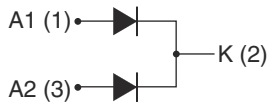
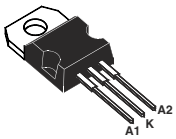
STPSC20H065C-Y

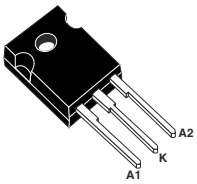
Automotive 650 V power Schottky silicon carbide diode

Datasheet - production data





TO-220AB
STPSC20H065CTY



TO-247
STPSC20H065CWY

Features

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

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 are ideal for automotive applications.

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

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	2 x 10 A
V_{RRM}	650 V
T_j (max)	175 °C

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

1 Characteristics

Table 2. Absolute ratings (limiting values per diode at 25 °C unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		650	V
$I_{F(RMS)}$	Forward rms current		22	A
$I_{F(AV)}$	Average forward current	T_c = 135 °C(1), DC, per diode	10	A
		T_c = 125 °C(2), DC, per device	20	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal, T_c = 25 °C t_p = 10 ms sinusoidal, T_c = 125 °C t_p = 10 µs square, T_c = 25 °C	90 80 470	A
I_{FRM}	Repetitive peak forward current	T_c = 135 °C(1), T_j = 175 °C, δ = 0.1	41	A
T_{stg}	Storage temperature range		-55 to +175	°C
T_j	Operating junction temperature(3)		-40 to +175	°C

1. Value based on $R_{th(j-c)}$ max (per diode)
2. Value based on $R_{th(j-c)}$ max (per device)
3. $\frac{dPtot}{dTj} < \frac{1}{Rth(j-a)}$ condition to avoid thermal runaway for a diode on its own heatsink

Table 3. Thermal resistance

Symbol	Parameter			Value		Unit
				Typ.	Max.	
$R_{th(j-c)}$	Junction to case per diode	Per diode	TO-247	1.25	1.5	°C/W
			TO-220AB			
		Total	TO-247	0.83	0.95	
			TO-220AB			
$R_{th(c)}$	Coupling				0.4	

When the two diodes 1 and 2 are used simultaneously:

ΔT_j(diode 1) = P(diode 1) x $R_{th(j-c)}$(Per diode) + P(diode 2) x $R_{th(c)}$

Table 4. Static electrical characteristics per diode

Symbol	Parameter	Tests conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-	9	100	µA
		T_j = 150 °C		-	85	425	
V_F(2)	Forward voltage drop	T_j = 25 °C	I_F = 10 A	-	1.56	1.75	V
		T_j = 150 °C		-	1.98	2.5	

1. Pulse test: t_p = 5 ms, δ < 2%
2. Pulse test: t_p = 380 µs, δ < 2%

To evaluate the conduction losses use the following equation:

$P = 1.35 \times I_{F(AV)} + 0.115 \times I_F^2{}_{(RMS)}$

Table 5. Dynamic electrical characteristics per diode

Symbol	Parameter	Test conditions	Typ.	Unit
Q_{cj} (1)	Total capacitive charge	V_R = 400 V	28.5	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	480	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	48	

1. Most accurate value for the capacitive charge: $Q_{cj} = \int_0^{V_{OUT}} C_j(v_R).dv_R$

Figure 1. Forward voltage drop versus forward current (typical values per diode, low level)

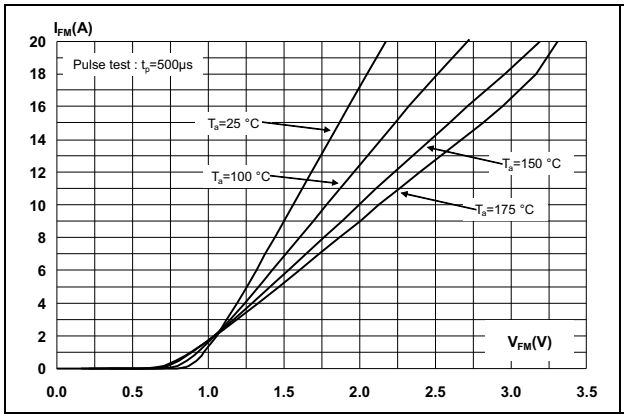


Figure 2. Forward voltage drop versus forward current (typical values per diode, high level)

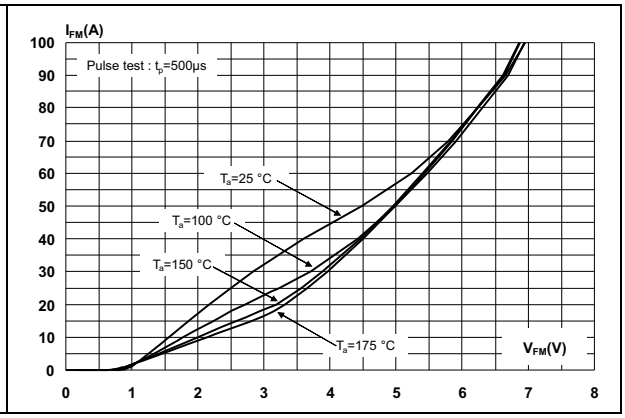


Figure 3. Reverse leakage current versus reverse voltage applied (typical values per diode)

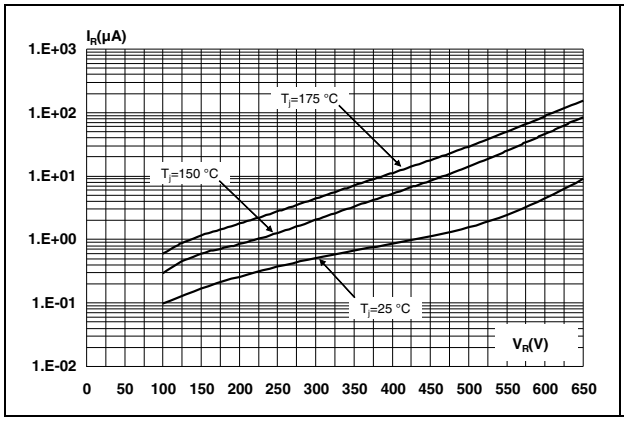


Figure 4. Peak forward current versus case temperature (per diode)

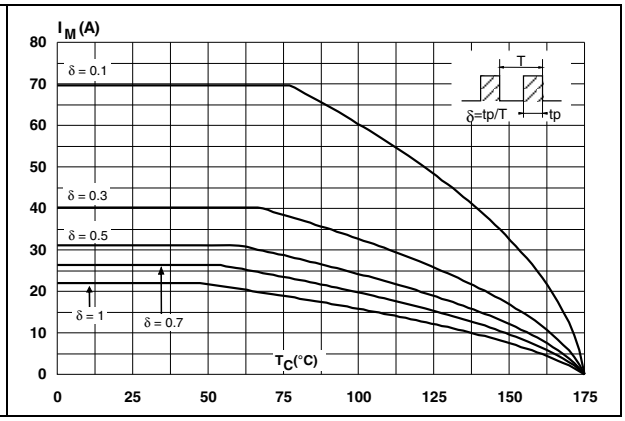


Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)

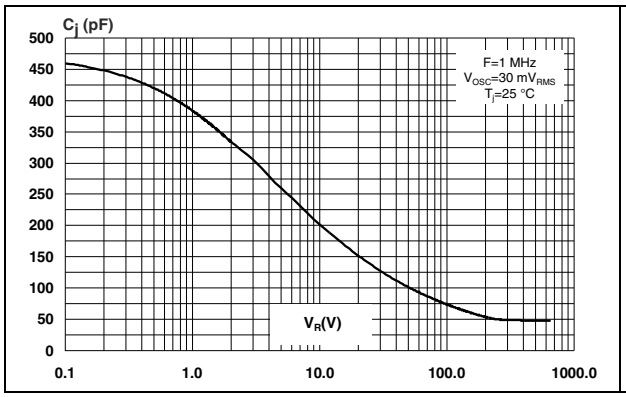


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration per diode

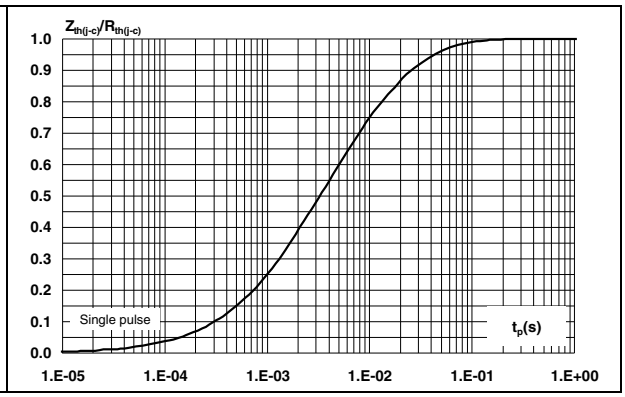


Figure 7. Non-repetitive peak surge forward current versus pulse duration per diode (sinusoidal waveform)

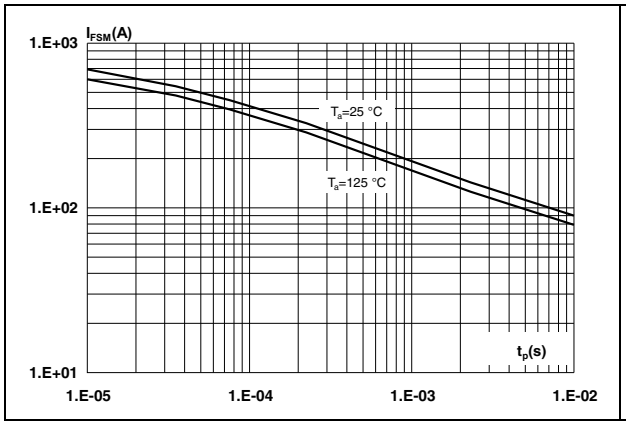
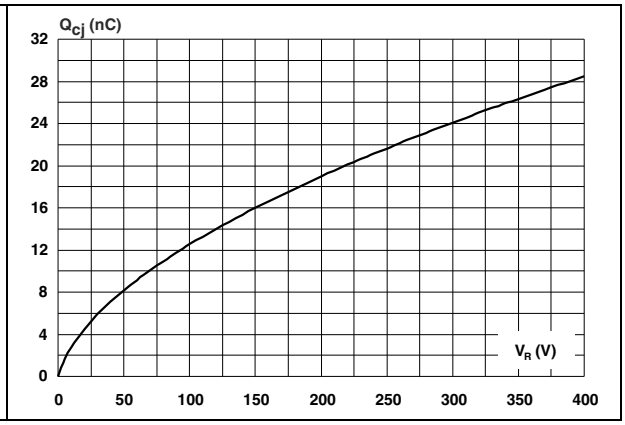


Figure 8. Total capacitive charges versus reverse voltage applied (typical values per diode)



2 Package information

- Epoxy meets UL94, V0
- Cooling method: conduction (C)
- Recommended torque value:
  - TO-220AB 0.4 to 0.6 N·m,
  - TO-247 0.55 N·m (1.0 N·m maximum)

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

Figure 9. TO-220AB dimension definitions

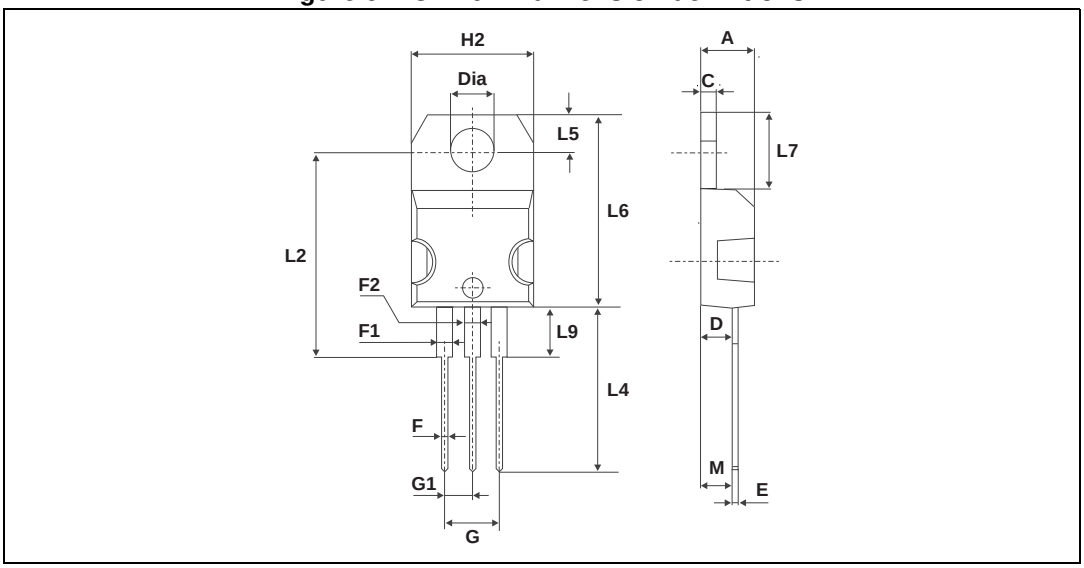


Table 6. TO-220AB dimension values

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
F2	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
G1	2.40	2.70	0.094	0.106
H2	10	10.40	0.393	0.409
L2	16.4 typ.		0.645 typ.	
L4	13	14	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.	3.75	3.85	0.147	0.151

Figure 10. TO-247 dimension definitions

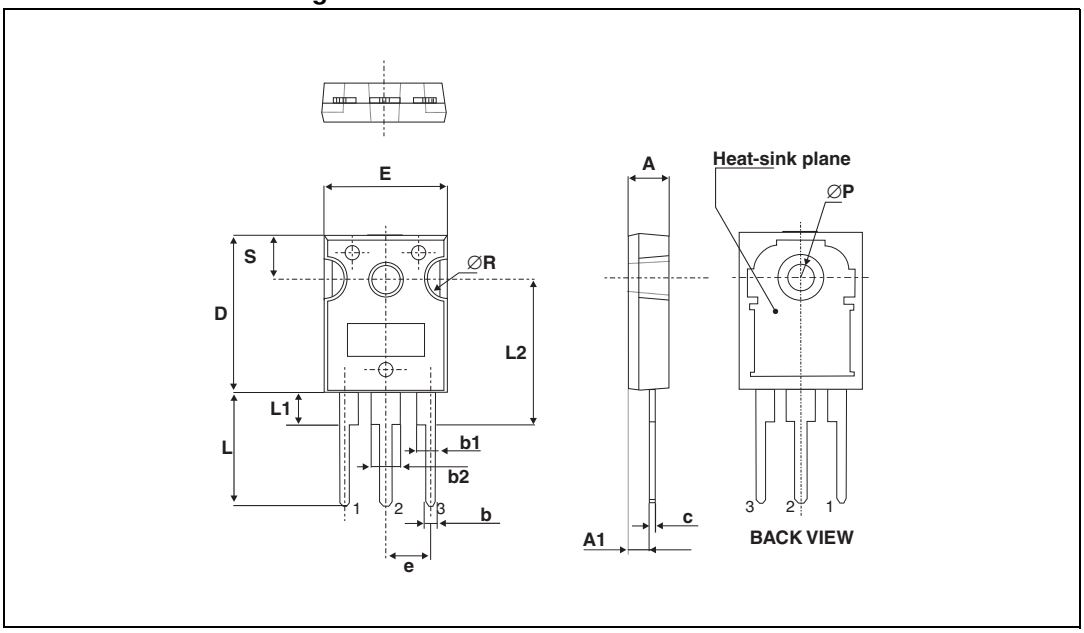


Table 7. TO-247 dimension values

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ	Max.
A	4.85		5.15	0.191		0.203
A1	2.20		2.60	0.086		0.102
b	1.00		1.40	0.039		0.055
b1	2.00		2.40	0.078		0.094
b2	3.00		3.40	0.118		0.133
c	0.40		0.80	0.015		0.031
D(1)	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e	5.30	5.45	5.60	0.209	0.215	0.220
L	14.20		14.80	0.559		0.582
L1	3.70		4.30	0.145		0.169
L2	18.50 typ.			0.728 typ.		
ØP(2)	3.55		3.65	0.139		0.143
ØR	4.50		5.50	0.177		0.217
S	5.30	5.50	5.70	0.209	0.216	0.224

1. Dimension D plus gate protrusion does not exceed 20.5 mm
2. Resin thickness around the mounting hole is not less than 0.9 mm

3 Ordering information

Table 8. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPSC20H065CTY	PSC20H065CTY	TO-220AB	1.86 g	50	Tube
STPSC20H065CWY	PSC20H065CWY	TO-247	4.43 g	30	Tube

4 Revision history

Table 9. Document revision history

Date	Revision	Changes
26-Jun-2014	1	First issue.
19-Sep-2014	2	Updated *Table 8*.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2014 STMicroelectronics – All rights reserved