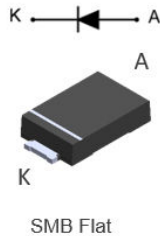


Automotive 650 V, 4 A high surge silicon carbide power Schottky diode



Product label




Product status link

[STPSC4G065UFY](#)

Product summary

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

Features

- AEC-Q101 qualified and PPAP capable 
- 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

- OBC (On board battery chargers)
- LVDC
- EV Charging station

Description

The SiC diode, available in SMB-Flat, 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 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 while bringing robustness to the design. Its high forward surge capability ensures a good robustness during transient phases.

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage ($T_j = -55\text{ °C}$ to $+175\text{ °C}$)		650	V
$I_{F(RMS)}$	Forward rms current		10	A
$I_{F(AV)}$	Average forward current	$T_l = 70\text{ °C}$, $T_j = 175\text{ °C}$, $\delta = 1$	4	A
I_{FRM}	Repetitive peak forward current	$T_l = 70\text{ °C}$, $T_j = 175\text{ °C}$, $\delta = 0.1$, $f_{sw} > 10\text{ kHz}$	16	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal	$T_c = 25\text{ °C}$	A
			$T_c = 150\text{ °C}$	
		$t_p = 10\text{ }\mu\text{s}$ square	$T_c = 25\text{ °C}$	
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.	
$R_{th(j-l)}$	Junction to lead	10.5	15	°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	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	4	40	μA
		$T_j = 175\text{ °C}$		-	23	170	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 4\text{ A}$	-	1.3	1.45	V
		$T_j = 175\text{ °C}$		-	1.49	1.70	

1. Pulse test: $t_p = 10\text{ ms}$, $\delta < 2\%$

2. Pulse test: $t_p = 380\text{ }\mu\text{s}$, $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

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

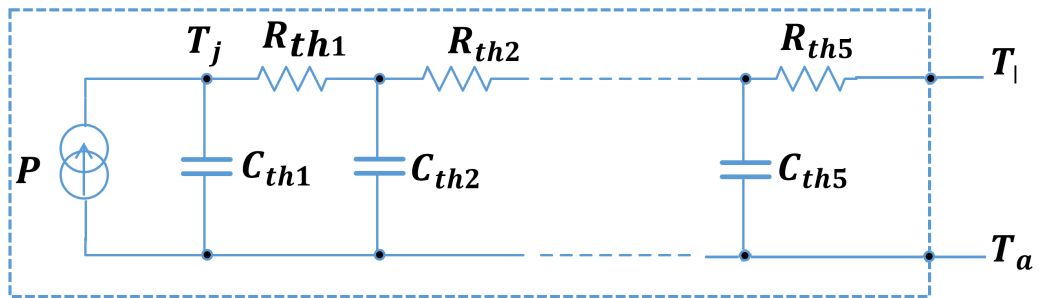
For more information, you can refer to the following application notes related to the power losses:

- [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	$V_R = 400 \text{ V}$	-	14.5	-	nC
C_j	Total capacitance	$V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$	-	285	-	pF
		$V_R = 400 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$	-	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 – $Z_{th(j-l)}$

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

Ref.	Value (K/W)	Ref.	Value (J/K)
R_{th1}	606.69 m	C_{th1}	0.45 m
R_{th2}	1442.64 m	C_{th2}	1.67 m
R_{th3}	5125.21 m	C_{th3}	6.15 m
R_{th4}	2580.19 m	C_{th4}	42.94 m
R_{th5}	701.27 m	C_{th5}	928.09 m

1.1 Characteristics (curves)

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

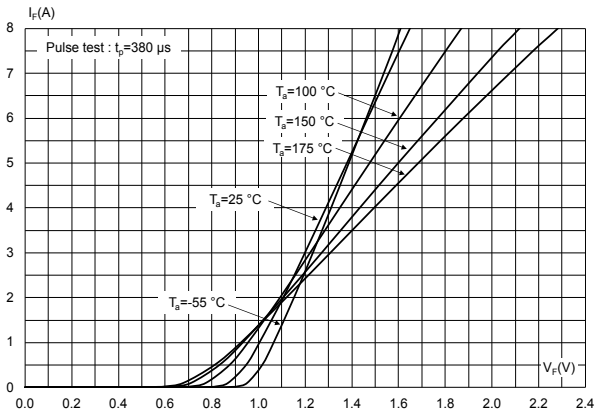


Figure 3. Reverse leakage current versus reverse voltage applied (typical values)

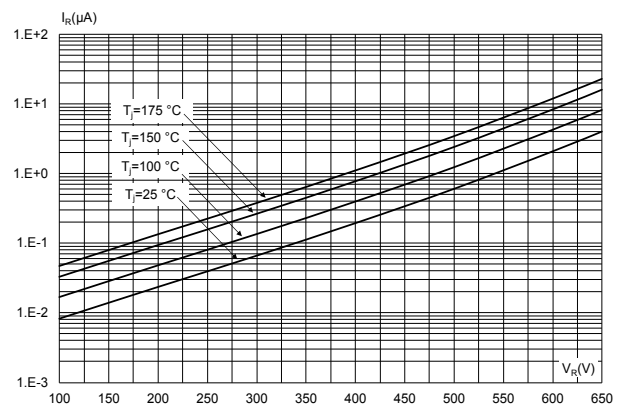


Figure 4. Peak forward current versus lead temperature ($f_{sw} > 10$ kHz)

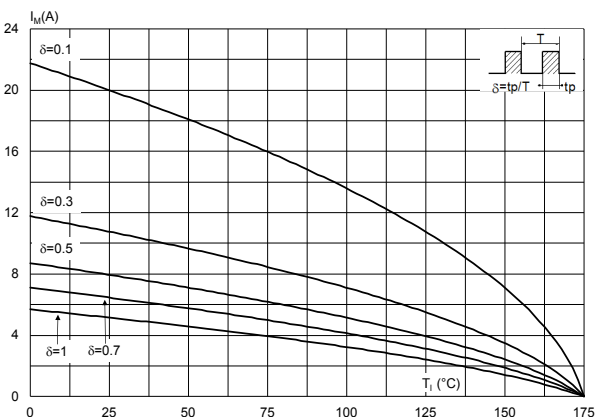


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

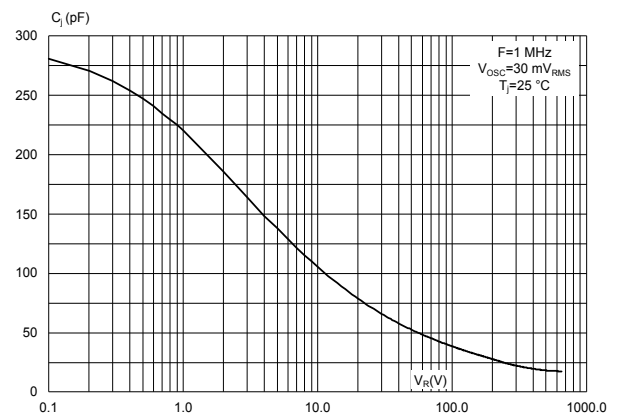


Figure 6. Relative variation of thermal impedance junction to lead versus pulse duration

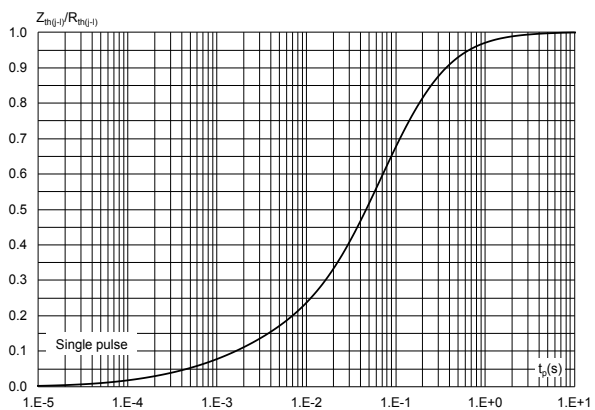


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

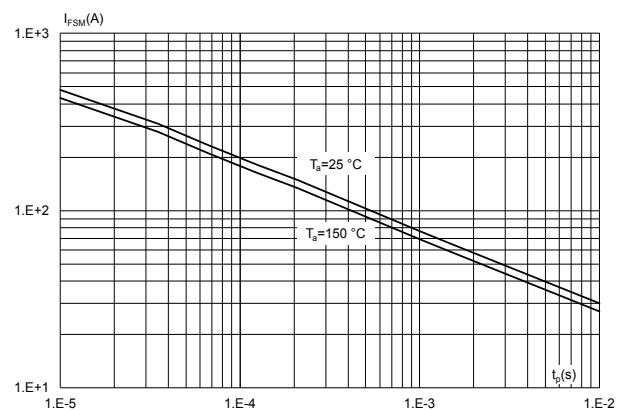


Figure 8. Total capacitive charges versus reverse voltage applied (typical values)

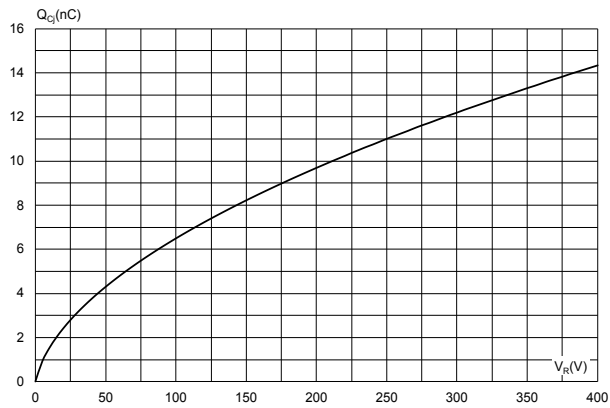
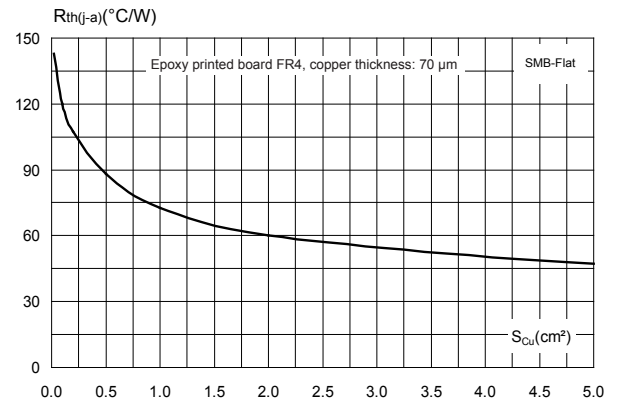


Figure 9. Thermal resistance junction to ambient versus copper surface under each lead (typical values)



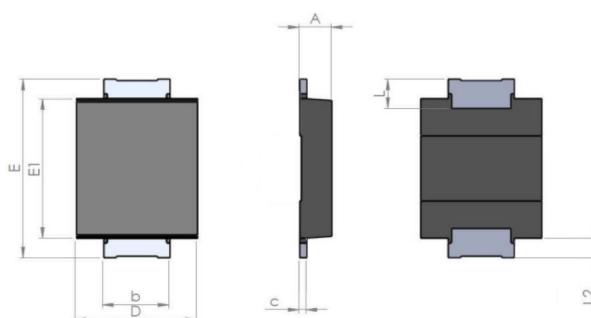
2 Package information

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 SMB Flat package information

- Epoxy meets UL94, V0
- Lead-free package

Figure 10. SMB Flat package outline

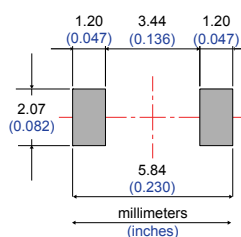


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. SMB Flat mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.10	0.035		0.043
b	1.95		2.20	0.077		0.087
c	0.15		0.40	0.006		0.016
D	3.30		3.95	0.130		0.156
E	5.10		5.60	0.200		0.220
E1	4.05		4.60	0.159		0.181
L	0.75		1.50	0.030		0.060
L2		0.60			0.024	

Figure 11. Footprint recommendations, dimensions in mm (inches)





3 Ordering information

Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC4G065UFY	4G65Y	SMB Flat	0.050 g	5000	Tape and reel

Revision history

Table 8. Document revision history

Date	Revision	Changes
11-Feb-2025	1	Initial release.

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