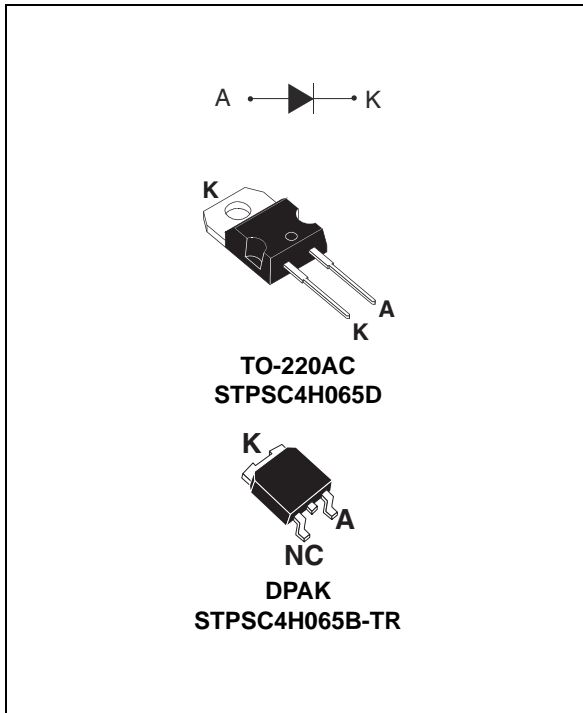


## 650 V power Schottky silicon carbide diode

Datasheet - production data



### 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.

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
$I_{F(AV)}$	4 A
$V_{RRM}$	650 V
$T_j$ (max)	175 °C

### Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- High forward surge capability

# 1 Characteristics

**Table 2. Absolute ratings (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		22	A
$I_{F(AV)}$	Average forward current	$T_C = 145\text{ °C}^{(1)}$ , DC	4	A
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal, $T_C = 25\text{ °C}$	38	A
		$t_p = 10\text{ ms}$ sinusoidal, $T_C = 125\text{ °C}$	35	
		$t_p = 10\text{ }\mu\text{s}$ square, $T_C = 25\text{ °C}$	200	
$I_{FRM}$	Repetitive peak forward current	$T_C = 145\text{ °C}^{(1)}$ , $T_j = 175\text{ °C}$ , $\delta = 0.1$	11	A
$T_{stg}$	Storage temperature range		-55 to +175	°C
$T_j$	Operating junction temperature <sup>(2)</sup>		-40 to +175	°C

- Value based on  $R_{th(j-c)}$  max.
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$  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	1.8	2.7	°C/W

**Table 4. Static electrical characteristics**

Symbol	Parameter	Tests conditions	Min.	Typ.	Max.	Unit	
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	3	40	$\mu\text{A}$
		$T_j = 150\text{ °C}$		-	35	170	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 4\text{ A}$	-	1.56	1.75	V
		$T_j = 150\text{ °C}$		-	1.98	2.5	

- $t_p = 10\text{ ms}$ ,  $\delta < 2\%$
- $t_p = 500\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 1.35 \times I_{F(AV)} + 0.288 \times I_{F(RMS)}^2$$

**Table 5. Dynamic electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Unit
$Q_{cj}^{(1)}$	Total capacitive charge	$V_R = 400\text{ V}$		12.5	nC
$C_j$	Total capacitance	$V_R = 0\text{ V}$ , $T_C = 25\text{ °C}$ , $F = 1\text{ MHz}$		200	$\mu\text{F}$
		$V_R = 400\text{ V}$ , $T_C = 25\text{ °C}$ , $F = 1\text{ MHz}$		21	

- Most accurate value for the capacitive charge:  $Q_{cj} = \int_0^{V_{OUT}} c_j(V_R) \cdot dV_R$

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

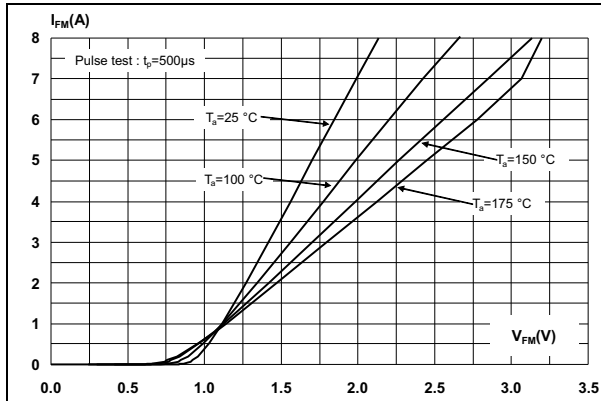


Figure 2. Forward voltage drop versus forward current (typical values, high level)

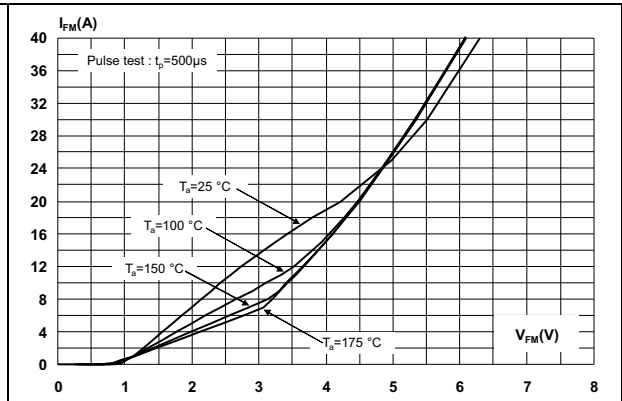


Figure 3. Reverse leakage current versus reverse voltage applied (typical values)

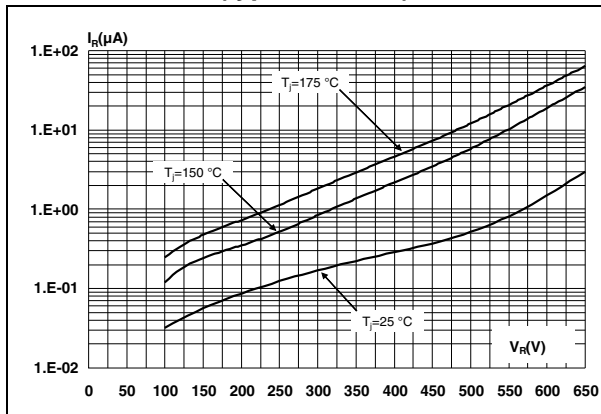


Figure 4. Peak forward current versus case temperature

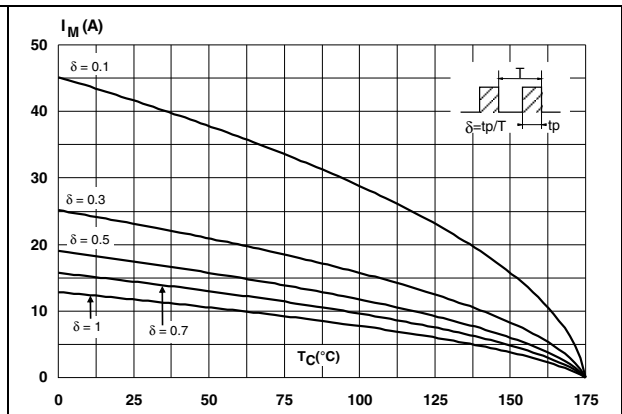


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

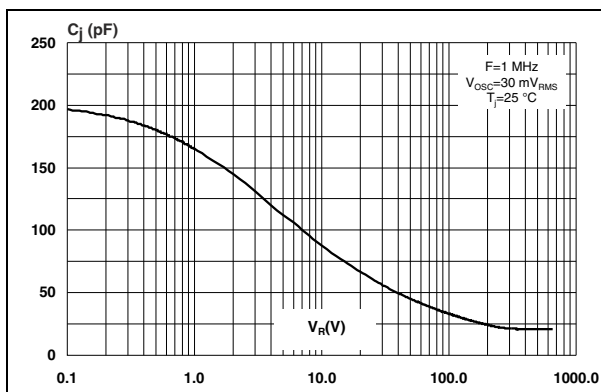


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration

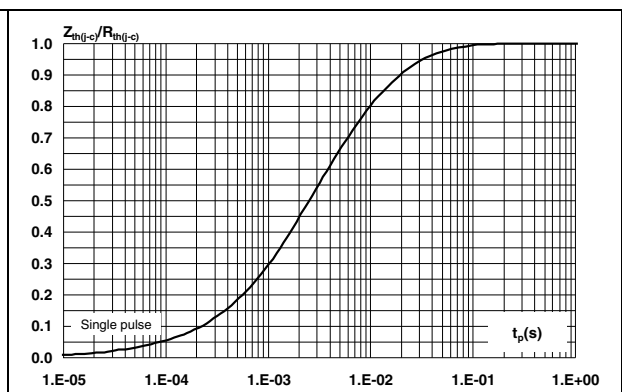


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

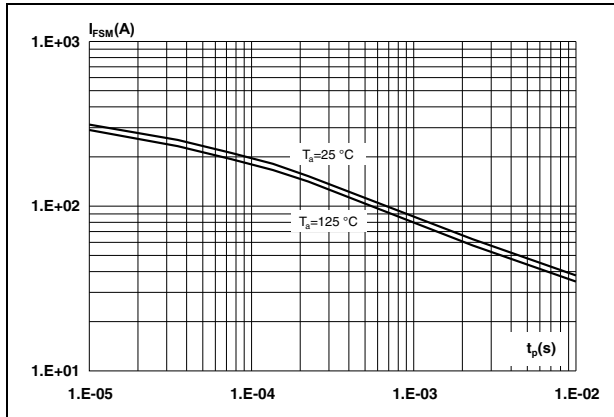
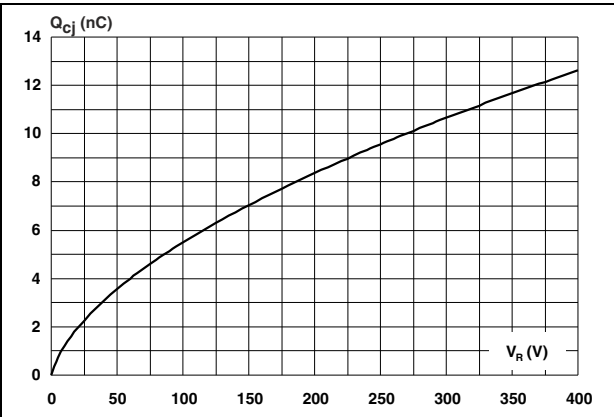


Figure 8. Total capacitive charges versus reverse voltage applied (typical values)



## 2 Package information

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

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: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 9. TO-220AC dimension definitions

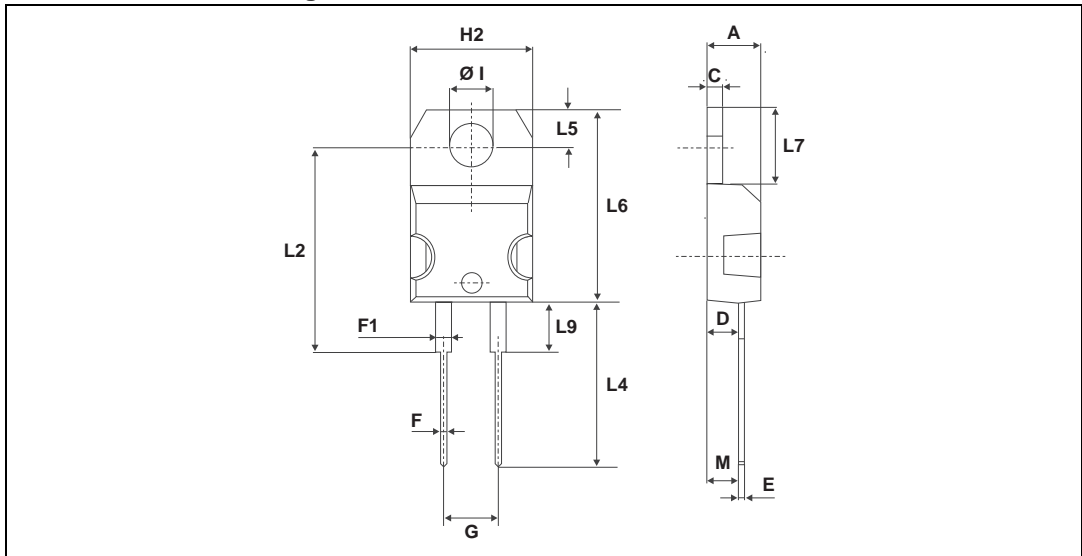


Table 6. TO-220AC dimension values

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
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	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. I	3.75	3.85	0.147	0.151

Figure 10. DPAK dimension definitions

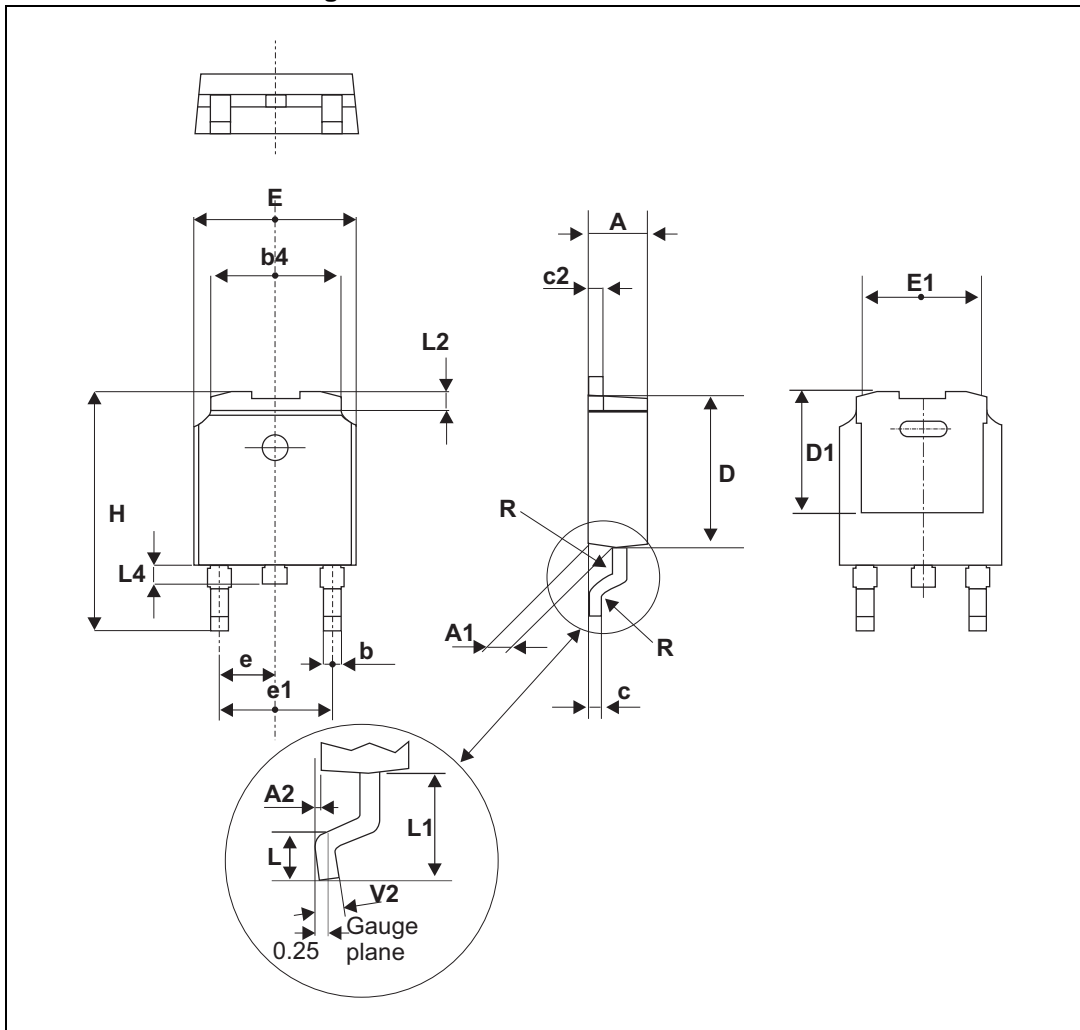
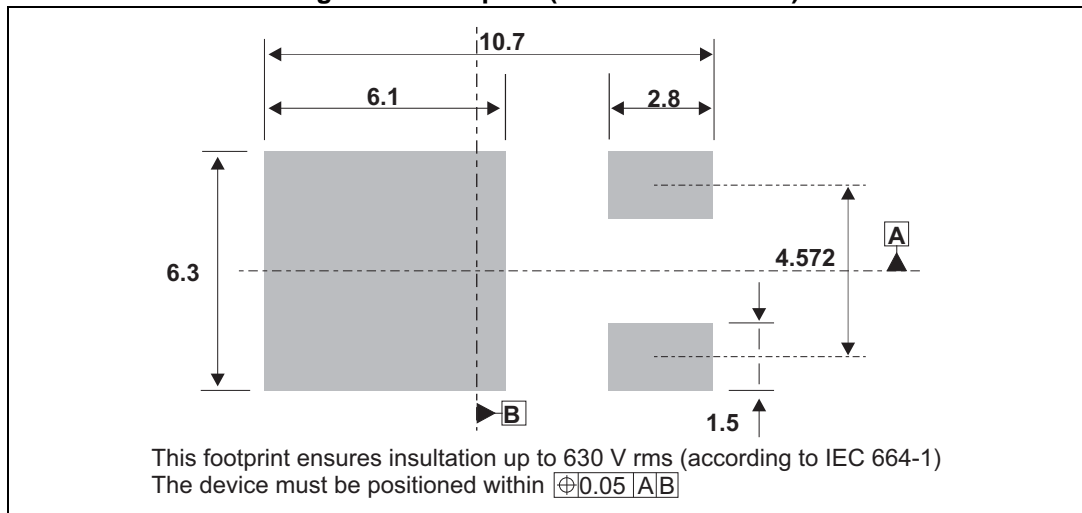


Table 7. DPAK dimension values

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.086		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
b	0.64		0.90	0.025		0.035
b4	5.20		5.40	0.204		0.212
c	0.45		0.60	0.017		0.023
c2	0.48		0.60	0.018		0.023
D	6.00		6.20	0.236		0.244
D1		5.10			0.201	
E	6.40		6.60	0.251		0.259
E1		4.70			0.185	
e		2.28			0.090	
e1	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.397
L	1.00		1.50	0.039		0.059
L1		2.80			0.11	
L2		0.80			0.032	
L4	0.60		1.00	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°

Figure 11. Footprint (dimensions in mm)





### 3 Ordering information

**Table 8. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPSC4H065D	STPSC4H065D	TO-220AC	1.86 g	50	Tube
STPSC4H065B-TR	STPSC 4H065	DKPAK	0.32 g	2500	Tape and reel

### 4 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
31-Aug-2012	1	First issue.
10-Oct-2012	2	Added Max. value in <a href="#">Table 3</a> .
07-Nov-2013	3	Updated <a href="#">Figure 1</a> , <a href="#">Figure 2</a> , <a href="#">Figure 10</a> , <a href="#">Figure 11</a> and <a href="#">Table 7</a> .

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