STPSC30H12CWL STPSC40H12CWL
1.5 Issue date	2021-06-28

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
Transfer	Product transfer from one site to another site, even if test or process line is qualified	Subcontractor in Philippines and subcontractor in China

4. Description of change		
	Old	New
4.1 Description	Assembly and Test at Subcontractor in Philippines	Assembly and Test at Subcontractor in China
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No	

5. Reason / motivation for change	
5.1 Motivation	In the frame of the activity closure at one subcontractor in Philippines, ST has initiated a transfer of Rectifiers (SiC power Schottky, Ultrafast) in DO-247LL & TO-247LL packages to a subcontractor in China. Subcontractor in China is already a major production site for ST products housed in TO-247 Long Leads package. Former subcontractor line closure in Philippines is scheduled in 30-September-2021.
5.2 Customer Benefit	SERVICE CONTINUITY

6. Marking of parts / traceability of change	
6.1 Description	Finished Good, device top marking and trace code

7. Timing / schedule	
7.1 Date of qualification results	2021-06-07

7.2 Intended start of delivery	2021-09-30
7.3 Qualification sample available?	Not Applicable

8. Qualification / Validation			
8.1 Description			
8.2 Qualification report and qualification results	In progress	**Issue Date**	

9. Attachments (additional documentations)
12832 Public product.pdf 12832 Transfer Rectifiers DO247LL TO247LL at subcontractor in China.pdf

10. Affected parts		
10. 1 Current		**10.2 New (if applicable)**
10.1.1 Customer Part No	**10.1.2 Supplier Part No**	**10.1.2 Supplier Part No**
	STPSC10H12CWL	
	STPSC10H12WL	
	STPSC15H12WL	
	STPSC20H12CWL	
	STPSC20H12WL	
	STPSC30H12CWL	
	STPSC40H12CWL	
	STTH30AC06CWL	
	STTH30RQ06WL	
	STTH31AC06SWL	
	STTH60AC06CWL	
	STTH60RQ06CWL	
	STTH60RQ06WL	

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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 : Transfer of Assembly & Test manufacturing activity for Rectifiers housed in DO-247LL & TO-247LL packages

PCN Reference : ADG/21/12832

Subject : Public Products List

Dear Customer,

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

STTH30RQ06WL	STTH30AC06CWL	STPSC30H12CWL
STPSC20H12CWL	STTH31AC06SWL	STPSC20H12WL
STTH60AC06CWL	STPSC20065CWL	STPSC10H12CWL
STPSC10H12WL	STTH60RQ06CWL	STTH60RQ06WL
STPSC15H12WL	STPSC40H12CWL	

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PCN
Product/Process Change Notification

Transfer of Assembly & Test manufacturing activity

for Rectifiers housed in DO-247LL & TO-247LL packages at subcontractor in China

Notification number:	ADG/21/12832	**Issue Date**	28-Jun-2021
Issued by	Isabelle Ballon		

Product series affected by the change	STTH30AC06CWL STTH31AC06SWL STTH60AC06CWL STTH30RQ06WL STTH60RQ06CWL STTH60RQ06WL STPSC20065CWL STPSC10H12CWL STPSC10H12WL STPSC15H12WL STPSC20H12CWL STPSC20H12WL STPSC30H12CWL STPSC40H12CWL
Type of change	Package Assembly & Test production line transfer

Description of the change

Transfer to subcontractor in China.

Reason for change

In the frame of the activity closure at one subcontractor in Philippines, ST has initiated a transfer of Rectifiers (SiC power Schottky, Ultrafast) in DO-247LL & TO-247LL packages to a subcontractor in China.
Subcontractor in China is already a major production site for ST products housed in TO-247 Long Leads package.
Former subcontractor line closure in Philippines is scheduled in 30-September-2021.

Former versus changed product:	The changed products do not present modified electrical or thermal parameters, leaving unchanged the current information published in the product datasheet. For TO-247LL, slight dimensions variation (notch) still compatible with ST recommendations for handling and mounting techniques (Application Note AN5088). For DO-247LL, slight dimensions variation on tab and notch still compatible with ST recommendations for handling and mounting techniques (Application Note AN5088).

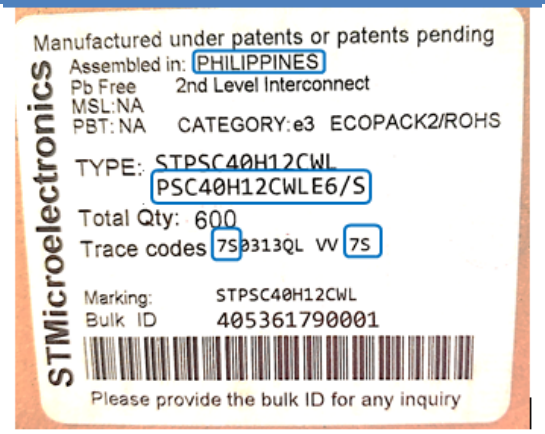
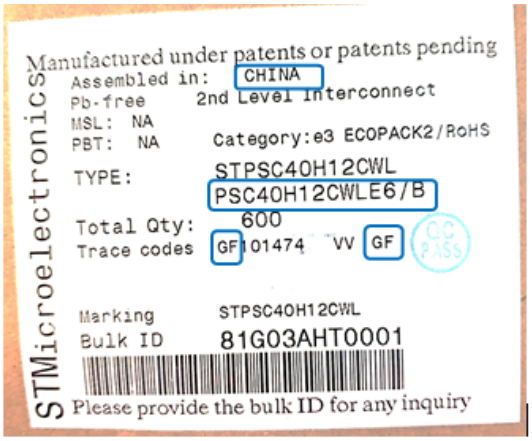
	There is no change in the packing modes and the standard delivery quantities either. The SiC power Schottky and Ultrafast RQ series products remain in full compliance with the ST ECOPACK®2 grade (“halogen-free”). Ultrafast AC series products are now proposed in ST ECOPACK®2 grade (“halogen-free”).
Disposition of former products Units manufactured at subcontractor in Philippines will be delivered till stock depletion.	

Marking and traceability

Traceability of the change will be ensured by an **internal codification (Finished Good)** (printed on carton box labels) and by the **trace code** (printed on device top side and on the carton box label).
The first two digits of the trace code indicate the back-end plant origin.

Current Finished Good/Type (Subcontractor in Philippines)	New Finished Good/Type (Subcontractor in China)
Ending by **S**	Ending by **B**

Refer to examples here below:

Labels example for STPSC40H12CWL	
Subcontractor in Philippines	**Subcontractor in China**
Current Finished Good/Type: PSC40H12CWLE6/**S**	**New Finished Good/Type:** PSC40H12CWLE6/**B**
Current Label	**New Label**
	

Top marking example for STTH60AC06CWL	
Subcontractor in Philippines	**Subcontractor in China**
Trace code: First 2 digits: **7S**	Trace code: First 2 digits: **GF**
	

Qualification complete date	14-Jun-2021

Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Rectifiers	Ultrafast	STTH60RQ06WL	Available
Rectifiers	Ultrafast	STTH30AC06CWL	Available
Rectifiers	SiC	STPSC10H12CWL	Available
Rectifiers	SiC	STPSC20065CWL	Available
Rectifiers	SiC	STPSC15H12WL	Available
Rectifiers	SiC	STPSC40H12CWL	Available

Other samples are available 12 weeks upon request.

Change implementation schedule

Sales-types	Estimated production start	Estimated first shipments
All	**July-2021**	**Oct-2021**

Comments:	With early PCN acceptance, shipment possible starting week 29-2021 on selected part numbers

Customer's feedback

Please contact your local ST sales representative or quality contact for requests concerning this change notification.
Absence of acknowledgement of this PCN within 30 days of receipt will constitute acceptance of the change.
Absence of additional response within 90 days of receipt of this PCN will constitute acceptance of the change.

Qualification program and results	21033QRP Attached

Qualification Report

Transfer of Assembly & Test manufacturing activity
SiC and Ultrafast diodes
DO-247LL & TO-247LL packages

General Information	
Product Line	*Rectifiers*
Product Description	*Silicon Carbide Power Schottky, Ultrafast Diodes*
Product perimeter	*STPSC20065CWL, STPSC10H12CWL* *STPSC10H12WL, STPSC15H12WL* *STPSC20H12CWL, STPSC20H12WL* *STPSC30H12CWL, STPSC40H12CWL* *STTH30AC06CWL, STTH31AC06SWL* *STTH60AC06CWL, STTH30RQ06WL* *STTH60RQ06CWL, STTH60RQ06WL*
Product Group	*ADG*
Product division	*Discrete & Filter*
Package	*DO247LL, TO247LL*
Maturity level step	*QUALIFIED*

Locations	
Wafer fab	*ST Catania - ITALY* *ST Tours – FRANCE*
Assembly plant	*Subcontractor 998G – CHINA*
Reliability Lab	*ST TOURS - FRANCE*
Reliability assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	18-June-2021	16	Christophe GOIN	Julien MICHELON	Initial release

TABLE OF CONTENTS

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
Tj	Junction Temperature
BS	Bond Shear
WBS	Wire Bond Strength

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify Silicon Carbide Power Schottky and Ultrafast Diodes, housed in DO-247LL and TO-247LL in China Subcontractor.

The involved products are listed in the table here below:

Product	Description	Package	Assembly Location
STPSC20065CWL	Silicon Carbide Power Schottky	TO-247LL	Subcontractor – China (998G)
STPSC10H12CWL			
STPSC20H12CWL			
STPSC30H12CWL			
STPSC40H12CWL			
STPSC10H12WL		DO-247LL	
STPSC15H12WL			
STPSC20H12WL			
STTH30AC06CWL	Ultrafast Diode	TO-247LL	
STTH31AC06SWL			
STTH60AC06CWL			
STTH60RQ06CWL			
STTH30RQ06WL		DO-247LL	
STTH60RQ06WL			

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

The following reliability tests ensuing are:

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

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

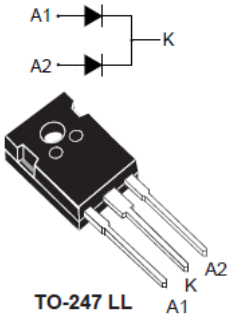
Refer to ST specification (example below for STTH60RQ06CWL):

life.augmented

STTH60RQ06CWL

Datasheet

600 V, 2 X 30 A ultrafast high voltage rectifier



TO-247 LL

Features

- High junction temperature capability
- Ultrafast with soft recovery behavior
- Low reverse current
- Low thermal resistance
- Reduced switching and conduction losses
- ECOPACK2 compliant component

Applications

- Solar boost diode
- Output rectification
- PFC
- UPS
- Air conditioning
- Charging station
- OBC in EV-HEV

Description

The STTH60RQ06CWL has been developed for applications requiring a high-voltage (HV) capability such as in secondary rectification in HV LLC full bridge topology or in high voltage boost function.

It is ideal for switching power supplies and industrial applications, as rectification function, or even freewheeling and clamping diode.

Product status link
STTH60RQ06CWL

Product summary	
Symbol	**Value**
$I_{F(AV)}$	2 X 30 A
V_{RRM}	600 V
V_F(max.)	1.45 V
t_{rr}(max.)	30 ns
T_j(max.)	175 °C

4.2 Construction Note

	STPSC200065CWL – STPSCxxH12CWL
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-247LL
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

	STPSCxxH12WL
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	DO-247LL
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

	STTH31AC06SWL - STTHxxxx06CWL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Tours – France
Technology / Process family	Ultrafast Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Tours – France
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	TO-247LL
Molding compound	ECOPACK®2
Lead finishing	Lead free (Pure Tin)
Final testing information	
Testing location	Subcontractor – China (998G)

	STTHxxRQ06WL
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Tours – France
Technology / Process family	Ultrafast Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Tours – France
Assembly information	
Assembly site	Subcontractor – China (998G)
Package description	DO-247LL
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
L1	STTH60AC06CWL	TO247-LL	Qualification lot 1
L2	STPSC20065CWL	TO247-LL	Qualification lot 2
L3	STPSC40H12CWL	TO247-LL	Qualification lot 3
L4	STTH60RQ06WL	DO247-LL	Qualification lot 4
L5	STPSC15H12WL	DO247-LL	Qualification lot 5
L6	STPSC20H12WL	DO247-LL	Qualification lot 6
GD 1	STPS80170CWLY	TO247-LL	Generic data for solderability test
GD 2	Dummies	TO247-LL	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	
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	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	L1, L2, L3, L4, L5, L6	462		X
High Temperature Forward Bias	HTFB	JESD22A-108			Not required, applicable only to LEDS	
High Temperature Operating Life Test	HTOL	JESD22A-108			Covered by HTRB.	
Steady State Operational	SSOP	MIL-STD-750-1 M1038 Test B			Required for Voltage Regulator (Zener) only.	
AC blocking voltage	ACBV	MIL-STD-750-1 M1040 Test A			Required for Thyristor only.	
Temperature Cycling	TC	JESD22A-104	L1, L3, L5, L6	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	L3, L5, L6	231		X
Autoclave	AC	JESD22A-102			Not recommended	
Highly Accelerated Stress Test	HAST	JESD22A-110			Covered by H3TRB	
High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	L1, L3, L4, L5, L6	385		X
High Temperature High Humidity Bias	HTHHB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOL / TF	MIL-STD-750 Method 1037	L3, L4, L5, L6	308	For power devices.	X
Power and Temperature Cycle	PTC	JED22A-105			Covered by IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005			For automotive products only	
ESD Characterization	ESD CDM	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		60	Not relevant for wafer production and test qualification	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 > 5.5*12.5mm and die paddle > 2.5*3.5mm	
Solderability	SD	J-STD-002 JESD22B102	GD1	30		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate			Required in case of process change.	
Wire Bond Strength	WBS	MIL-STD-750 Method 2037	L1, L2, L3, L4, L5, L6	180	Covered during workability trials	X
Bond Shear	BS	AEC-Q101-003	L1, L2, L3, L4, L5, L6	360	Covered during workability trials	X
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	GD2	54		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 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
Parametric Verifications		ST datasheet	Over part temperature range	90	-	Refer to paragraph 6.1 in Annexes					
External Visual Inspection		JESD22 B-101	-	1694	-	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	1694	-	0/1694					
HTRB	N	JESD22-A108/MIL-STD-750-1 M1038 Method A	Junction Temperature=175°C Voltage=480V	77	1000h	0/77					
			Junction Temperature=175°C Voltage=520V	77	1000h		0/77				
			Junction Temperature=150°C Voltage=480V	77	1000h				0/77		
			Junction Temperature=175°C Voltage=960V	231	1000h			0/77		0/77	0/77
TC	N	JESD22-A104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-65°C	308	500cy	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
uHAST	N	JESD22 A-118	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	231	96h			0/77		0/77	0/77
IOLT	N	MIL-STD 750 Method 1037	Delta Tj=125°C Intensity (If)=3.2A Time (off)=300s Time (on)=300s	77	500h			0/77			
			Delta Tj=125°C Intensity (If)=5A Time (off)=300s Time (on)=300s	77	500h				0/77		
			Delta Tj=125°C Intensity (If)=3.7A Time (off)=300s Time (on)=300s	77	500h					0/77	
			Delta Tj=125°C Intensity (If)=3.8A Time (off)=300s Time (on)=300s	77	500h						0/77
WBS		MIL-STD-750 Method 2037	Pre and Post change 10 bonds from minimum 5parts	180	-	0/30	0/30	0/30	0/30	0/30	0/30
BS		AEC-Q101-003	10 bonds from minimum 5parts	360	-	0/60	0/60	0/60	0/60	0/60	0/60

Test	PC	Std ref.	Conditions	Total	Steps	Results/Lot Fail/S.S.	
						GD 1	GD 2
SD		J-STD-002	Wet aging, SnAgCu bath (245°C)	30	-	0/15	
			Wet aging, SnPb bath (245°C)			0/15	
Whiskers		JESD201	No Reflow 30°C/60%RH	6	4000h		0/6
			No Reflow 30°C/85%RH	6	4000h		0/6
			No Reflow -55°C/95°C	6	1500cy		0/6
			Reflow SnPb 215°C 30°C/60%RH	6	4000h		0/6
			Reflow SnPb 215°C 30°C/85%RH	6	4000h		0/6
			Reflow SnPb 215°C -55°C/95°C	6	1500cy		0/6
			Reflow Pb Free 245°C 30°C/60%RH	6	4000h		0/6
			Reflow Pb Free 245°C 30°C/85%RH	6	4000h		0/6
			Reflow Pb Free 245°C -55°C/95°C	6	1500cy		0/6

6 ANNEXES

6.1 Parametric Verifications

- Results on STPSC40H12CWL product (TO-247LL package):

TEST	VBR	IR	VF	IR	VF	RTH(J-C)
EQUIPMENT	TESEC_881TT_TEST292					MESU1150
Condition 1	23°C	23°C	23°C	150°C	150°C	
Condition 2		VR=1.2kV	IF=20A	VR=1.2kV	IF=20A	
Min. Datasheet	1200V					
Typ. Datasheet		10uA	1.35V	60uA	1.75V	0.40°C/W
Max. Datasheet		120uA	1.50V	800uA	2.25V	0.55°C/W
UNIT	V	uA	V	uA	V	°C/W
N	60	60	60	60	60	10
Min	1323.000	0.240	1.290	2.282	1.529	0.300
Max	1465.000	5.685	1.335	27.140	1.683	0.356
Avg	1432.683	1.084	1.317	7.048	1.627	0.333

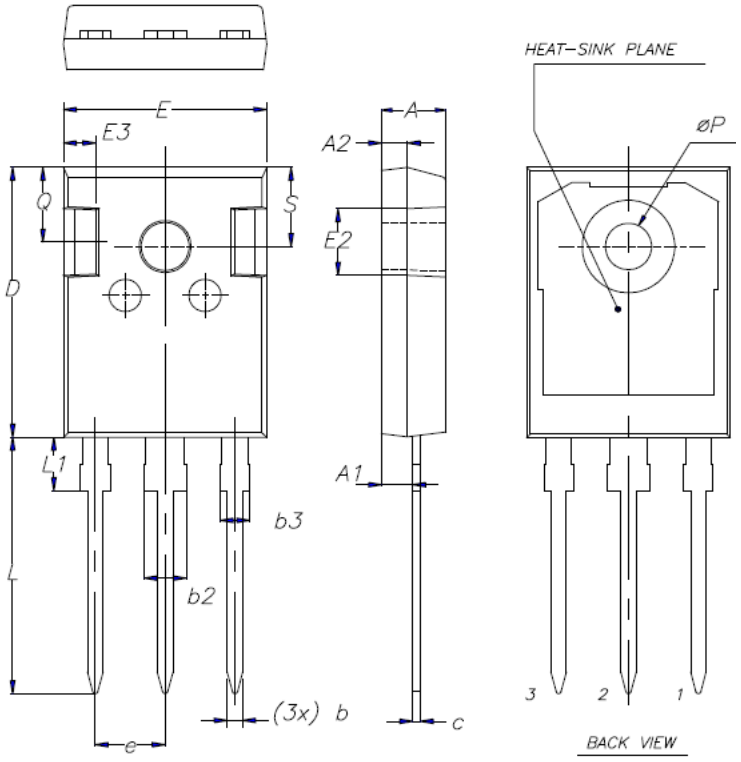
- Results on STTH60RQ06WL product (DO-247LL package):

TEST	IR	VBR	VF	VF
EQUIPMENT	TESEC_881TT_TEST292			
Condition 1	25°C	25°C	25°C	25°C
Condition 2	VR=600V		IF=30A	IF=60A
Min. Datasheet		600V		
Typ. Datasheet				
Max. Datasheet	80uA		2.45V	2.95V
UNIT	uA	V	V	V
N	30	30	30	30
Min	0.084	726.200	1.820	2.226
Max	1.223	745.700	2.028	2.532
Avg	0.158	736.883	1.933	2.392

TEST	IR	VF	VF	RTH(J-C)
EQUIPMENT	TESEC_881TT_TEST292			MESU1150
Condition 1	150°C	150°C	150°C	
Condition 2	VR=600V	IF=30A	IF=60A	
Min. Datasheet				
Typ. Datasheet	160uA	1.15V	1.45V	
Max. Datasheet	1600uA	1.45V	1.85V	0.38°C/W
UNIT	uA	V	V	°C/W
N	30	30	30	5
Min	216.600	1.119	1.428	0.316
Max	242.000	1.210	1.567	0.327
Avg	229.820	1.168	1.503	0.320

6.2 Physical Dimensions

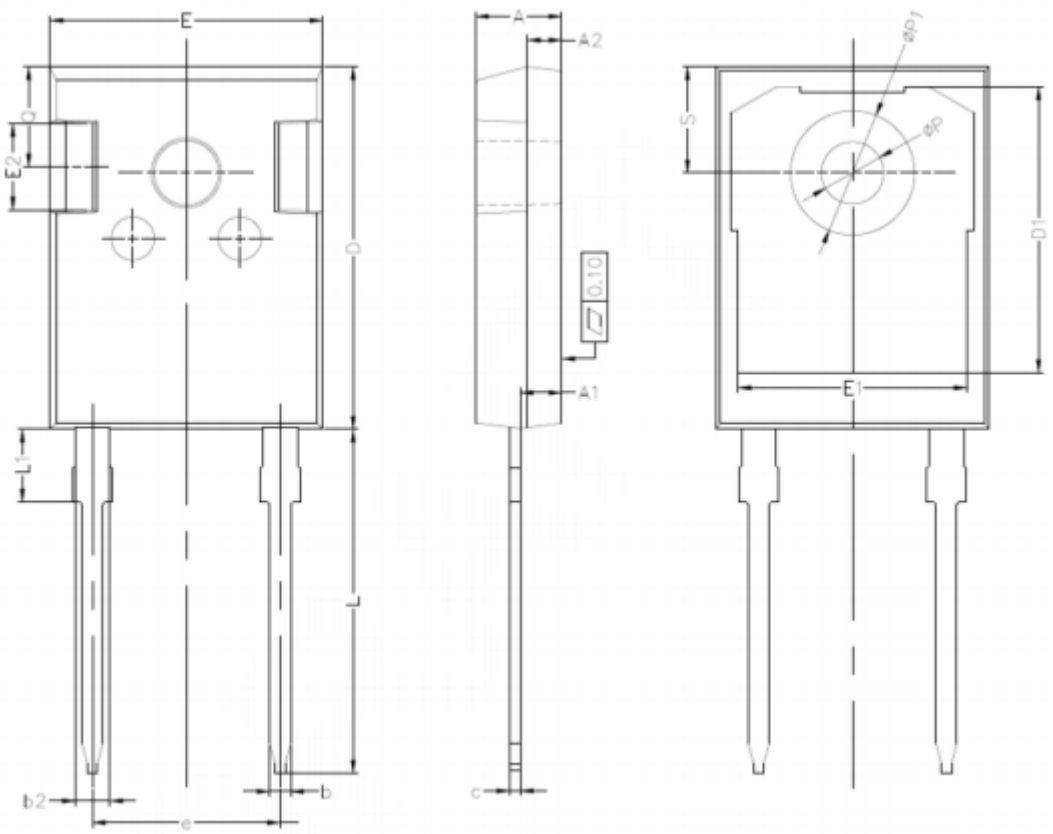
TO-247 long leads package outline



Dim.	mm.			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.90	-	5.15	0.192	-	0.203
A1	2.25	-	2.55	0.088	-	0.101
A2	1.85	-	2.10	0.072	-	0.083
B	1.07	-	1.32	0.042	-	0.052
B2	2.87	-	3.38	0.112	-	0.134
B3	1.90	-	2.38	0.074	-	0.094
C	0.55	-	0.67	0.021	-	0.027
D	20.82	-	21.10	0.819	-	0.831
E	15.70	-	16.02	0.618	-	0.631
E2	4.90	-	5.10	0.192	-	0.201
E3	2.40	-	2.60	0.094	-	0.103
e	5.34	-	5.54	0.210	-	0.219
L	19.80	-	20.30	0.779	-	0.800
L1	4.16	-	4.47	0.163	-	0.176
P	3.50	-	3.70	0.137	-	0.146
Q	5.49	-	6.00	0.216	-	0.237
S	6.04	-	6.29	0.237	-	0.248

(mm)	A	A1	A2	B	B2	B3	C	D	E	E2	E3	e	L	L1	P	Q	S
LSL	4.9	2.25	1.85	1.07	2.87	1.9	0.55	20.82	15.7	4.90	2.40	5.34	19.8	4.16	3.50	5.49	6.04
TYP																	
USL	5.15	2.55	2.1	1.32	3.38	2.38	0.67	21.10	16.02	5.10	2.60	5.54	20.3	4.47	3.70	6.00	6.29
AVERAGE	5.02	2.37	1.98	1.21	3.14	2.14	0.62	21.00	15.83	4.99	2.50	5.44	20.00	4.19	3.62	5.78	6.15
MIN	4.99	2.36	1.91	1.20	3.07	2.12	0.62	20.95	15.81	4.97	2.46	5.43	19.93	4.17	3.60	5.71	6.11
MAX	5.06	2.38	2.00	1.22	3.16	2.19	0.63	21.02	15.86	5.01	2.56	5.47	20.08	4.22	3.64	5.86	6.22

DO-247 LL package outline



Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
c	0.38	0.89	0.015	0.035
D	20.80	21.46	0.819	0.845
D1	13.08		0.515	
E	15.49	16.26	0.610	0.640
e	10.88 typ.		0.428	
E1	13.06		0.514	
E2	3.43	5.10	0.135	0.200
L	19.80	20.32	0.779	0.800
L1		4.50		0.177
P	3.50	3.70	0.137	0.146
P1	7.00	7.40	0.275	0.292
Q	5.38	6.20	0.219	0.244
S	6.16 typ.		0.243	

(mm)	A	A1	A2	b	b2	c	D	D1	E	E1	E2	e	L	L1	P	P1	Q	S
LSL	4.70	2.21	1.50	0.99	1.65	0.38	20.80	13.08	15.49	13.06	3.43		19.80		3.50	7.00	5.38	
TYP												10.88						6.16
USL	5.31	2.59	2.49	1.40	2.39	0.89	21.46		16.26		5.10		20.32	4.50	3.70	7.40	6.20	
AVERAGE	5.02	2.37	1.98	1.21	2.00	0.61	21.00	16.46	15.83	13.29	4.99	10.88	20.02	4.19	3.62	7.12	5.78	6.15
MIN	4.99	2.36	1.91	1.2	1.97	0.59	20.95	16.39	15.81	13.24	4.97	10.86	19.97	4.15	3.6	7.06	5.71	6.11
MAX	5.06	2.38	2	1.22	2.05	0.64	21.02	16.54	15.86	13.35	5.01	10.91	20.09	4.3	3.64	7.16	5.86	6.22

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

Test name	Description	Purpose
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.