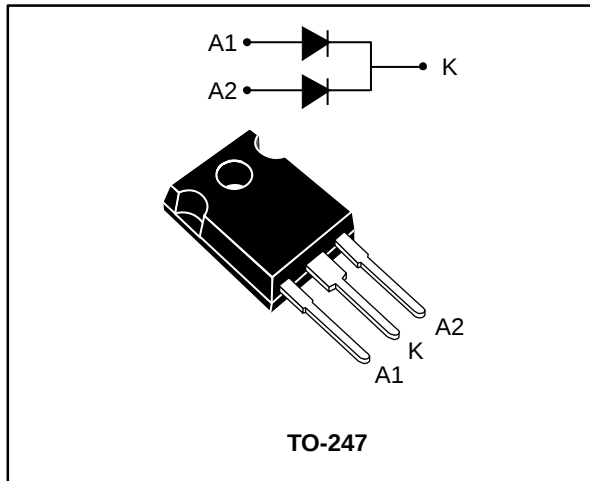


Automotive 650 V power Schottky silicon carbide diode

Datasheet - production data



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

Features

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- Dedicated to PFC applications
- AEC-Q101 qualified
- PPAP capable
- ECOPACK®2 compliant component

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 ($T_j = -40\text{ °C}$ to $+175\text{ °C}$)		650	V
$I_{F(RMS)}$	Forward rms current		40	A
$I_{F(AV)}$	Average forward current	$T_c = 140\text{ °C}^{(1)}$, DC, per diode	20	A
		$T_c = 130\text{ °C}^{(1)}$, DC, per device	40	
I_{FRM}	Repetitive peak forward current	$T_c = 140\text{ °C}$, $T_j = 175\text{ °C}$, $\delta = 0.1$	87	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal, $T_c = 25\text{ °C}$	90	A
		$t_p = 10\text{ ms}$ sinusoidal, $T_c = 125\text{ °C}$	70	
		$t_p = 10\text{ }\mu\text{s}$ square, $T_c = 25\text{ °C}$	400	
T_{stg}	Storage temperature range		-55 to +175	°C
T_j	Operating junction temperature ⁽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	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	30	300	μA
		$T_j = 150\text{ °C}$		-	280	2000	
		$T_j = 25\text{ °C}$	$V_R = 600\text{ V}$		15	150	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 20\text{ A}$	-	1.30	1.45	V
		$T_j = 150\text{ °C}$		-	1.45	1.65	
		$T_j = 175\text{ °C}$		-	1.50		

Notes:

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

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

To evaluate the conduction losses use the following equation:

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

Table 5: Dynamic electrical characteristics (per diode)

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

Notes:

⁽¹⁾Most accurate value for the capacitive charge: $Q_{Cj} = \int_0^{V_{OUT}} C_j(V_R) \cdot dV_R$

1.1 Characteristics (curves)

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

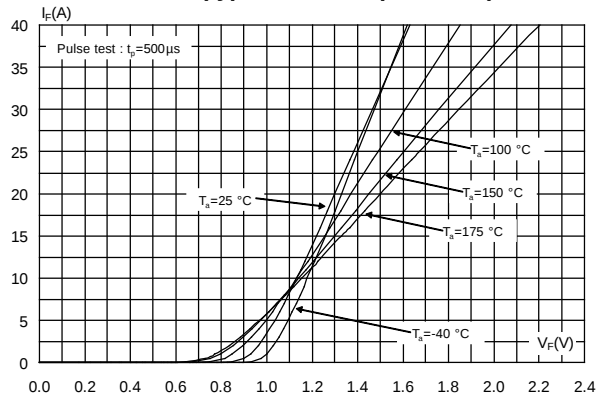


Figure 2: Reverse leakage current versus reverse voltage applied (typical values, per diode)

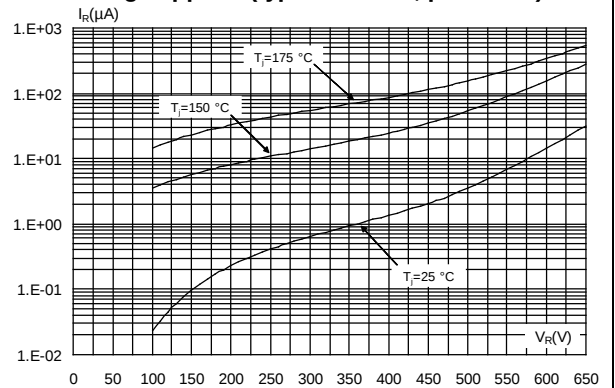


Figure 3: Peak forward current versus case temperature (per diode)

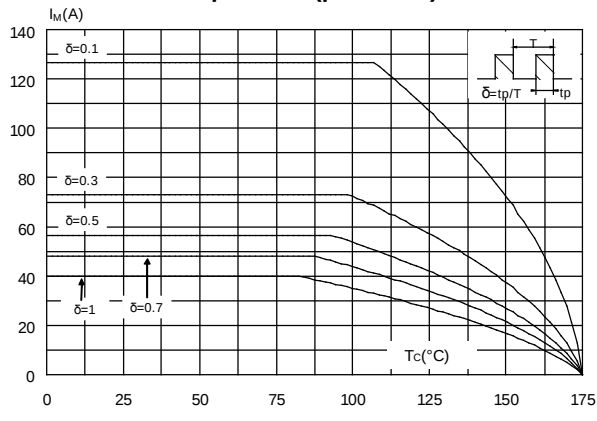


Figure 4: Junction capacitance versus reverse voltage applied (typical values, per diode)

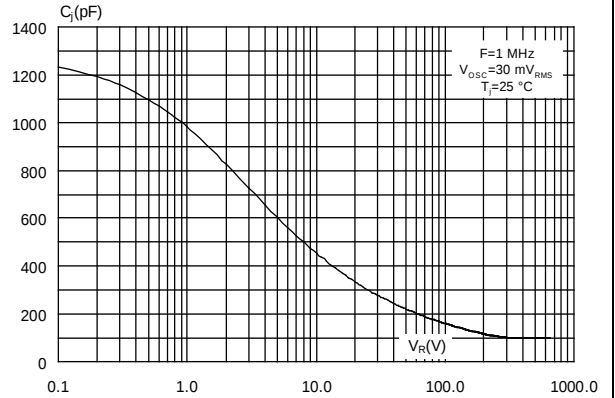


Figure 5: Relative variation of thermal impedance junction to case versus pulse duration

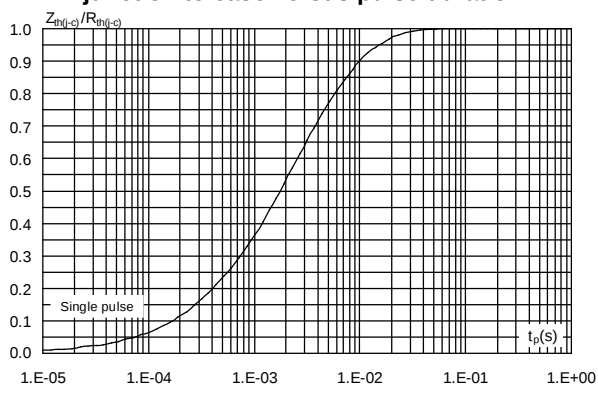


Figure 6: Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

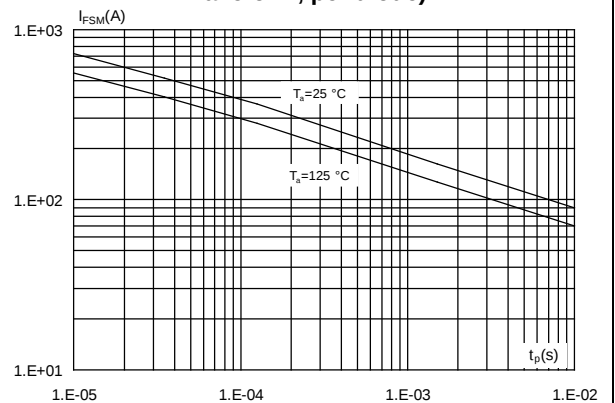
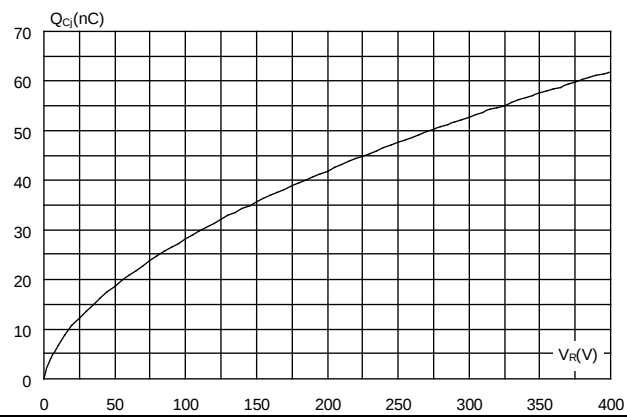


Figure 7: Total capacitive charges versus reverse voltage applied (typical values, per diode)

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

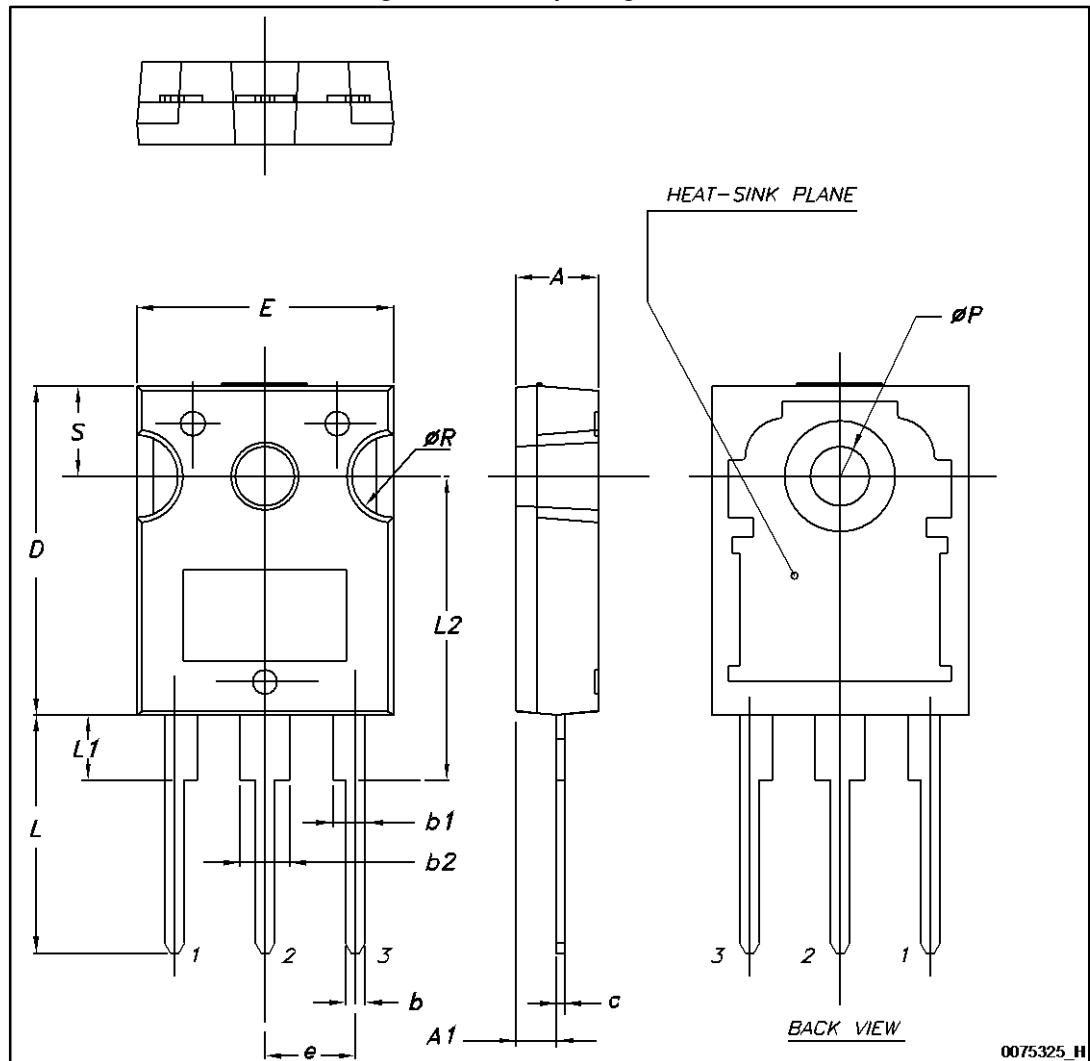


Table 6: TO-247 package mechanical data

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
STPSC40065CWY	PSC40065CWY	TO-247	4.43 g	30	Tube

4 Revision history

Table 8: Document revision history

Date	Revision	Changes
11-May-2016	1	First issue.
12-May-2016	2	Updated cover page footnote.

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