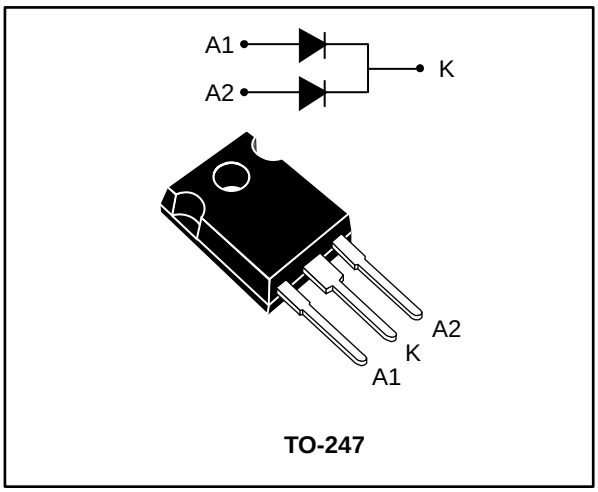
STPSC40065C

650 V power Schottky silicon carbide diode

Datasheet - production data



TO-247

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
$I_{F(AV)}$	2 x 20 A
V_{RRM}	650 V
T_j (max.)	175 °C
V_F (typ.)	1.30 V

This is information on a product in full production.

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1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		650	V
$I_{F(RMS)}$	Forward rms current		40	A
$I_{F(AV)}$	Average forward current	T_c = 140 °C(1), DC, per diode	20	A
		T_c = 130 °C(1), DC, per device	40	
I_{FRM}	Repetitive peak forward current	T_c =140 °C, T_j = 175 °C, δ = 0.1	87	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal, T_c = 25 °C	90	A
		t_p = 10 ms sinusoidal, T_c = 125 °C	70	
		t_p = 10 µs square, T_c = 25 °C	400	
T_{stg}	Storage temperature range		-55 to +175	°C
T_j	Operating junction temperature range(2)		-40 to +175	°C

Notes:

(1)Value based on $R_{th(j-c)}$ max.

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

Table 3: Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case	Per diode	0.90	°C/W
		Total	0.60	
$R_{th(c)}$	Coupling		0.30	

Table 4: Static electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R(1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-	30	300	µA
		T_j = 150 °C		-	280	2000	
		T_j = 25 °C	V_R = 600 V	-	15	150	
V_F(2)	Forward voltage drop	T_j = 25 °C	I_F = 20 A	-	1.30	1.45	V
		T_j = 150 °C		-	1.45	1.65	
		T_j = 175 °C		-	1.50		

Notes:

(1)Pulse test: t_p = 5 ms, δ < 2%

(2)Pulse test: t_p = 500 µs, δ < 2%

To evaluate the conduction losses use the following equation:

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

Table 5: Dynamic electrical characteristics (per diode)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Q_{cj}(1)	Total capacitive charge	V_R = 400 V	-	62	-	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	-	1250	-	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	-	100	-	

Notes:

(1)Most accurate value for the capacitive charge:

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

1.1 Characteristics (curves)

Figure 1: Forward voltage drop versus forward current (typical values, per diode)

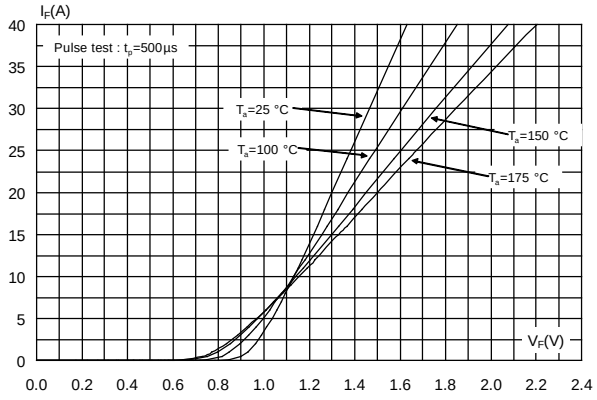


Figure 2: Reverse leakage current versus reverse voltage applied (typical values, per diode)

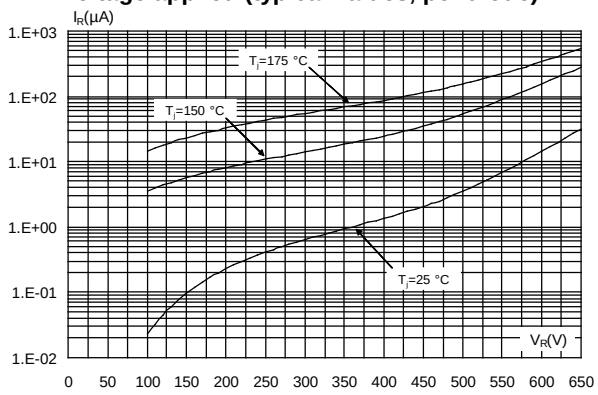


Figure 3: Peak forward current versus case temperature (per diode)

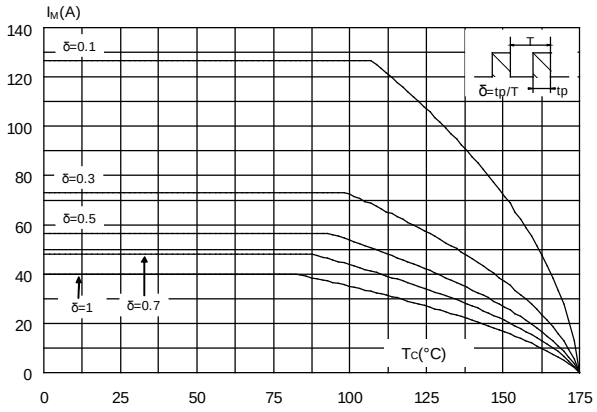


Figure 4: Junction capacitance versus reverse voltage applied (typical values, per diode)

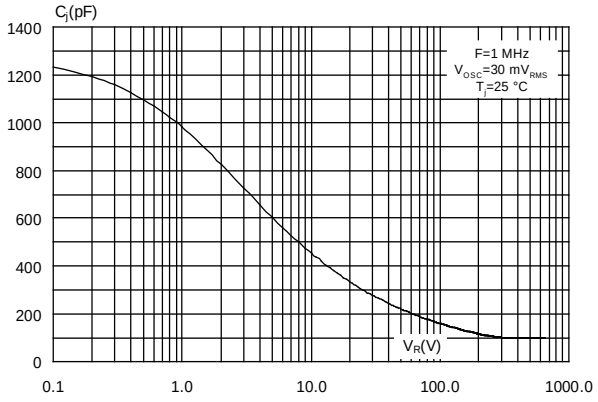


Figure 5: Relative variation of thermal impedance junction to case versus pulse duration

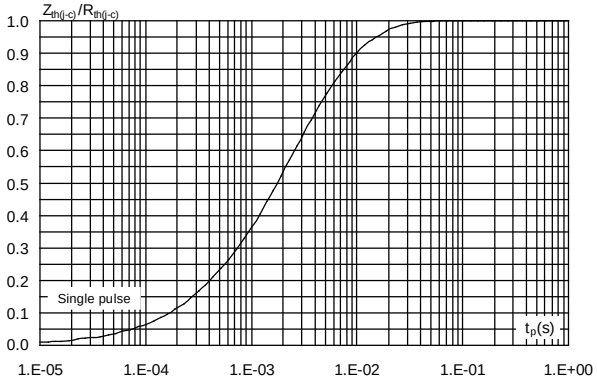


Figure 6: Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

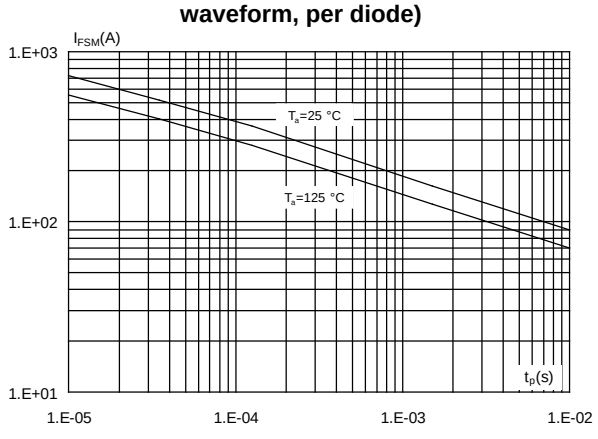
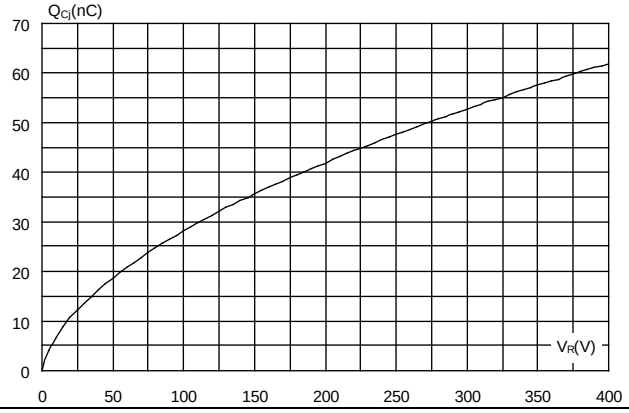


Figure 7: Total capacitive charges versus reverse voltage applied (typical values, per diode)



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.

- Epoxy meets UL 94,V0
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1 N·m

2.1 TO-247 package information

Figure 8: TO-247 package outline

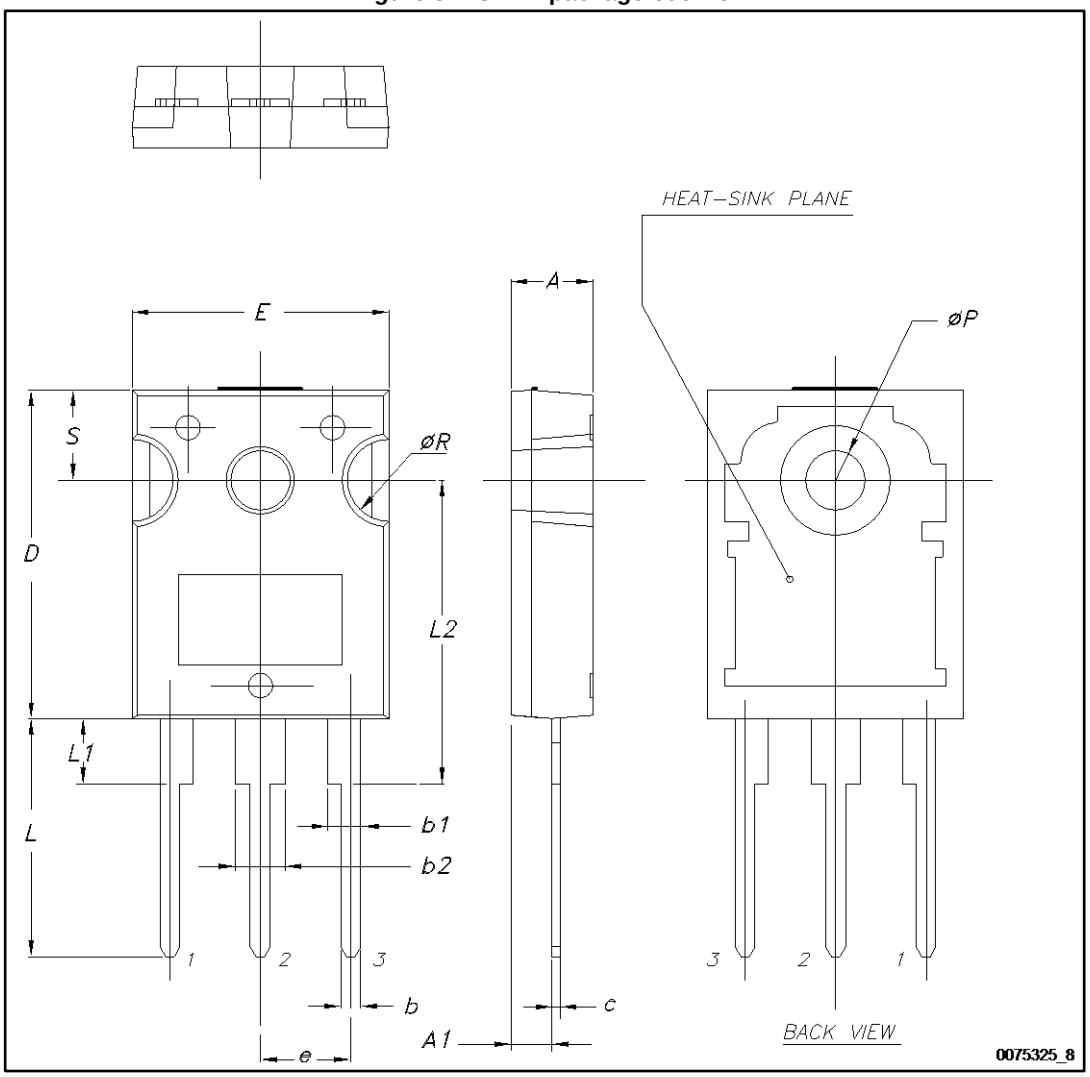


Table 6: TO-247 package mechanical data

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			0.728	
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

Notes:

(1)Dimension D plus gate protusion does not exceed 20.5 mm

(2)Resin thickness around the mounting hole is not less than 0.9 mm.

3 Ordering information

Table 7: Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC40065CW	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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