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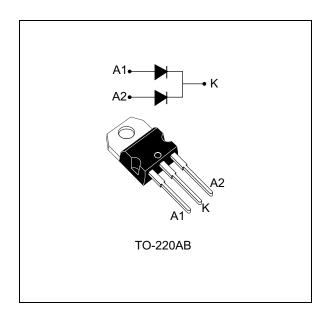




## STPSC12H065C

## 650 V power Schottky silicon carbide diode

Datasheet - production data



#### **Features**

- · No or negligible reverse recovery
- Switching behavior independent of temperature
- · High forward surge capability
- ECOPACK<sup>®</sup>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 minimized capacitive charge at turn-off behavior is independent of temperature.

Especially suited for use in interleaved or bridgeless topologies, this dual-diode rectifier 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 <sub>F(AV)</sub>	2 x 6 A
V <sub>RRM</sub>	650 V
T <sub>j</sub> (max)	175 °C

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#### 1 Characteristics

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

Symbol	Para	Value	Unit		
$V_{RRM}$	Repetitive peak reverse voltage	Repetitive peak reverse voltage			V
I <sub>F(RMS)</sub>	Forward rms current			22	Α
	Average ferward current	$T_c = 135  {}^{\circ}C^{(1)},  DC$	Per diode	6	Α
I <sub>F(AV)</sub>	Average forward current	$T_c = 135  {}^{\circ}C^{(2)},  DC$	Per device	12	Α
		t <sub>p</sub> = 10 ms sinusoida	I, T <sub>C</sub> = 25 °C	60	
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10 \text{ ms sinusoidal}, T_c = 125 °C$		52	Α
		$t_p = 10 \mu s square, T_c$	= 25 °C	400	
$I_{FRM}$	Repetitive peak forward current $T_c = 135  ^{\circ}C^{(1)}, T_j = 175  ^{\circ}C,  \delta = 0.1$		25	Α	
T <sub>stg</sub>	Storage temperature range			-65 to +175	°C
T <sub>j</sub>	Operating junction temperature <sup>(3)</sup>			-40 to +175	°C

<sup>1.</sup> Value based on  $R_{th(j-c)}$  max (per diode)

Table 3. Thermal resistance parameters

Symbol	Parameter		Тур.	Max.	Unit
В	lunction to coop	Per diode	1.6	2.4	
R <sub>th(j-c)</sub>	Junction to case	Per device	0.875	1.275	°C/W
R <sub>th(c)</sub>	Coupling	•	-	0.15	

When the diodes 1 and 2 are used simultaneously:

 $\Delta T_i(diode 1) = P(diode1) \times R_{th(i-c)}(Per diode) + P(diode2) \times R_{th(c)}$ 

Table 4. Static electrical characteristics (per diode)

Symbol	Parameter	Tests conditions		Min.	Тур.	Max.	Unit
I <sub>B</sub> <sup>(1)</sup>	Reverse leakage current	T <sub>j</sub> = 25 °C	V - V	-	5	60	μΑ
'R`´	IR Weverse leakage current	T <sub>j</sub> = 150 °C	$V_R = V_{RRM}$	-	50	250	μΑ
V <sub>E</sub> (2)	V <sub>F</sub> <sup>(2)</sup> Forward voltage drop	T <sub>j</sub> = 25 °C	I <sub>F</sub> = 6 A	-	1.56	1.75	V
V <sub>F</sub> · Forward voltage drop	T <sub>j</sub> = 150 °C	1 IF = 0 A	-	1.98	2.5	V	

<sup>1.</sup>  $t_p = 10 \text{ ms}, \delta < 2\%$ 

To evaluate the conduction losses use the following equation:

$$P = 1.35 \times I_{F(AV)} + 0.192 \times I_{F^{2}(RMS)}$$

<sup>2.</sup> Value based on  $R_{\text{th(j-c)}}$  max (per device)

<sup>3.</sup>  $\frac{dPtot}{dT_j} < \frac{1}{Rth(j-a)}$  condition to avoid thermal runaway for a diode on its own heatsink

<sup>2.</sup>  $t_p = 500 \ \mu s, \ \delta < 2\%$ 

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Symbol	Parameter	Test conditions	Тур.	Unit
Q <sub>cj</sub> <sup>(1)</sup>	Total capacitive charge	V <sub>R</sub> = 400 V	18	nC
C <sub>j</sub> Total capacitance	Total capacitance	$V_R = 0 \text{ V}, T_c = 25 \text{ °C}, F = 1 \text{ MHz}$	300	pF
	Total capacitance	$V_R = 400 \text{ V}, T_c = 25 \text{ °C}, F = 1 \text{ MHz}$	30	ρι

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

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

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

1<sub>EM</sub>(A)

Pulse test: t<sub>p</sub> = 500 μs

T<sub>a</sub> = 100 °C

T<sub>a</sub> = 175 °C

V<sub>FM</sub>(V)

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0

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

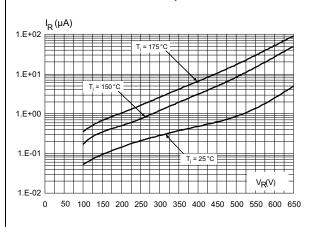
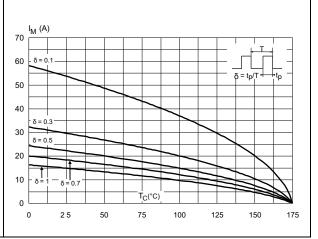


Figure 4. Peak forward current versus case temperature



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Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode) C<sub>i</sub> (pF) 300 F = 1 MHz V<sub>OSC</sub> = 30 mV<sub>RMS</sub> 250 200 150 100 50  $V_{R}(V)$ 1.0 100.0 1000.0 0.1 10.0

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

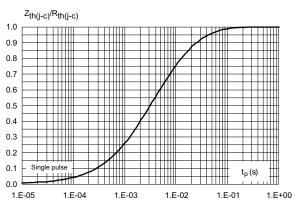


Figure 7. Non-respective peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

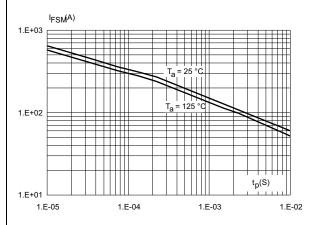
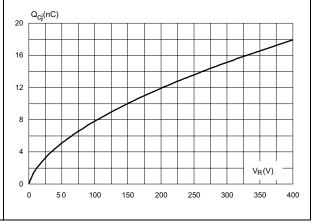


Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)



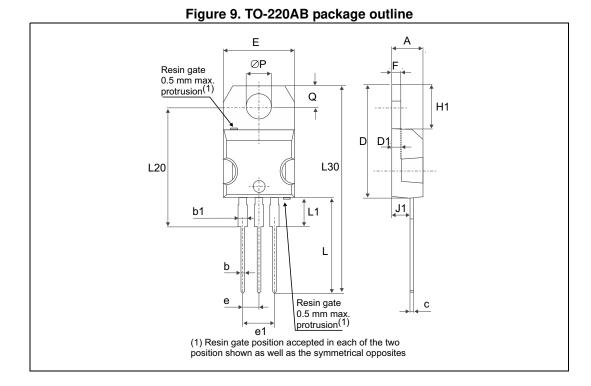
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## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

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

### 2.1 TO-220AB package information



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Package information STPSC12H065C

Table 6. TO-220AB package mechanical data

		Dimensions					
Ref.		Millimeters			Inches <sup>(1)</sup>		
	Тур.	Min.	Max.	Тур.	Min.	Max.	
Α		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	
С		0.48	0.70		0.019	0.027	
D		15.25	15.75		0.60	0.62	
D1	1.27			0.05			
E		10	10.40		0.39	0.41	
е		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			0.64			
L30	28.90			1.13			
Ø₽		3.75	3.85		0.147	0.151	
Q		2.65	2.95		0.104	0.116	

<sup>1.</sup> Values in inches are converted from mm and rounded to 4 decimal digits.

# 3 Ordering information

**Table 7. Ordering information** 

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPSC12H065CT	PSC12H065CT	TO-220AB	1.86 g	50	Tube

# 4 Revision history

**Table 8. Document revision history** 

Date	Revision	Changes	
24-Jun-2013	1	First issue.	
07-Nov-2013	2 Updated Figure 1 and Figure 2.		
10-Dec-2015 3		Updated cover page and <i>Table 7</i> . Format updated to current standard.	

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