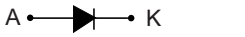
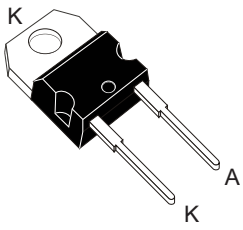
STPSC4G065

Datasheet

650 V, 4 A high surge silicon carbide power Schottky diode





TO-220AC

STPOWER

Product label

SUSTAINABLE TECHNOLOGY

Product status link

STPSC4G065

Product summary

$I_{F(AV)}$	4 A
V_{RRM}	650 V
T_j(max.)	175 °C
V_F(typ.)	1.30 V

Features

- None or negligible reverse recovery charge in application current range
- Switching behaviour independent of temperature
- High forward surge capability
- Operating T_j from -55 °C to +175 °C
- ECOPACK2 compliant component

Application

- Air conditioning equipment
- EV Charging station
- SMPS in telecom power
- Solar converter
- Telecom / Server power equipment
- UPS power supply

Description

The SiC diode, available in TO-220AC, is an ultrahigh performance power Schottky rectifier. It is manufactured using a silicon carbide substrate. The wide band-gap material allows the design of a low V_F Schottky diode structure with a 650 V rating. Thanks 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.

Based on latest technology optimization, this diode has an improved forward surge current capability, making it ideal for use in PFC, where this ST SiC diode boosts the performance in hard switching conditions. Using the latest design improvement of the “G” series of ST SiC diodes, as well as implemented tests in production, this diode is becoming the reference point in the combination of efficiency and application.

1 Characteristics

Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

Symbol	Parameter			Value	Unit
V_{RRM}	Repetitive peak reverse voltage (T_j = -55 °C to +175 °C)			650	V
$I_{F(RMS)}$	Forward rms current			15	A
$I_{F(AV)}$	Average forward current	T_C = 150 °C, δ = 1		4	A
I_{FRM}	Repetitive peak forward current	T_C = 150 °C, T_j = 175 °C, δ = 0.1, f_{sw} > 10 kHz		16	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	T_c = 25 °C	30	A
			T_c = 150 °C	27	
		t_p = 10 µs square	T_c = 25 °C	385	
T_{stg}	Storage temperature range			-65 to +175	°C
T_j	Operating junction temperature range			-55 to +175	°C

Table 2. Thermal resistance parameters

Symbol	Parameter	Value		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Junction to case	2.45	3.5	°C/W

For more information, you can refer to the following application note:

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-	4	40	µA
		T_j = 175 °C		-	23	170	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 4 A	-	1.3	1.45	V
		T_j = 175 °C		-	1.49	1.70	

1. *Pulse test: t_p = 10 ms, δ < 2%*
2. *Pulse test: t_p = 380 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

$P = 0.879 \times I_{F(AV)} + 0.206 \times I_F{}^2{}_{(RMS)}$

For more information, you can refer to the following application notes related to the power losses:

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Q_{Cj} (1)	Total capacitive charge	V_R = 400 V	-	14.5	-	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	-	285	-	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	-	20	-	

1. *Most accurate value for the capacitive charge:* $Q_{cj}(V_R) = \int_0^{V_R} C_j(V)dV$

Figure 1. Thermal transient impedance model circuit of the diode – $Z_{th(j-c)}$

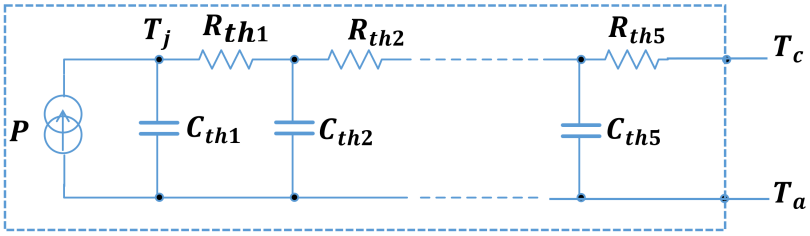


Table 5. Components typical values of the diode thermal transient impedance model $Z_{th(j-c)}$

Ref.	Value (K/W)	Ref.	Value (J/K)
R_{th1}	83.75 m	C_{th1}	0.38 m
R_{th2}	1221.29 m	C_{th2}	0.20 m
R_{th3}	661.09 m	C_{th3}	1.86 m
R_{th4}	387.85 m	C_{th4}	11.56 m
R_{th5}	95.24 m	C_{th5}	166.42 m

1.1 Characteristics (curves)

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

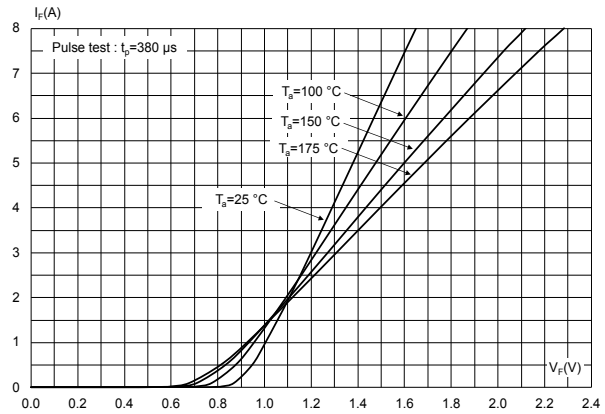


Figure 3. Reverse leakage current versus reverse voltage applied (typical values)

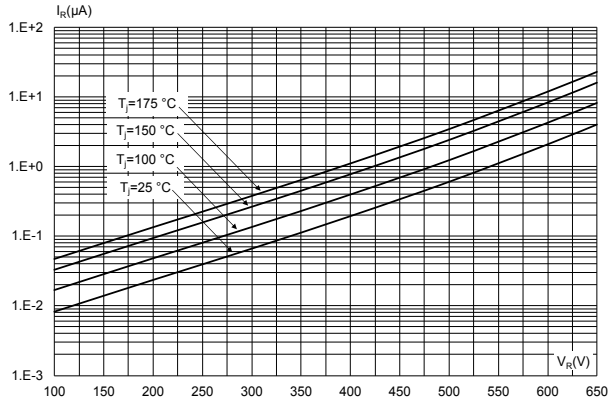


Figure 4. Peak forward current versus case temperature (f_{sw} > 10 kHz)

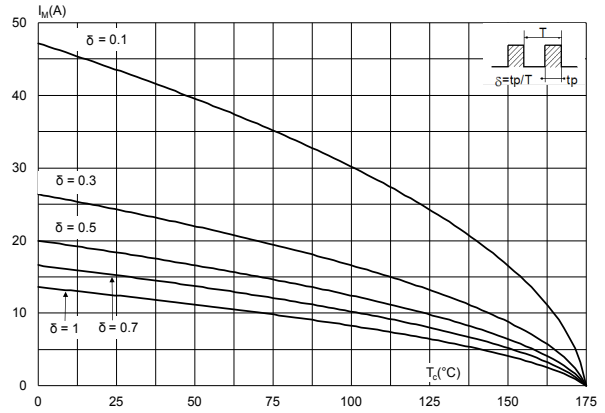


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

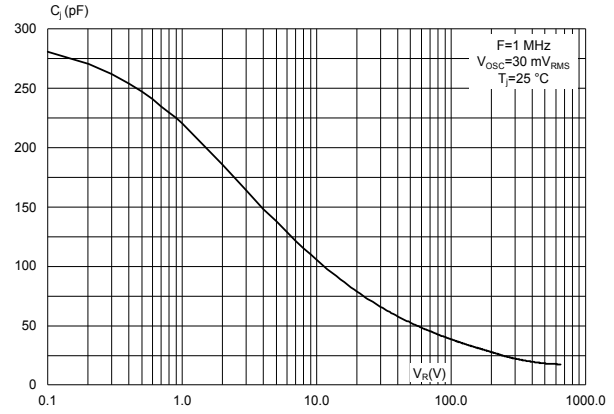


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration

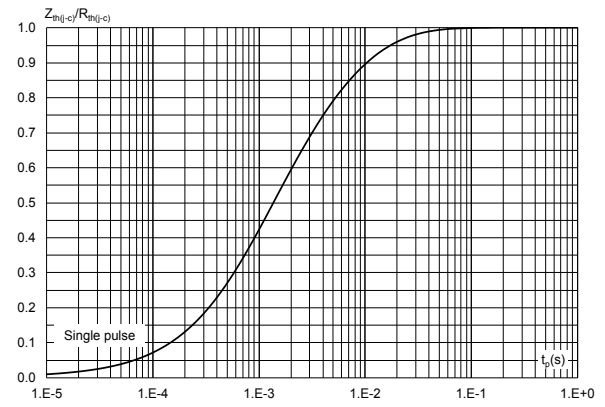


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

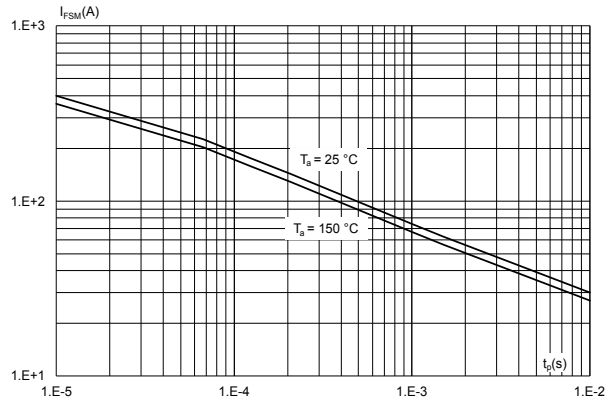
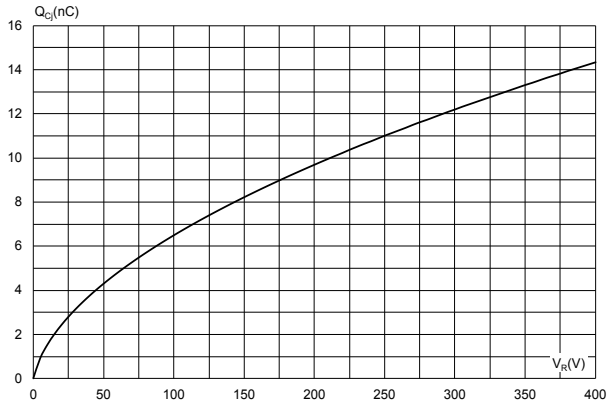


Figure 8. Total capacitive charges versus reverse voltage applied (typical values)



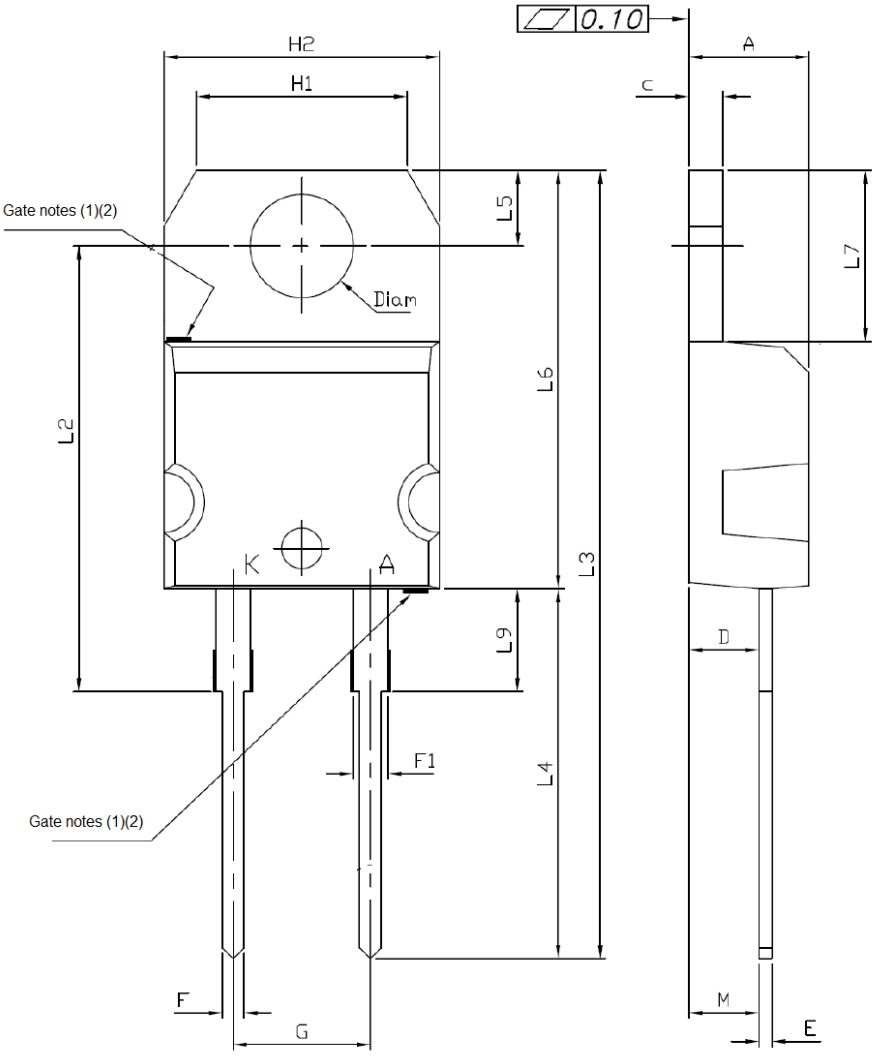
2 Package information

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.

2.1 TO-220AC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 9. TO-220AC package outline



(1) : Max resin gate protusion 0.5 mm

(2) : Resin gate position is accepted in each of the two positions shown on the drawings or their symmetrical

Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. TO-220AC package mechanical data

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	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			0.645	
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		2.60			0.102	
Diam	3.75		3.85	0.147		0.151
Slug flatness		0.03	0.10		0.001	0.004

Note: For packing information, inner box dimensions and tube dimensions, refer to TN1173.

3 Ordering information

Table 7. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC4G065D	PSC4G65D	TO-220AC	1.86 g	50	Tube

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
20-Mar-2025	1	Initial release.

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