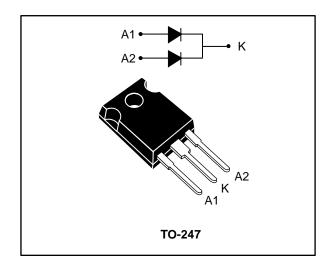


# STPSC40065C

# 650 V power Schottky silicon carbide diode

Datasheet - production data



## **Features**

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- Dedicated to PFC applications
- ECOPACK®2 compliant component

# **Description**

The SiC diode is a high voltage 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.

Used as a freewheeling or output rectification diode, this rectifier will enhance the performance and form factor of the targeted power supply or inverter.

**Table 1: Device summary** 

Symbol	Value
I <sub>F(AV)</sub>	2 x 20 A
V <sub>RRM</sub>	650 V
T <sub>j</sub> (max.)	175 °C
V <sub>F</sub> (typ.)	1.30 V

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## 1 Characteristics

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

Symbol	P	Parameter					
V <sub>RRM</sub>	Repetitive peak reverse volt	age	650	V			
I <sub>F(RMS)</sub>	Forward rms current		40	Α			
	Assessed assessed assessed	$T_c = 140  ^{\circ}C^{(1)}$ , DC, per diode	20				
I <sub>F(AV)</sub>	Average forward current	$T_c = 130  ^{\circ}C^{(1)}$ , DC, per device	40	Α			
I <sub>FRM</sub>	Repetitive peak forward current $T_c = 140  ^{\circ}\text{C},  T_j = 175  ^{\circ}\text{C},  \delta = 0.1$		87	А			
		t <sub>p</sub> = 10 ms sinusoidal, T <sub>c</sub> = 25 °C	90				
I <sub>FSM</sub>	Surge non repetitive forward current	t <sub>p</sub> = 10 ms sinusoidal, T <sub>c</sub> = 125 °C	70	Α			
	Torward ourrorn	$t_p = 10 \ \mu s \ square, T_c = 25 \ ^{\circ}C$	400				
T <sub>stg</sub>	Storage temperature range	-55 to +175	°C				
Tj	Operating junction temperature range <sup>(2)</sup> -40 to +17						

#### Notes:

**Table 3: Thermal parameters** 

Symbol	Parameter	Value	Unit	
D., a	R <sub>th(i-c)</sub> Junction to case		0.90	
R <sub>th(j-c)</sub> Junct	Junction to case	Total	0.60	°C/W
R <sub>th(c)</sub>	Coupling		0.30	

Table 4: Static electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Тур.	Max.	Unit
		T <sub>j</sub> = 25 °C	V <sub>R</sub> = V <sub>RRM</sub>	-	30	300	
I <sub>R</sub> <sup>(1)</sup>	I <sub>R</sub> <sup>(1)</sup> Reverse leakage current	T <sub>j</sub> = 150 °C	VR = VRRM	-	280	2000	μΑ
		T <sub>j</sub> = 25 °C	V <sub>R</sub> = 600 V	-	15	150	
		T <sub>j</sub> = 25 °C		-	1.30	1.45	
V <sub>F</sub> <sup>(2)</sup>	Forward voltage drop	T <sub>j</sub> = 150 °C	1.65	V			
		T <sub>j</sub> = 175 °C		-	1.50		

### Notes:

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 $^{(1)}\text{Pulse}$  test:  $t_p$  = 5 ms,  $\delta$  < 2%

 $^{(2)}$ Pulse test:  $t_p$  = 500  $\mu$ s,  $\delta$  < 2%

To evaluate the conduction losses use the following equation:

 $P = 1.02 \text{ x } I_{F(AV)} + 0.039 \text{ x } I_{F^2(RMS)}$ 

 $<sup>^{(1)}\</sup>mbox{Value}$  based on  $R_{th(j\text{-}c)}$  max.

 $<sup>^{(2)}(</sup>dP_{tot}/dT_j) < (1/R_{th(j\text{-}a)}) \ condition \ to \ avoid \ thermal \ runaway \ for \ a \ diode \ on \ its \ own \ heatsink.$ 

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Table 5: Dynamic electrical characteristics (per diode)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Q <sub>cj</sub> <sup>(1)</sup>	Total capacitive charge	V <sub>R</sub> = 400 V	-	62	1	nC
C	Total conscitores	$V_R = 0 \text{ V}, T_c = 25 \text{ °C}, F = 1 \text{ MHz}$	-	1250	1	, F
Cj	Total capacitance	V <sub>R</sub> = 400 V, T <sub>c</sub> = 25 °C, F = 1 MHz	-	100	-	pF

## Notes:

<sup>(1)</sup>Most accurate value for the capacitive charge:

$$Q_{cj} = \int_0^{V_{OUT}} C_J(V_R) . \ dV_R$$



Characteristics STPSC40065C

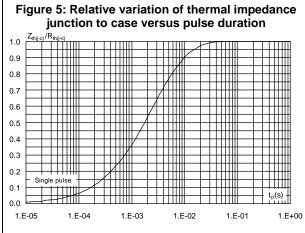
# 1.1 Characteristics (curves)

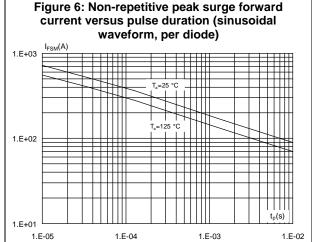
Figure 1: Forward voltage drop versus forward current (typical values, per diode) 40 Pulse test : t =500 µs 35 30 25 20 15 10 0.2 0.4 0.0 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4

1.E+01
1.E+00
0 50 100 150 200 250 300 350 400 450 500 550 600 650

Figure 3: Peak forward current versus case temperature (per diode)  $I_M(A)$ 140 120 100 80 δ=0.3 60 40 20 Tc(°C) 0 0 25 50 75 100 125 150

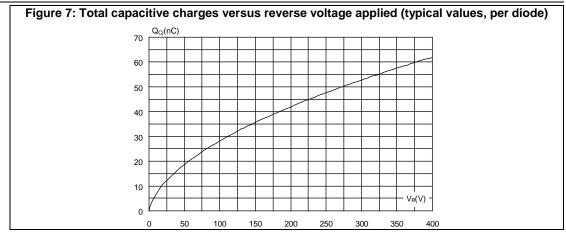
Figure 4: Junction capacitance versus reverse voltage applied (typical values, per diode) 1400 F=1 MHz 1200 1000 800 600 400 200  $V_R(V)$ 0 0.1 1.0 10.0 100.0 1000.0





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STPSC40065C Package information

#### 2 **Package information**

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.

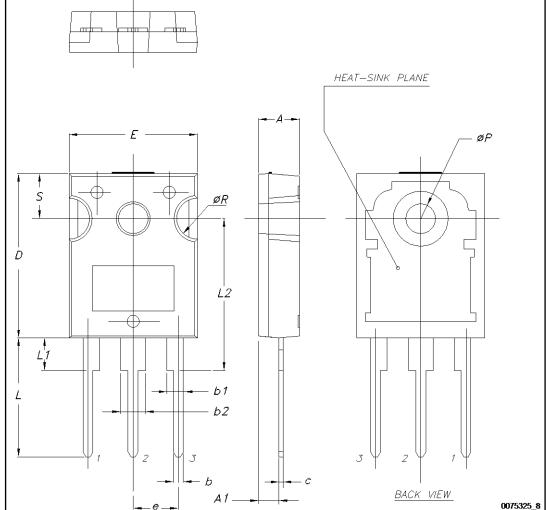
Figure 8: TO-247 package outline

Epoxy meets UL 94,V0

Recommended torque value: 0.8 N·m

Maximum torque value: 1 N·m

#### **TO-247 package information** 2.1



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STPSC40065C Package information

Table 6: TO-247 package mechanical data

	Dimensions					
Ref.		Millimeters		Inches		
	Min.	Тур.	Max.	Min.	Тур.	Max.
А	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
С	0.40		0.80	0.015		0.031
D <sup>(1)</sup>	19.85		20.15	0.781		0.793
Е	15.45		15.75	0.608		0.620
е	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			0.728	
ØP <sup>(2)</sup>	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

## Notes:

 $<sup>^{(1)}</sup>$ Dimension D plus gate protusion does not exceed 20.5 mm

 $<sup>\</sup>ensuremath{^{(2)}}\mbox{Resin}$  thickness around the mounting hole is not less than 0.9 mm.

Ordering information STPSC40065C

# 3 Ordering information

**Table 7: Ordering information** 

	Order code	Marking	Package	Weight	Base qty.	Delivery mode
S	TPSC40065CW	PSC40065CW	TO-247	4.43 g	30	Tube

# 4 Revision history

Table 8: Document revision history

Date	Revision	Changes
19-Jun-2015	1	First issue.
17-May-2016	2	Datasheet curves and device parameters updated following optimization of the die layout.
27-Sep-2016	3	Updated Section 1: "Characteristics".

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