PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	POWER AND DISCRETE PRODUCTS/24/14789
1.3 Title of PCN	Transfer of assembly and test line qualification for TO220 & I2PAK automotive grade packages
1.4 Product Category	TO220 & I2PAK automotive grade Rectifiers products
1.5 Issue date	2024-06-18

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 (China)

4. Description of change		
	Old	New
4.1 Description	Assembly and Test & Finishing in ST Shenzhen (China)	Assembly and Test & Finishing in a subcontractor (China)
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No	

5. Reason / motivation for change	
5.1 Motivation	ST Shenzhen has decided to phase out TO220 & I2PAK line to extend production capacity for other packages.
5.2 Customer Benefit	SERVICE CONTINUITY

6. Marking of parts / traceability of change	
6.1 Description	Traceability of the change will be ensured by Finished Good/Type print on carton labels (New FG ending by F).

7. Timing / schedule	
7.1 Date of qualification results	2024-06-07
7.2 Intended start of delivery	2024-12-20
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	14789 24016QRP.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2024-06-18

9. Attachments (additional documentations)
14789 Public product.pdf 14789 PCN TO220PWR auto transfer.pdf 14789 24016QRP.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
	STPS41H100CTY	
	STPSC10065DY	
	STPSC12065DY	
	STPSC12C065DY	
	STPSC20065DY	
	STPSC20H065CTY	
	STTH15RQ06DY	
	STTH16L06CTY	
	STTH30R04DY	
	STTH30RQ06DY	

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Qualification Report
Transfer of assembly & test line for automotive grade TO-220PWR package at Subcontractor (993X)

General Information	
Product Line	*Rectifier Automotive*
Product Description	*Silicon Carbide Power Schottky, Power Schottky and Ultrafast Diodes*
Product Perimeter	*Refer table page 4*
Product Group	*APMS*
Product Division	*Discrete & Filter*
Packages	*TO-220AB, TO-220AC*
Maturity level step	*QUALIFIED*

Locations	
Wafer Fab	*STMicroelectronics SINGAPORE* *STMicroelectronics TOURS – FRANCE* *STMicroelectronics CATANIA – ITALY*
Assembly Plant	*Subcontractor 993X - CHINA*
Reliability Lab	*STMicroelectronics TOURS – FRANCE*
	Whisker's test at Subcontractor -CHINA
Reliability Assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	07/06/2024	18	Elisabeth PREVOST	Julien Michelon Digitally signed by Julien Michelon Date: 2024.06.06 17:21:58 +02'00'	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 3
2 GLOSSARY 3
3 RELIABILITY EVALUATION OVERVIEW 4
3.1 OBJECTIVES 4
3.2 CONCLUSION 4
4 DEVICE CHARACTERISTICS 5
4.1 DEVICE DESCRIPTION 5
4.2 CONSTRUCTION NOTE 8
5 TESTS PLAN AND RESULTS SUMMARY 9
5.1 TEST VEHICLES 9
5.2 TEST PLAN 10
5.3 RELIABILITY RESULTS SUMMARY 12
6 ANNEXES 13
6.1 PARAMETRIC VERIFICATION & ESD 13
6.2 THERMAL RESISTANCE 15
6.3 ASSEMBLY TESTS 15
6.4 PHYSICAL DIMENSIONS 16
6.5 TESTS DESCRIPTION 18

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

ACBV	Alternative Current Blocking Voltage
BS	Bond Shear
DBT	Dead Bug Test
DPA	Destructive Physical Analysis
DS	Die Shear
EV	External Visual
GD	Generic Data
H3TRB	High Humidity High Temperature Reverse Bias
HTRB	High Temperature Reverse Bias
IOLT	Intermittent Operating Life Test
MSL	Moisture Sensitivity Level
PD	Physical Dimensions
PV	Parametric Verification
RSH	Resistance to Soldering Heat
SD	Solderability test
SS	Sample Size
TC	Temperature Cycling
TW/WG	Tin Whiskers / Whiskers Growth
UHAST	Unbiased Highly Accelerated Stress Test
WBS	Wire Bond Strength

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify Transfer of assembly & test line from ST Shenzhen to Subcontractor (993x), for Power Schottky, Power Schottky Silicon Carbide and Ultrafast Diodes housed in TO-220AB and TO-220AC packages.

Table of involved products:

Product	Description	Package	Assembly Location
STPS41H100CTY	Automotive Power Schottky Diode	TO-220AB	ST Subcontractor (993X) - China
STPSC20H065CTY	Automotive Silicon Carbide Power Schottky Diode		
STTH16L06CTY	Automotive Ultrafast Diode		
STPSC6C065DY	Automotive Silicon Carbide Power Schottky Diode	TO-220AC	
STPSC12C065DY			
STPSC12065DY			
STPSC20065DY			
STPSC10065DY			
STTH1210DY	Automotive Ultrafast Diode		
STTH15RQ06DY			
STTH30RQ06DY			
STTH30R04DY			

The reliability test methodology used follows the JESD47: « Stress Test driven Qualification Methodology » and AEC-Q101 Rev.E 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, UHAST to check the robustness to corrosion and the good package hermeticity.
- RSH, Solderability and DBT to check compatibility of package with customer assembly.
- TW/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.

Based on these results, those products parts are complaint with AEC-Q101 Rev.E.

4 DEVICE CHARACTERISTICS

4.1 Device description

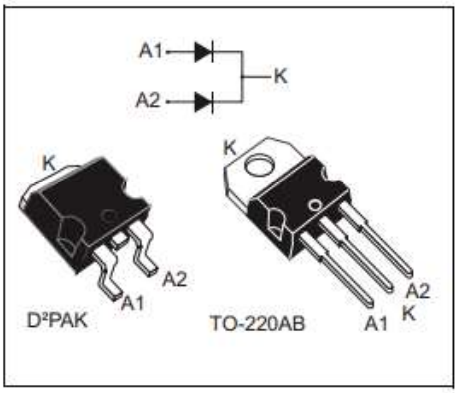
Refer to products datasheets.

life.augmented

STPS41H100C-Y

Automotive low drop power Schottky rectifier

Datasheet – production data



Description

Dual center tap Schottky rectifier designed for high frequency miniature switched mode power supplies such as adaptors and on board DC/DC converters for automotive applications.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	2 x 20 A
V_{RRM}	100 V
$T_{j(max)}$	175 °C
$V_{F\ (Typ)}$	0.62 V

Features

- Negligible switching losses
- High junction temperature capability
- Good trade off between leakage current and forward voltage drop
- Low leakage current
- Avalanche rated
- AEC-Q101 qualified
- PPAP capable
- ECOPACK®2 compliant component on TO-220AB

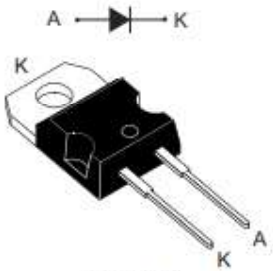
January 2015 DocID018564 Rev 2 1/9

This is information on a product in full production. www.st.com

STPSC6C065-Y

Automotive 650 V power Schottky silicon carbide diode

Datasheet - production data



TO-220AC

Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability
- PPAP capable
- ECOPACK®2 compliant component

Description

The SiC diode is an ultrahigh 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 650 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 and is ideal for automotive applications.

Especially suited for use as boost diode, this rectifier will enhance the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	6 A
V_{RRM}	650 V
T_j (max)	175 °C

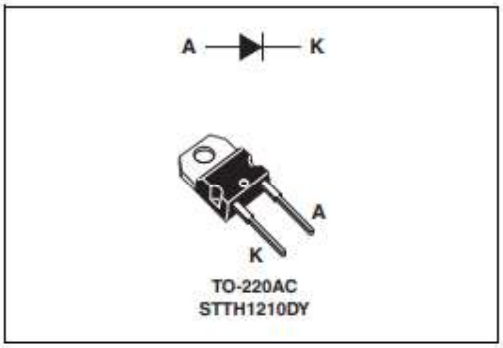
STTH1210-Y

Automotive ultrafast recovery - high voltage diode

Datasheet – production data

Features

- AEC-Q101 qualified
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and high pulsed current operation
- High reverse voltage capability
- High junction temperature



TO-220AC
STTH1210DY

Description

The high quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long term reliability, like automotive applications.

These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.

Table 1. Device summary

$I_{F(AV)}$	12 A
V_{RRM}	1000 V
T_j	175 °C
V_F (typ)	1.30 V
t_{rr} (typ)	48 ns

4.2 Construction Note

	STPS41H100CTY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Singapore
Technology / Process family	Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Singapore
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AB
Final testing information	
Testing location	Subcontractor (993x) - China

	STPSC20H065CTY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Catania – Italy
Technology / Process family	Silicon Carbide Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Catania – Italy
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AB
Final testing information	
Testing location	Subcontractor (993x) - China

	STPSCxxC65DY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Catania – Italy
Technology / Process family	Silicon Carbide Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Catania – Italy
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

	STTHxxxxxxDY
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 (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

	STTHxxxxxxCTY
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 (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

5 TESTS PLAN AND RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L1	STPSC20065DY	TO-220AC	Qualification lot 1
L2	STPS41H100CTY	TO-220AB	Qualification lot 2
L3	STPS41H100CR	I²PAK	Qualification lot 3
L4	STTH30RQ06DY	TO-220AC	Qualification lot 4
L5	STTH16L06CTY	TO-220AB	Qualification lot 5
L6	STTH3012D	TO-220AC	Qualification lot 6
L7	STTH8S12D	TO-220AC	Qualification lot 7
L8	STPSC12C065DY	TO-220AC	Qualification lot 8
GD1	Dummy	TO-220AB	Generic data for whiskers test

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	
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 L2 L5	90		X
High Temperature Reverse Bias	HTRB	MIL-STD-750-1 M1038 Method A (for diodes, rectifiers and Zeners) M1039 Method A (for transistors)	L2 L4 L5 L6 L8	385		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 L6	231		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for Power MOSFET – IGBT only.	
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	L1 L3 L4	231	Required for SCR/TRIAC RECTIFIER and Protection devices	X
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 L4 L6	308	Alternative to HAST	X
High Temperature High Humidity Bias	HTHHB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOLT	MIL-STD-750 Method 1037	L2 L7 L8	231	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	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
					Perform PTC if ΔTj>100°C cannot be achieved with IOL Alternative to IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1 L2 L5	90		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1 L2 L5	90		X
Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1 L2	8	After H3TRB and TC	X
Physical Dimension	PD	JESD22B-100	GD	60		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)	L2	30	Not applicable for SMD pitch < 0.5mm, package size > 5.5*12.5mm and die paddle > 2.5*3.5mm	X
Solderability	SD	J-STD-002 JESD22B102	L2	30		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L1 L2 L5	45	Required in case of process change. Not applicable to protection device as no limit specified in the datasheet	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037	L1 L2 L5	30		X
Bond Shear	BS	AEC-Q101-003	L1 L2 L5	30		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 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	GD1	54		X
Screwing test	Screw	ST 0063378	L2	22		X
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)	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 Reliability results summary

Test	PC	Std ref.	Conditions	Steps / Duration	SS	Failure / SS								
						L1	L2	L3	L4	L5	L6	L7	L8	GD1
Pre- and Post-Electrical Test	-	ST datasheet	Ir, Vf,parameters following product datasheet	-	1493	0/1493								
HTRB	N	MIL-STD-750- 1 M1038 Method A	Tj=152°C Voltage=600V	1Khrs	385	-	-	-	0/77	-	-	-	-	-
	N		Tj=114°C Voltage=100V			-	0/77	-	-	-	-	-	-	-
	N		Tj=151°C Voltage=960V	1Khrs		-	-	-	-	-	0/77	-	-	-
	N		Tj=175°C Voltage=650V	1Krs		-	-	-	-	-	-	-	0/77	-
	N		Tj=175°C Voltage=600V	1Krs		-	-	-	-	0/77	-	-	-	-
TC	N	JESD22 A-104	-55/+150°C 2cy/h	1Kcy	308	0/77	0/77	0/77	-	-	0/77	-	-	-
DPA	N	ST 0060102 AEC-Q101	After TC 1Kcy	-	4	0/2	0/2	-	-	-	-	-	-	-
RSH	N	JESD22 B-106	Dipping 270°C-7s	-	30	-	0/30	-	-	-	-	-	-	-
H3TRB	N	JESD22 A-101	85°C; 85% RH Voltage=100V	1Khrs	308	0/77	-	-	0/77	-	0/77	-	-	-
			85°C; 85% RH Voltage=80V	1Khrs		-	0/77	-	-	-	-	-	-	-
DPA	N	ST 0060102 AEC-Q101	After H3TRB 1Khrs	-	4	0/2	0/2	-	-	-	-	-	-	-
UHAST	N	JESD22 A-118	130°C; 85% RH 2.3bar	96hrs	231	0/77	-	0/77	0/77	-	-	-	-	-
IOLT	N	MIL-STD 750 Method 1037	ΔTj=125°C Ton=Toff=210s	500hrs	231	-	0/77	-	-	-	-	-	0/77	-
	N		ΔTj=125°C Ton=Toff=210s	500hrs		-	-	-	-	-	-	0/77	-	-
Screw	N	ST 063378	Torque = 0.7N.m	-	22		0/22							
SD	N	J-STD-002 JESD22 B-102	Wet ageing SnPb bath 245°C	-	30	-	0/15	-	-	-	-	-	-	-
			Wet ageing SnAgCu bath 245°C	-	30	-	0/15	-	-	-	-	-	-	-
WG	N	AEC-Q005 JESD201	TC **-40°C/85°C**	500cy	18	-	-	-	-	-	-	-	-	0/18
			THS 30°C/60%RH	1.5Khrs	18	-	-	-	-	-	-	-	-	0/18
			THS 55°C 85%RH	1.5Khrs	18	-	-	-	-	-	-	-	-	0/18

6 ANNEXES

6.1 Parametric Verification & ESD

STPSC20065DY

TEST	IR	IR	IR	VF	VF
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	25°C	25°C	150°C	25°C	150°C
Condition 2	VR=600V	VR=650V	VR=650V	IF=20A	IF=20A
Min. Datasheet					
Typ. Datasheet	*15uA*	*30uA*	*280uA*	*1.30V*	*1.45V*
Max. Datasheet	*150uA*	*300uA*	*2000uA*	*1.45V*	*1.65V*
Comments					
UNIT	nA	uA	uA	V	V
N	30	30	29	30	29
Min	140,10	0,50	4,46	1,32	1,45
Max	2740,00	9,63	26,86	1,37	1,51
Avg.	405,95	1,28	6,99	1,34	1,48

TEST	VR	VR	VR	ESD_CDM	ESD_HBM
EQUIPMENT	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	-40°C	25°C	150°C	23°C	23°C
Condition 2					
Min. Datasheet	*650V*	*650V*	*650V*		
Typ. Datasheet					
Max. Datasheet					
Comments				AEC-Q101	AEC-Q101
UNIT	V	V	V	KV	KV
N	29	30	29	30	30
Min	837,60	840,30	846,90	>1.0	>8.0
Max	892,40	899,50	908,80	>1.0	>8.0
Avg.	885,07	890,78	894,96		

STTH16L06CTY

TEST	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	25°C	150°C	25°C	25°C	150°C	150°C
Condition 2	VR=600V	VR=600V	IF=8A	IF=16A	IF=8A	IF=16A
Min. Datasheet						
Typ. Datasheet		*25uA*			*1.05V*	*1.28V*
Max. Datasheet	*8uA*	*240uA*	*1.8V*	*2.08V*	*1.35V*	*1.64V*
Comments						
UNIT	uA	uA	V	V	V	V
N	30	30	30	30	30	30
Min	0,00	15,05	1,29	1,48	1,00	1,21
Max	0,32	18,91	1,44	1,66	1,08	1,32
Avg.	0,03	16,54	1,37	1,58	1,05	1,27

TEST	VR	VR	VR	ESD CDM	ESD HBM
EQUIPMENT	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	-40°C	25°C	150°C	25oC	25oC
Condition 2					
Min. Datasheet	*600V*	*600V*	*600V*		
Typ. Datasheet					
Max. Datasheet					
Comments					
UNIT	V	V	V	KV	KV
N	30	30	30	30	30
Min	675,10	724,90	801,30	>1.0	>8.0
Max	693,30	745,40	824,60	>1.0	>8.0
Avg.	689,39	741,30	820,03		

STPS41H100CTY

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	-40°C	24°C	125°C	24°C	125°C
Condition 2				VR=100V	VR=100V
Min. Datasheet	*100V*	*100V*	*100V*		
Typ. Datasheet					*3mA*
Max. Datasheet				*10uA*	*10mA*
Comments					
UNIT	V	V	V	uA	mA
N	30	30	30	30	30
Min	115,300	124,200	110,500	1,742	2,893
Max	118,000	127,100	114,600	2,416	3,376
Avg.	116,690	125,623	112,713	1,947	3,117

TEST	VF	VF	VF	VF	ESD_CDM	ESD_HBM
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	24°C	24°C	125°C	125°C	25°C	25°C
Condition 2	IF=20A	IF=40A	IF=20A	IF=40A		
Min. Datasheet						
Typ. Datasheet			*0.62V*	*0.7V*		
Max. Datasheet	*0.8V*	*0.9V*	*0.67V*	*0.76V*		
Comments						
UNIT	V	V	V	V		
N	30	30	30	30	30	30
Min	0,741	0,851	0,609	0,721	>1.0	>8.0
Max	0,750	0,864	0,618	0,734	>1.0	>8.0
Avg.	0,746	0,857	0,614	0,728		

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.

6.2 Thermal Resistance

TEST	RTH (j-c) STPSC20065DY	RTH (j-c) STTH16L06CTY	RTH (C) STTH16L06CTY	RTH (j-c) STPS41H100CTY	RTH (C) STPSC41H100CTY
EQUIPMENT					
Condition 1	25°C	25°C	25°C	25°C	25°C
Condition 2					
Min. Datasheet					
Typ Datasheet	*0.60°C/W*				
Max. Datasheet	*0.90°C/W*	*2.5°C/W*	*0.7°C/W*	*1.5°C/W*	*0.1°C/W*
UNIT	°CW	*°CW*	*°CW*	*°CW*	*°CW*
N	10	10	5	10	10
Min	0,66	1,26	0,12	0,483	0,005
Max	0,71	1,42	0,15	0,649	0,063
Avg	0,69	1,35	0,14	0,563	0,035

6.3 Assembly Tests

Wire Pull Tests

Commercial Product	Conditions	Sample size	Failure /SS
STPS41H100CTY	500g Min	10 units	0/10
STTH16L06CY	500g Min	10 units	0/10
STPSC20065DY	350g Min	10 units	0/10

Ball / Wedge Shear Test

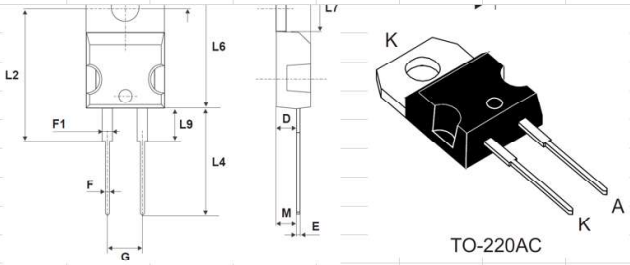
Commercial Product	Conditions	Sample size	Failure /SS
STPS41H100CTY	1000g Min	10 units	0/10
STTH16L06CY	1000g Min	10 units	0/10
STPSC20065DY	700g Min	10 units	0/10

6.4 Physical Dimensions

Dimensional Report for TO220-AC package

March-2024

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151



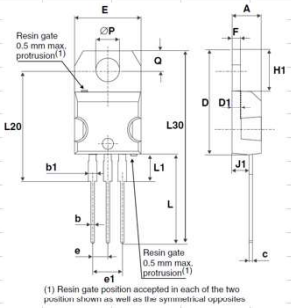
TO-220AC

Sample\Inspection item	A	C	D	E	F	F1	G	H2	L2	L4	L5	L7	L6	L9	Diam. I
S1	4,432	1,292	2,519	0,517	0,805	1,397	5,075	10,169	16,431	13,346	2,802	6,478	15,519	3,716	3,801
S2	4,421	1,295	2,521	0,516	0,803	1,371	5,063	10,177	16,459	13,371	2,811	6,498	15,523	3,755	3,790
S3	4,423	1,294	2,523	0,513	0,808	1,360	5,080	10,173	16,423	13,343	2,793	6,476	15,521	3,737	3,808
S4	4,421	1,293	2,517	0,514	0,810	1,383	5,080	10,177	16,423	13,347	2,815	6,515	15,544	3,717	3,802
S5	4,431	1,293	2,521	0,513	0,815	1,387	5,060	10,018	16,454	13,349	2,812	6,506	15,542	3,766	3,797
S6	4,43	1,292	2,518	0,512	0,815	1,388	5,073	10,169	16,425	13,339	2,811	6,507	15,531	3,753	3,794
S7	4,431	1,295	2,520	0,514	0,805	1,386	5,067	10,172	16,461	13,370	2,797	6,503	15,530	3,763	3,795
S8	4,440	1,293	2,514	0,513	0,814	1,384	5,074	10,180	16,442	13,346	2,817	6,515	15,527	3,777	3,796
S9	4,443	1,292	2,519	0,512	0,803	1,394	5,066	10,171	16,448	13,334	2,812	6,517	15,529	3,740	3,791
S10	4,436	1,294	2,518	0,514	0,808	1,382	5,065	10,167	16,455	13,322	2,817	6,516	15,524	3,763	3,798
S11	4,435	1,296	2,515	0,513	0,806	1,387	5,085	10,178	16,424	13,351	2,809	6,515	15,526	3,727	3,802
S12	4,435	1,294	2,518	0,512	0,809	1,374	5,075	10,178	16,413	13,331	2,799	6,518	15,535	3,744	3,808
S13	4,441	1,299	2,520	0,514	0,813	1,387	5,060	10,183	16,445	13,336	2,820	6,516	15,530	3,716	3,798
S14	4,441	1,294	2,518	0,515	0,811	1,403	5,079	10,180	16,425	13,375	2,824	6,499	15,521	3,774	3,798
S15	4,435	1,295	2,525	0,511	0,809	1,392	5,072	10,180	16,435	13,343	2,792	6,500	15,534	3,734	3,794
S16	4,439	1,295	2,526	0,512	0,812	1,396	5,065	10,185	16,429	13,320	2,805	6,528	15,530	3,737	3,799
S17	4,436	1,289	2,519	0,510	0,804	1,376	5,075	10,179	16,452	13,372	2,810	6,527	15,529	3,741	3,798
S18	4,431	1,287	2,515	0,512	0,804	1,393	5,071	10,183	16,426	13,382	2,823	6,524	15,535	3,780	3,795
S19	4,438	1,288	2,510	0,514	0,801	1,394	5,080	10,175	16,434	13,333	2,802	6,523	15,531	3,751	3,797
S20	4,435	1,285	2,513	0,509	0,809	1,390	5,066	10,176	16,425	13,351	2,807	6,525	15,534	3,752	3,800
S21	4,439	1,286	2,510	0,511	0,810	1,389	5,080	10,181	16,428	13,347	2,809	6,527	15,530	3,732	3,799
S22	4,435	1,287	2,511	0,513	0,813	1,384	5,072	10,182	16,435	13,365	2,819	6,524	15,533	3,759	3,802
S23	4,436	1,286	2,512	0,516	0,809	1,400	5,088	10,183	16,427	13,334	2,803	6,523	15,527	3,768	3,802
S24	4,437	1,285	2,513	0,518	0,800	1,382	5,069	10,169	16,425	13,363	2,816	6,528	15,529	3,754	3,800
S25	4,435	1,280	2,510	0,517	0,807	1,392	5,062	10,165	16,429	13,354	2,815	6,523	15,531	3,763	3,807
S26	4,438	1,284	2,514	0,518	0,802	1,386	5,079	10,180	16,425	13,356	2,803	6,521	15,528	3,749	3,798
S27	4,439	1,286	2,513	0,516	0,807	1,382	5,083	10,170	16,428	13,376	2,804	6,520	15,527	3,724	3,798
S28	4,435	1,285	2,512	0,512	0,808	1,382	5,072	10,182	16,427	13,337	2,804	6,524	15,529	3,741	3,801
S29	4,434	1,284	2,511	0,509	0,816	1,390	5,074	10,174	16,425	13,374	2,809	6,522	15,526	3,766	3,805
S30	4,441	1,285	2,516	0,514	0,820	1,392	5,069	10,152	16,451	13,351	2,818	6,527	15,528	3,741	3,801
LSL	4,40	1,23	2,40	0,48	0,61	1,14	4,95	10,00		13,00	2,65	6,20	15,25	3,50	3,75
Typ									16.40						
USL	4,60	1,32	2,72	0,70	0,88	1,70	5,15	10,40		14,00	2,95	6,60	15,75	3,93	3,85
Min	4,421	1,28	2,51	0,509	0,8	1,36	5,06	10,018	16,413	13,32	2,792	6,476	15,519	3,716	3,79
Max	4,443	1,299	2,526	0,518	0,82	1,403	5,088	10,185	16,461	13,382	2,824	6,528	15,544	3,78	3,808

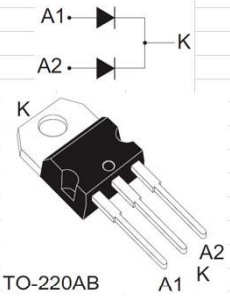
Dimensional Report for TO220-AB package

March-2024

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.17	0.18
b	0.61	0.88	0.024	0.035
b1	1.14	1.70	0.045	0.067
c	0.48	0.70	0.019	0.027
D	15.25	15.75	0.60	0.62
D1	1.27 typ.		0.05 typ.	
E	10	10.40	0.39	0.41
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.19	0.20
F	1.23	1.32	0.048	0.052
H1	6.20	6.60	0.24	0.26
J1	2.40	2.72	0.094	0.107
L	13	14	0.51	0.55
L1	3.50	3.93	0.137	0.154
L20	16.40 typ.		0.64 typ.	
L30	28.90 typ.		1.13 typ.	
ØP	3.75	3.85	0.147	0.151
Q	2.65	2.95	0.104	0.116



(1) Resin gate position accepted in each of the two position shown as well as the symmetrical opposites



Sample\Inspection item	A	b	b1	c	D	D1	E	e	e1	F	H1	J1	L	L1	L20	L30	øP	Q
S1	4,432	0,805	1,397	0,517	15,519	1,201	10,169	2,510	5,075	1,292	6,478	2,519	13,346	3,716	16,431	28,825	3,801	2,802
S2	4,421	0,803	1,371	0,516	15,523	1,207	10,177	2,519	5,063	1,295	6,498	2,521	13,371	3,755	16,459	28,864	3,790	2,811
S3	4,423	0,808	1,360	0,513	15,521	1,205	10,173	2,516	5,080	1,294	6,476	2,523	13,343	3,737	16,423	28,826	3,808	2,793
S4	4,421	0,810	1,383	0,514	15,544	1,200	10,177	2,518	5,080	1,293	6,515	2,517	13,347	3,717	16,423	28,835	3,802	2,815
S5	4,431	0,815	1,387	0,513	15,542	1,189	10,018	2,530	5,060	1,293	6,506	2,521	13,349	3,766	16,454	28,842	3,797	2,812
S6	4,43	0,815	1,388	0,512	15,531	1,203	10,169	2,533	5,073	1,292	6,507	2,518	13,339	3,753	16,425	28,840	3,794	2,811
S7	4,431	0,805	1,386	0,514	15,530	1,198	10,172	2,545	5,067	1,295	6,503	2,520	13,370	3,763	16,461	28,831	3,795	2,797
S8	4,440	0,814	1,384	0,513	15,527	1,188	10,180	2,541	5,074	1,293	6,515	2,514	13,346	3,777	16,442	28,837	3,796	2,817
S9	4,443	0,803	1,394	0,512	15,529	1,209	10,171	2,516	5,066	1,292	6,517	2,519	13,334	3,740	16,448	28,824	3,791	2,812
S10	4,436	0,808	1,382	0,514	15,524	1,202	10,167	2,532	5,065	1,294	6,516	2,518	13,322	3,763	16,455	28,863	3,798	2,817
S11	4,435	0,806	1,387	0,513	15,526	1,206	10,178	2,523	5,085	1,296	6,515	2,515	13,351	3,727	16,424	28,807	3,802	2,809
S12	4,435	0,809	1,374	0,512	15,535	1,210	10,178	2,523	5,075	1,294	6,518	2,518	13,331	3,744	16,413	28,840	3,808	2,799
S13	4,441	0,813	1,387	0,514	15,530	1,208	10,183	2,526	5,060	1,299	6,516	2,520	13,336	3,716	16,445	28,839	3,798	2,820
S14	4,441	0,811	1,403	0,515	15,521	1,209	10,180	2,520	5,079	1,294	6,499	2,518	13,375	3,774	16,425	28,856	3,798	2,824
S15	4,435	0,809	1,392	0,511	15,534	1,214	10,180	2,517	5,072	1,295	6,500	2,525	13,343	3,734	16,435	28,822	3,794	2,792
S16	4,439	0,812	1,396	0,512	15,530	1,209	10,185	2,513	5,065	1,295	6,528	2,526	13,320	3,737	16,429	28,854	3,799	2,805
S17	4,436	0,804	1,376	0,510	15,529	1,212	10,179	2,519	5,075	1,289	6,527	2,519	13,372	3,741	16,452	28,867	3,798	2,810
S18	4,431	0,804	1,393	0,512	15,535	1,208	10,183	2,516	5,071	1,287	6,524	2,515	13,382	3,780	16,426	28,823	3,795	2,823
S19	4,438	0,801	1,394	0,514	15,531	1,212	10,175	2,525	5,080	1,288	6,523	2,510	13,333	3,751	16,434	28,851	3,797	2,802
S20	4,435	0,809	1,390	0,509	15,534	1,209	10,176	2,539	5,066	1,285	6,525	2,513	13,351	3,752	16,425	28,860	3,800	2,807
S21	4,439	0,810	1,389	0,511	15,530	1,210	10,181	2,530	5,080	1,286	6,527	2,510	13,347	3,732	16,428	28,877	3,799	2,809
S22	4,435	0,813	1,384	0,513	15,533	1,207	10,182	2,526	5,072	1,287	6,524	2,511	13,365	3,759	16,435	28,808	3,802	2,819
S23	4,436	0,809	1,400	0,516	15,527	1,209	10,183	2,539	5,088	1,286	6,523	2,512	13,334	3,768	16,427	28,875	3,802	2,803
S24	4,437	0,800	1,382	0,518	15,529	1,211	10,169	2,513	5,069	1,285	6,528	2,513	13,363	3,754	16,425	28,870	3,800	2,816
S25	4,435	0,807	1,392	0,517	15,531	1,213	10,165	2,512	5,062	1,280	6,523	2,510	13,354	3,763	16,429	28,851	3,807	2,815
S26	4,438	0,802	1,386	0,518	15,528	1,210	10,180	2,522	5,079	1,284	6,521	2,514	13,356	3,749	16,425	28,880	3,798	2,803
S27	4,439	0,807	1,382	0,516	15,527	1,208	10,170	2,510	5,083	1,286	6,520	2,513	13,376	3,724	16,428	28,827	3,798	2,804
S28	4,435	0,808	1,382	0,512	15,529	1,212	10,182	2,526	5,072	1,285	6,524	2,512	13,337	3,741	16,427	28,880	3,801	2,804
S29	4,434	0,816	1,390	0,509	15,526	1,210	10,174	2,535	5,074	1,284	6,522	2,511	13,374	3,766	16,425	28,865	3,805	2,809
S30	4,441	0,820	1,392	0,514	15,528	1,211	10,152	2,543	5,069	1,285	6,527	2,516	13,351	3,741	16,451	28,860	3,801	2,818
LSL	4,40	0,61	1,14	0,48	15,25		10,00	2,40	4,95	1,23	6,20	2,40	13,00	3,50			3,75	2,65
Typ						1,27									16,40	28,90		
USL	4,60	0,88	1,70	0,70	15,75		10,40	2,70	5,15	1,32	6,60	2,72	14,00	3,93			3,85	2,95
Min	4,421	0,8	1,36	0,509	15,519	1,188	10,018	2,51	5,06	1,28	6,476	2,51	13,32	3,716	16,413	28,807	3,79	2,792
Max	4,443	0,82	1,403	0,518	15,544	1,214	10,185	2,545	5,088	1,299	6,528	2,526	13,382	3,78	16,461	28,88	3,808	2,824

6.5 Tests description

Test name	Description	Purpose
HTRB High Temperature Reverse Bias / **HTFB** High Temperature Forward 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. Forward: device is forward biased with a current fixed and adjusted to reach the 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. To assess active area and contacts integrity
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.
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, 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
RSH Resistance to Solder Heat	Package is dipped by the leads in a solder bath after initial wet ageing (for SMDs only). Assessment by electrical test + no external crack	To simulate wave soldering process and verify that package will not be thermally damaged during this step.
SD Solderability	The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder.	This evaluation is made on the basis of the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish.
TW/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.

PCN
Product/Process Change Notification

Transfer of assembly and test line qualification for TO220 & I2PAK automotive grade packages

Notification number:	PDP/24/14789	**Issue Date**	10-Jun-2024
Issued by	Sophie da Silva		
Product series affected by the change		TO220 & I2PAK automotive grade Rectifiers products *Refer to attached table for involved Commercial Products.*	
Type of change		Transfer	

Description of the change

The production of TO220 & I2PAK automotive grade packages (Assembly, Test & Finishing) currently located in ST Shenzhen Plant (China) will be transferred to a subcontractor plant located in China.

Reason for change

ST Shenzhen has decided to phase out TO220 & I2PAK line to extend production capacity for other packages.

Former versus changed product:	The changed products do not present modified electrical, dimensional or thermal parameters, leaving unchanged the current information published in the product datasheet. 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

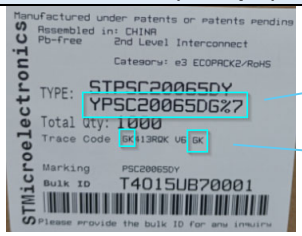
Delivery of current products will be done until stock depletion.

(1) PDP: Power & Discrete Products

Marking and traceability

Traceability of the change will be ensured by Finished Good/Type print on carton labels (New FG ending by **F**).

Commercial part number/Order code	Former Finished Good/Type (examples)	New Finished Good/Type (examples)
STPS41H100CTY STPSC20H065CTY STTH16L06CTY	YPS41H100CTHJ%7 YPSC20H065CTG/7 YTH16L06CTJ/7	YPS41H100CTH%F YPSC20H065CT/F YTH16L06CT/F

Former Label (example)	New Label (example)
	YPSC20065DG%F GS

Qualification completion date	7-Jun-2024

Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
RECTIFIER	SiC	STPSC10065DY	Week 30-2024
RECTIFIER	SiC	STPSC12065DY	Week 30-2024
RECTIFIER	SiC	STPSC20065DY	Week 30-2024
RECTIFIER	Ultrafast	STTH15RQ06DY	Week 30-2024

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

Change implementation schedule

Sales-types	Estimated production start	Estimated first shipments
Finished Good	**Week25-2024**	**Week51-2024**

Comments:	With early PCN acceptance, shipments could be anticipated

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	24016QRP Attached

(1) PDP: Power & Discrete Products

Involved Commercial part numbers
STPS41H100CTY
STPSC10065DY
STPSC12065DY
STPSC12C065DY
STPSC20065DY
STPSC20H065CTY
STPSC6C065DY
STTH1210DY
STTH15RQ06DY
STTH16L06CTY
STTH30R04DY
STTH30RQ06DY

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

Qualification Report
Transfer of assembly & test line for automotive grade TO-220PWR package at Subcontractor (993X)

General Information	
Product Line	*Rectifier Automotive*
Product Description	*Silicon Carbide Power Schottky, Power Schottky and Ultrafast Diodes*
Product Perimeter	*Refer table page 4*
Product Group	*APMS*
Product Division	*Discrete & Filter*
Packages	*TO-220AB, TO-220AC*
Maturity level step	*QUALIFIED*

Locations	
Wafer Fab	*STMicroelectronics SINGAPORE* *STMicroelectronics TOURS – FRANCE* *STMicroelectronics CATANIA – ITALY*
Assembly Plant	*Subcontractor 993X - CHINA*
Reliability Lab	*STMicroelectronics TOURS – FRANCE*
	Whisker's test at Subcontractor -CHINA
Reliability Assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comments
1.0	07/06/2024	18	Elisabeth PREVOST	Julien Michelon Digitally signed by Julien Michelon Date: 2024.06.06 17:21:58 +02'00'	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 3
2 GLOSSARY 3
3 RELIABILITY EVALUATION OVERVIEW 4
3.1 OBJECTIVES 4
3.2 CONCLUSION 4
4 DEVICE CHARACTERISTICS 5
4.1 DEVICE DESCRIPTION 5
4.2 CONSTRUCTION NOTE 8
5 TESTS PLAN AND RESULTS SUMMARY 9
5.1 TEST VEHICLES 9
5.2 TEST PLAN 10
5.3 RELIABILITY RESULTS SUMMARY 12
6 ANNEXES 13
6.1 PARAMETRIC VERIFICATION & ESD 13
6.2 THERMAL RESISTANCE 15
6.3 ASSEMBLY TESTS 15
6.4 PHYSICAL DIMENSIONS 16
6.5 TESTS DESCRIPTION 18

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

ACBV	Alternative Current Blocking Voltage
BS	Bond Shear
DBT	Dead Bug Test
DPA	Destructive Physical Analysis
DS	Die Shear
EV	External Visual
GD	Generic Data
H3TRB	High Humidity High Temperature Reverse Bias
HTRB	High Temperature Reverse Bias
IOLT	Intermittent Operating Life Test
MSL	Moisture Sensitivity Level
PD	Physical Dimensions
PV	Parametric Verification
RSH	Resistance to Soldering Heat
SD	Solderability test
SS	Sample Size
TC	Temperature Cycling
TW/WG	Tin Whiskers / Whiskers Growth
UHAST	Unbiased Highly Accelerated Stress Test
WBS	Wire Bond Strength

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to qualify Transfer of assembly & test line from ST Shenzhen to Subcontractor (993x), for Power Schottky, Power Schottky Silicon Carbide and Ultrafast Diodes housed in TO-220AB and TO-220AC packages.

Table of involved products:

Product	Description	Package	Assembly Location
STPS41H100CTY	Automotive Power Schottky Diode	TO-220AB	ST Subcontractor (993X) - China
STPSC20H065CTY	Automotive Silicon Carbide Power Schottky Diode		
STTH16L06CTY	Automotive Ultrafast Diode		
STPSC6C065DY	Automotive Silicon Carbide Power Schottky Diode	TO-220AC	
STPSC12C065DY			
STPSC12065DY			
STPSC20065DY			
STPSC10065DY			
STTH1210DY	Automotive Ultrafast Diode		
STTH15RQ06DY			
STTH30RQ06DY			
STTH30R04DY			

The reliability test methodology used follows the JESD47: « Stress Test driven Qualification Methodology » and AEC-Q101 Rev.E 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, UHAST to check the robustness to corrosion and the good package hermeticity.
- RSH, Solderability and DBT to check compatibility of package with customer assembly.
- TW/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.

Based on these results, those products parts are complaint with AEC-Q101 Rev.E.

4 DEVICE CHARACTERISTICS

4.1 Device description

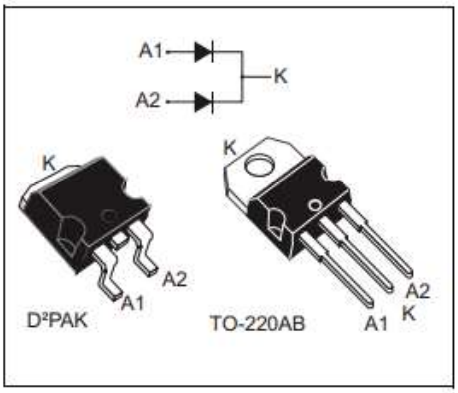
Refer to products datasheets.

life.augmented

STPS41H100C-Y

Automotive low drop power Schottky rectifier

Datasheet – production data



Description

Dual center tap Schottky rectifier designed for high frequency miniature switched mode power supplies such as adaptors and on board DC/DC converters for automotive applications.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	2 x 20 A
V_{RRM}	100 V
$T_{j(max)}$	175 °C
$V_{F\ (Typ)}$	0.62 V

Features

- Negligible switching losses
- High junction temperature capability
- Good trade off between leakage current and forward voltage drop
- Low leakage current
- Avalanche rated
- AEC-Q101 qualified
- PPAP capable
- ECOPACK®2 compliant component on TO-220AB

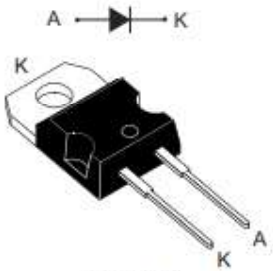
January 2015 DocID018564 Rev 2 1/9

This is information on a product in full production. www.st.com

STPSC6C065-Y

Automotive 650 V power Schottky silicon carbide diode

Datasheet - production data



TO-220AC

Features

- AEC-Q101 qualified
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability
- PPAP capable
- ECOPACK®2 compliant component

Description

The SiC diode is an ultrahigh 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 650 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 and is ideal for automotive applications.

Especially suited for use as boost diode, this rectifier will enhance the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	6 A
V_{RRM}	650 V
T_j (max)	175 °C

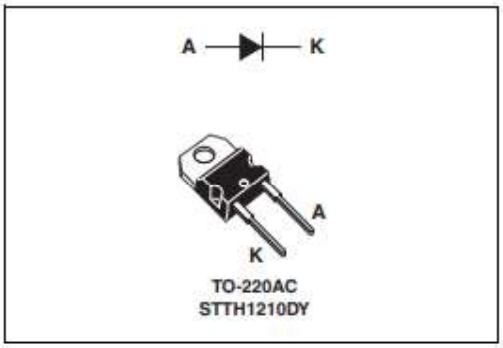
STTH1210-Y

Automotive ultrafast recovery - high voltage diode

Datasheet – production data

Features

- AEC-Q101 qualified
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and high pulsed current operation
- High reverse voltage capability
- High junction temperature



TO-220AC
STTH1210DY

Description

The high quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long term reliability, like automotive applications.

These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.

Table 1. Device summary

$I_{F(AV)}$	12 A
V_{RRM}	1000 V
T_j	175 °C
V_F (typ)	1.30 V
t_{rr} (typ)	48 ns

4.2 Construction Note

	STPS41H100CTY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Singapore
Technology / Process family	Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Singapore
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AB
Final testing information	
Testing location	Subcontractor (993x) - China

	STPSC20H065CTY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Catania – Italy
Technology / Process family	Silicon Carbide Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Catania – Italy
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AB
Final testing information	
Testing location	Subcontractor (993x) - China

	STPSCxxC65DY
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Catania – Italy
Technology / Process family	Silicon Carbide Power Schottky Diode
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST Catania – Italy
Assembly information	
Assembly site	Subcontractor (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

	STTHxxxxxxDY
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 (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

	STTHxxxxxxCTY
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 (993x) - China
Package description	TO-220AC
Final testing information	
Testing location	Subcontractor (993x) - China

5 TESTS PLAN AND RESULTS SUMMARY

5.1 Test vehicles

Lot #	Part Number	Package	Comments
L1	STPSC20065DY	TO-220AC	Qualification lot 1
L2	STPS41H100CTY	TO-220AB	Qualification lot 2
L3	STPS41H100CR	I²PAK	Qualification lot 3
L4	STTH30RQ06DY	TO-220AC	Qualification lot 4
L5	STTH16L06CTY	TO-220AB	Qualification lot 5
L6	STTH3012D	TO-220AC	Qualification lot 6
L7	STTH8S12D	TO-220AC	Qualification lot 7
L8	STPSC12C065DY	TO-220AC	Qualification lot 8
GD1	Dummy	TO-220AB	Generic data for whiskers test

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	
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 L2 L5	90		X
High Temperature Reverse Bias	HTRB	MIL-STD-750-1 M1038 Method A (for diodes, rectifiers and Zeners) M1039 Method A (for transistors)	L2 L4 L5 L6 L8	385		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 L6	231		X
Temperature Cycling Hot Test	TCHT	JESD22A-104			Required for Power MOSFET – IGBT only.	
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	L1 L3 L4	231	Required for SCR/TRIAC RECTIFIER and Protection devices	X
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 L4 L6	308	Alternative to HAST	X
High Temperature High Humidity Bias	HTHHB	JED22A-101			Not required, LED only	
Intermittent Operational Life / Thermal Fatigue	IOLT	MIL-STD-750 Method 1037	L2 L7 L8	231	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	

Stress	Abrv	Reference	Lot	SS	Comments	Test plan
					Perform PTC if ΔTj>100°C cannot be achieved with IOL Alternative to IOL	
ESD Characterization	ESD HBM	AEC Q101-001 and 005	L1 L2 L5	90		X
ESD Characterization	ESD CDM	AEC Q101-001 and 005	L1 L2 L5	90		X
Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	L1 L2	8	After H3TRB and TC	X
Physical Dimension	PD	JESD22B-100	GD	60		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)	L2	30	Not applicable for SMD pitch < 0.5mm, package size > 5.5*12.5mm and die paddle > 2.5*3.5mm	X
Solderability	SD	J-STD-002 JESD22B102	L2	30		X
Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	L1 L2 L5	45	Required in case of process change. Not applicable to protection device as no limit specified in the datasheet	X
Wire Bond Strength	WBS	MIL-STD-750 Method 2037	L1 L2 L5	30		X
Bond Shear	BS	AEC-Q101-003	L1 L2 L5	30		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 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	GD1	54		X
Screwing test	Screw	ST 0063378	L2	22		X
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)	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 Reliability results summary

Test	PC	Std ref.	Conditions	Steps / Duration	SS	Failure / SS								
						L1	L2	L3	L4	L5	L6	L7	L8	GD1
Pre- and Post-Electrical Test	-	ST datasheet	Ir, Vf,parameters following product datasheet	-	1493	0/1493								
HTRB	N	MIL-STD-750- 1 M1038 Method A	Tj=152°C Voltage=600V	1Khrs	385	-	-	-	0/77	-	-	-	-	-
	N		Tj=114°C Voltage=100V			-	0/77	-	-	-	-	-	-	-
	N		Tj=151°C Voltage=960V	1Khrs		-	-	-	-	-	0/77	-	-	-
	N		Tj=175°C Voltage=650V	1Krs		-	-	-	-	-	-	-	0/77	-
	N		Tj=175°C Voltage=600V	1Krs		-	-	-	-	0/77	-	-	-	-
TC	N	JESD22 A-104	-55/+150°C 2cy/h	1Kcy	308	0/77	0/77	0/77	-	-	0/77	-	-	-
DPA	N	ST 0060102 AEC-Q101	After TC 1Kcy	-	4	0/2	0/2	-	-	-	-	-	-	-
RSH	N	JESD22 B-106	Dipping 270°C-7s	-	30	-	0/30	-	-	-	-	-	-	-
H3TRB	N	JESD22 A-101	85°C; 85% RH Voltage=100V	1Khrs	308	0/77	-	-	0/77	-	0/77	-	-	-
			85°C; 85% RH Voltage=80V	1Khrs		-	0/77	-	-	-	-	-	-	-
DPA	N	ST 0060102 AEC-Q101	After H3TRB 1Khrs	-	4	0/2	0/2	-	-	-	-	-	-	-
UHAST	N	JESD22 A-118	130°C; 85% RH 2.3bar	96hrs	231	0/77	-	0/77	0/77	-	-	-	-	-
IOLT	N	MIL-STD 750 Method 1037	ΔTj=125°C Ton=Toff=210s	500hrs	231	-	0/77	-	-	-	-	-	0/77	-
	N		ΔTj=125°C Ton=Toff=210s	500hrs		-	-	-	-	-	-	0/77	-	-
Screw	N	ST 063378	Torque = 0.7N.m	-	22		0/22							
SD	N	J-STD-002 JESD22 B-102	Wet ageing SnPb bath 245°C	-	30	-	0/15	-	-	-	-	-	-	-
			Wet ageing SnAgCu bath 245°C	-	30	-	0/15	-	-	-	-	-	-	-
WG	N	AEC-Q005 JESD201	TC **-40°C/85°C**	500cy	18	-	-	-	-	-	-	-	-	0/18
			THS 30°C/60%RH	1.5Khrs	18	-	-	-	-	-	-	-	-	0/18
			THS 55°C 85%RH	1.5Khrs	18	-	-	-	-	-	-	-	-	0/18

6 ANNEXES

6.1 Parametric Verification & ESD

STPSC20065DY

TEST	IR	IR	IR	VF	VF
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	25°C	25°C	150°C	25°C	150°C
Condition 2	VR=600V	VR=650V	VR=650V	IF=20A	IF=20A
Min. Datasheet					
Typ. Datasheet	*15uA*	*30uA*	*280uA*	*1.30V*	*1.45V*
Max. Datasheet	*150uA*	*300uA*	*2000uA*	*1.45V*	*1.65V*
Comments					
UNIT	nA	uA	uA	V	V
N	30	30	29	30	29
Min	140,10	0,50	4,46	1,32	1,45
Max	2740,00	9,63	26,86	1,37	1,51
Avg.	405,95	1,28	6,99	1,34	1,48

TEST	VR	VR	VR	ESD_CDM	ESD_HBM
EQUIPMENT	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	-40°C	25°C	150°C	23°C	23°C
Condition 2					
Min. Datasheet	*650V*	*650V*	*650V*		
Typ. Datasheet					
Max. Datasheet					
Comments				AEC-Q101	AEC-Q101
UNIT	V	V	V	KV	KV
N	29	30	29	30	30
Min	837,60	840,30	846,90	>1.0	>8.0
Max	892,40	899,50	908,80	>1.0	>8.0
Avg.	885,07	890,78	894,96		

STTH16L06CTY

TEST	IR	IR	VF	VF	VF	VF
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	25°C	150°C	25°C	25°C	150°C	150°C
Condition 2	VR=600V	VR=600V	IF=8A	IF=16A	IF=8A	IF=16A
Min. Datasheet						
Typ. Datasheet		*25uA*			*1.05V*	*1.28V*
Max. Datasheet	*8uA*	*240uA*	*1.8V*	*2.08V*	*1.35V*	*1.64V*
Comments						
UNIT	uA	uA	V	V	V	V
N	30	30	30	30	30	30
Min	0,00	15,05	1,29	1,48	1,00	1,21
Max	0,32	18,91	1,44	1,66	1,08	1,32
Avg.	0,03	16,54	1,37	1,58	1,05	1,27

TEST	VR	VR	VR	ESD CDM	ESD HBM
EQUIPMENT	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	-40°C	25°C	150°C	25oC	25oC
Condition 2					
Min. Datasheet	*600V*	*600V*	*600V*		
Typ. Datasheet					
Max. Datasheet					
Comments					
UNIT	V	V	V	KV	KV
N	30	30	30	30	30
Min	675,10	724,90	801,30	>1.0	>8.0
Max	693,30	745,40	824,60	>1.0	>8.0
Avg.	689,39	741,30	820,03		

STPS41H100CTY

TEST	VR	VR	VR	IR	IR
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	TESEC
Condition 1	-40°C	24°C	125°C	24°C	125°C
Condition 2				VR=100V	VR=100V
Min. Datasheet	*100V*	*100V*	*100V*		
Typ. Datasheet					*3mA*
Max. Datasheet				*10uA*	*10mA*
Comments					
UNIT	V	V	V	uA	mA
N	30	30	30	30	30
Min	115,300	124,200	110,500	1,742	2,893
Max	118,000	127,100	114,600	2,416	3,376
Avg.	116,690	125,623	112,713	1,947	3,117

TEST	VF	VF	VF	VF	ESD_CDM	ESD_HBM
EQUIPMENT	TESEC	TESEC	TESEC	TESEC	ESD-CDM	ESS6008
Condition 1	24°C	24°C	125°C	125°C	25°C	25°C
Condition 2	IF=20A	IF=40A	IF=20A	IF=40A		
Min. Datasheet						
Typ. Datasheet			*0.62V*	*0.7V*		
Max. Datasheet	*0.8V*	*0.9V*	*0.67V*	*0.76V*		
Comments						
UNIT	V	V	V	V		
N	30	30	30	30	30	30
Min	0,741	0,851	0,609	0,721	>1.0	>8.0
Max	0,750	0,864	0,618	0,734	>1.0	>8.0
Avg.	0,746	0,857	0,614	0,728		

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.

6.2 Thermal Resistance

TEST	RTH (j-c) STPSC20065DY	RTH (j-c) STTH16L06CTY	RTH (C) STTH16L06CTY	RTH (j-c) STPS41H100CTY	RTH (C) STPSC41H100CTY
EQUIPMENT					
Condition 1	25°C	25°C	25°C	25°C	25°C
Condition 2					
Min. Datasheet					
Typ Datasheet	*0.60°C/W*				
Max. Datasheet	*0.90°C/W*	*2.5°C/W*	*0.7°C/W*	*1.5°C/W*	*0.1°C/W*
UNIT	°CW	*°CW*	*°CW*	*°CW*	*°CW*
N	10	10	5	10	10
Min	0,66	1,26	0,12	0,483	0,005
Max	0,71	1,42	0,15	0,649	0,063
Avg	0,69	1,35	0,14	0,563	0,035

6.3 Assembly Tests

Wire Pull Tests

Commercial Product	Conditions	Sample size	Failure /SS
STPS41H100CTY	500g Min	10 units	0/10
STTH16L06CY	500g Min	10 units	0/10
STPSC20065DY	350g Min	10 units	0/10

Ball / Wedge Shear Test

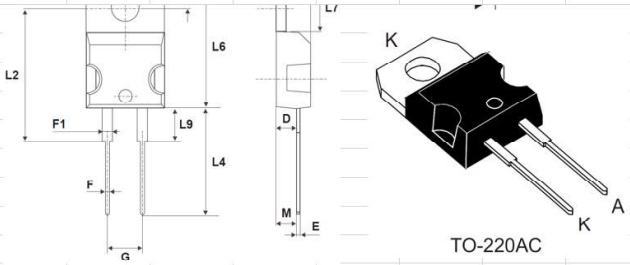
Commercial Product	Conditions	Sample size	Failure /SS
STPS41H100CTY	1000g Min	10 units	0/10
STTH16L06CY	1000g Min	10 units	0/10
STPSC20065DY	700g Min	10 units	0/10

6.4 Physical Dimensions

Dimensional Report for TO220-AC package

March-2024

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151



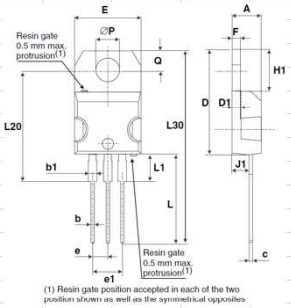
TO-220AC

Sample\Inspection item	A	C	D	E	F	F1	G	H2	L2	L4	L5	L7	L6	L9	Diam. I
S1	4,432	1,292	2,519	0,517	0,805	1,397	5,075	10,169	16,431	13,346	2,802	6,478	15,519	3,716	3,801
S2	4,421	1,295	2,521	0,516	0,803	1,371	5,063	10,177	16,459	13,371	2,811	6,498	15,523	3,755	3,790
S3	4,423	1,294	2,523	0,513	0,808	1,360	5,080	10,173	16,423	13,343	2,793	6,476	15,521	3,737	3,808
S4	4,421	1,293	2,517	0,514	0,810	1,383	5,080	10,177	16,423	13,347	2,815	6,515	15,544	3,717	3,802
S5	4,431	1,293	2,521	0,513	0,815	1,387	5,060	10,018	16,454	13,349	2,812	6,506	15,542	3,766	3,797
S6	4,43	1,292	2,518	0,512	0,815	1,388	5,073	10,169	16,425	13,339	2,811	6,507	15,531	3,753	3,794
S7	4,431	1,295	2,520	0,514	0,805	1,386	5,067	10,172	16,461	13,370	2,797	6,503	15,530	3,763	3,795
S8	4,440	1,293	2,514	0,513	0,814	1,384	5,074	10,180	16,442	13,346	2,817	6,515	15,527	3,777	3,796
S9	4,443	1,292	2,519	0,512	0,803	1,394	5,066	10,171	16,448	13,334	2,812	6,517	15,529	3,740	3,791
S10	4,436	1,294	2,518	0,514	0,808	1,382	5,065	10,167	16,455	13,322	2,817	6,516	15,524	3,763	3,798
S11	4,435	1,296	2,515	0,513	0,806	1,387	5,085	10,178	16,424	13,351	2,809	6,515	15,526	3,727	3,802
S12	4,435	1,294	2,518	0,512	0,809	1,374	5,075	10,178	16,413	13,331	2,799	6,518	15,535	3,744	3,808
S13	4,441	1,299	2,520	0,514	0,813	1,387	5,060	10,183	16,445	13,336	2,820	6,516	15,530	3,716	3,798
S14	4,441	1,294	2,518	0,515	0,811	1,403	5,079	10,180	16,425	13,375	2,824	6,499	15,521	3,774	3,798
S15	4,435	1,295	2,525	0,511	0,809	1,392	5,072	10,180	16,435	13,343	2,792	6,500	15,534	3,734	3,794
S16	4,439	1,295	2,526	0,512	0,812	1,396	5,065	10,185	16,429	13,320	2,805	6,528	15,530	3,737	3,799
S17	4,436	1,289	2,519	0,510	0,804	1,376	5,075	10,179	16,452	13,372	2,810	6,527	15,529	3,741	3,798
S18	4,431	1,287	2,515	0,512	0,804	1,393	5,071	10,183	16,426	13,382	2,823	6,524	15,535	3,780	3,795
S19	4,438	1,288	2,510	0,514	0,801	1,394	5,080	10,175	16,434	13,333	2,802	6,523	15,531	3,751	3,797
S20	4,435	1,285	2,513	0,509	0,809	1,390	5,066	10,176	16,425	13,351	2,807	6,525	15,534	3,752	3,800
S21	4,439	1,286	2,510	0,511	0,810	1,389	5,080	10,181	16,428	13,347	2,809	6,527	15,530	3,732	3,799
S22	4,435	1,287	2,511	0,513	0,813	1,384	5,072	10,182	16,435	13,365	2,819	6,524	15,533	3,759	3,802
S23	4,436	1,286	2,512	0,516	0,809	1,400	5,088	10,183	16,427	13,334	2,803	6,523	15,527	3,768	3,802
S24	4,437	1,285	2,513	0,518	0,800	1,382	5,069	10,169	16,425	13,363	2,816	6,528	15,529	3,754	3,800
S25	4,435	1,280	2,510	0,517	0,807	1,392	5,062	10,165	16,429	13,354	2,815	6,523	15,531	3,763	3,807
S26	4,438	1,284	2,514	0,518	0,802	1,386	5,079	10,180	16,425	13,356	2,803	6,521	15,528	3,749	3,798
S27	4,439	1,286	2,513	0,516	0,807	1,382	5,083	10,170	16,428	13,376	2,804	6,520	15,527	3,724	3,798
S28	4,435	1,285	2,512	0,512	0,808	1,382	5,072	10,182	16,427	13,337	2,804	6,524	15,529	3,741	3,801
S29	4,434	1,284	2,511	0,509	0,816	1,390	5,074	10,174	16,425	13,374	2,809	6,522	15,526	3,766	3,805
S30	4,441	1,285	2,516	0,514	0,820	1,392	5,069	10,152	16,451	13,351	2,818	6,527	15,528	3,741	3,801
LSL	4,40	1,23	2,40	0,48	0,61	1,14	4,95	10,00		13,00	2,65	6,20	15,25	3,50	3,75
Typ									16.40						
USL	4,60	1,32	2,72	0,70	0,88	1,70	5,15	10,40		14,00	2,95	6,60	15,75	3,93	3,85
Min	4,421	1,28	2,51	0,509	0,8	1,36	5,06	10,018	16,413	13,32	2,792	6,476	15,519	3,716	3,79
Max	4,443	1,299	2,526	0,518	0,82	1,403	5,088	10,185	16,461	13,382	2,824	6,528	15,544	3,78	3,808

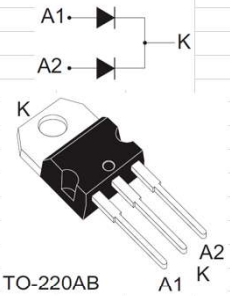
Dimensional Report for TO220-AB package

March-2024

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.17	0.18
b	0.61	0.88	0.024	0.035
b1	1.14	1.70	0.045	0.067
c	0.48	0.70	0.019	0.027
D	15.25	15.75	0.60	0.62
D1	1.27 typ.		0.05 typ.	
E	10	10.40	0.39	0.41
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.19	0.20
F	1.23	1.32	0.048	0.052
H1	6.20	6.60	0.24	0.26
J1	2.40	2.72	0.094	0.107
L	13	14	0.51	0.55
L1	3.50	3.93	0.137	0.154
L20	16.40 typ.		0.64 typ.	
L30	28.90 typ.		1.13 typ.	
ØP	3.75	3.85	0.147	0.151
Q	2.65	2.95	0.104	0.116



(1) Resin gate position accepted in each of the two position shown as well as the symmetrical opposites



Sample\Inspection item	A	b	b1	c	D	D1	E	e	e1	F	H1	J1	L	L1	L20	L30	øP	Q
S1	4,432	0,805	1,397	0,517	15,519	1,201	10,169	2,510	5,075	1,292	6,478	2,519	13,346	3,716	16,431	28,825	3,801	2,802
S2	4,421	0,803	1,371	0,516	15,523	1,207	10,177	2,519	5,063	1,295	6,498	2,521	13,371	3,755	16,459	28,864	3,790	2,811
S3	4,423	0,808	1,360	0,513	15,521	1,205	10,173	2,516	5,080	1,294	6,476	2,523	13,343	3,737	16,423	28,826	3,808	2,793
S4	4,421	0,810	1,383	0,514	15,544	1,200	10,177	2,518	5,080	1,293	6,515	2,517	13,347	3,717	16,423	28,835	3,802	2,815
S5	4,431	0,815	1,387	0,513	15,542	1,189	10,018	2,530	5,060	1,293	6,506	2,521	13,349	3,766	16,454	28,842	3,797	2,812
S6	4,43	0,815	1,388	0,512	15,531	1,203	10,169	2,533	5,073	1,292	6,507	2,518	13,339	3,753	16,425	28,840	3,794	2,811
S7	4,431	0,805	1,386	0,514	15,530	1,198	10,172	2,545	5,067	1,295	6,503	2,520	13,370	3,763	16,461	28,831	3,795	2,797
S8	4,440	0,814	1,384	0,513	15,527	1,188	10,180	2,541	5,074	1,293	6,515	2,514	13,346	3,777	16,442	28,837	3,796	2,817
S9	4,443	0,803	1,394	0,512	15,529	1,209	10,171	2,516	5,066	1,292	6,517	2,519	13,334	3,740	16,448	28,824	3,791	2,812
S10	4,436	0,808	1,382	0,514	15,524	1,202	10,167	2,532	5,065	1,294	6,516	2,518	13,322	3,763	16,455	28,863	3,798	2,817
S11	4,435	0,806	1,387	0,513	15,526	1,206	10,178	2,523	5,085	1,296	6,515	2,515	13,351	3,727	16,424	28,807	3,802	2,809
S12	4,435	0,809	1,374	0,512	15,535	1,210	10,178	2,523	5,075	1,294	6,518	2,518	13,331	3,744	16,413	28,840	3,808	2,799
S13	4,441	0,813	1,387	0,514	15,530	1,208	10,183	2,526	5,060	1,299	6,516	2,520	13,336	3,716	16,445	28,839	3,798	2,820
S14	4,441	0,811	1,403	0,515	15,521	1,209	10,180	2,520	5,079	1,294	6,499	2,518	13,375	3,774	16,425	28,856	3,798	2,824
S15	4,435	0,809	1,392	0,511	15,534	1,214	10,180	2,517	5,072	1,295	6,500	2,525	13,343	3,734	16,435	28,822	3,794	2,792
S16	4,439	0,812	1,396	0,512	15,530	1,209	10,185	2,513	5,065	1,295	6,528	2,526	13,320	3,737	16,429	28,854	3,799	2,805
S17	4,436	0,804	1,376	0,510	15,529	1,212	10,179	2,519	5,075	1,289	6,527	2,519	13,372	3,741	16,452	28,867	3,798	2,810
S18	4,431	0,804	1,393	0,512	15,535	1,208	10,183	2,516	5,071	1,287	6,524	2,515	13,382	3,780	16,426	28,823	3,795	2,823
S19	4,438	0,801	1,394	0,514	15,531	1,212	10,175	2,525	5,080	1,288	6,523	2,510	13,333	3,751	16,434	28,851	3,797	2,802
S20	4,435	0,809	1,390	0,509	15,534	1,209	10,176	2,539	5,066	1,285	6,525	2,513	13,351	3,752	16,425	28,860	3,800	2,807
S21	4,439	0,810	1,389	0,511	15,530	1,210	10,181	2,530	5,080	1,286	6,527	2,510	13,347	3,732	16,428	28,877	3,799	2,809
S22	4,435	0,813	1,384	0,513	15,533	1,207	10,182	2,526	5,072	1,287	6,524	2,511	13,365	3,759	16,435	28,808	3,802	2,819
S23	4,436	0,809	1,400	0,516	15,527	1,209	10,183	2,539	5,088	1,286	6,523	2,512	13,334	3,768	16,427	28,875	3,802	2,803
S24	4,437	0,800	1,382	0,518	15,529	1,211	10,169	2,513	5,069	1,285	6,528	2,513	13,363	3,754	16,425	28,870	3,800	2,816
S25	4,435	0,807	1,392	0,517	15,531	1,213	10,165	2,512	5,062	1,280	6,523	2,510	13,354	3,763	16,429	28,851	3,807	2,815
S26	4,438	0,802	1,386	0,518	15,528	1,210	10,180	2,522	5,079	1,284	6,521	2,514	13,356	3,749	16,425	28,880	3,798	2,803
S27	4,439	0,807	1,382	0,516	15,527	1,208	10,170	2,510	5,083	1,286	6,520	2,513	13,376	3,724	16,428	28,827	3,798	2,804
S28	4,435	0,808	1,382	0,512	15,529	1,212	10,182	2,526	5,072	1,285	6,524	2,512	13,337	3,741	16,427	28,880	3,801	2,804
S29	4,434	0,816	1,390	0,509	15,526	1,210	10,174	2,535	5,074	1,284	6,522	2,511	13,374	3,766	16,425	28,865	3,805	2,809
S30	4,441	0,820	1,392	0,514	15,528	1,211	10,152	2,543	5,069	1,285	6,527	2,516	13,351	3,741	16,451	28,860	3,801	2,818
LSL	4,40	0,61	1,14	0,48	15,25		10,00	2,40	4,95	1,23	6,20	2,40	13,00	3,50			3,75	2,65
Typ						1,27									16,40	28,90		
USL	4,60	0,88	1,70	0,70	15,75		10,40	2,70	5,15	1,32	6,60	2,72	14,00	3,93			3,85	2,95
Min	4,421	0,8	1,36	0,509	15,519	1,188	10,018	2,51	5,06	1,28	6,476	2,51	13,32	3,716	16,413	28,807	3,79	2,792
Max	4,443	0,82	1,403	0,518	15,544	1,214	10,185	2,545	5,088	1,299	6,528	2,526	13,382	3,78	16,461	28,88	3,808	2,824

6.5 Tests description

Test name	Description	Purpose
HTRB High Temperature Reverse Bias / **HTFB** High Temperature Forward 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. Forward: device is forward biased with a current fixed and adjusted to reach the 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. To assess active area and contacts integrity
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.
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, 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
RSH Resistance to Solder Heat	Package is dipped by the leads in a solder bath after initial wet ageing (for SMDs only). Assessment by electrical test + no external crack	To simulate wave soldering process and verify that package will not be thermally damaged during this step.
SD Solderability	The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder.	This evaluation is made on the basis of the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish.
TW/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.

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PCN Title : Transfer of assembly and test line qualification for TO220 & I2PAK automotive grade packages

PCN Reference : POWER AND DISCRETE PRODUCTS/24/14789

Subject : Public Products List

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STPSC6C065DY	STTH30RQ06DY	STPS41H100CTY
STTH1210DY	STPSC12C065DY	STPSC10065DY
STPSC12065DY	STTH30R04DY	STTH16L06CTY

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