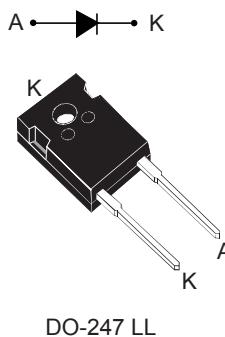


## 1200 V, 40 A power Schottky high surge silicon carbide diode



### Features

- None or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating  $T_j$  from -55 °C to 175 °C
- Avalanche energy rated
- ECOPACK2 compliant component

### Applications

- Solar inverter
- Boost PFC
- Air conditioning equipment
- UPS power supply
- Telecom / Server power equipment
- HEV/EV OBC (On board battery chargers)
- EV Charging station

### Description

The SiC diode, available in DO-247 with long leads, 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 1200 V rating. Thanks to the Schottky construction, no recovery is shown during 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 while bringing robustness to the design. Its high forward surge capability ensures a good robustness during transient phases.

#### Product label



#### Product status link

[STPSC40G12](https://www.st.com/STPSC40G12)

#### Product summary

$I_{F(AV)}$	40 A
$V_{RRM}$	1200 V
$T_j$ (max.)	175 °C
$V_F$ (typ.)	1.35 V

# 1 Characteristics

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

Symbol	Parameter			Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage ( $T_j = -40$ °C to $+175$ °C)			1200	V
$E_{AS}^{(1)}$	Single pulse avalanche energy, starting $T_j = 25$ °C, $I_{AS} = 9.3$ A, $L = 10$ mH			432	mJ
$I_{F(RMS)}$	Forward rms current			79	A
$I_{F(AV)}$	Average forward current	$T_c = 140$ °C, $\delta = 1$		40	A
$I_{FRM}$	Repetitive peak forward current	$T_c = 140$ °C, $T_j = 175$ °C, $\delta = 0.1$ , $f_{sw} > 10$ kHz		158	A
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10$ ms sinusoidal	$T_c = 25$ °C	280	A
			$T_c = 150$ °C	250	
		$t_p = 10$ µs square	$T_c = 25$ °C	1700	
$T_{stg}$	Storage temperature range			-65 to +175	°C
$T_j$	Operating junction temperature range			-55 to +175	°C

1. Please refer to Figure 1.

**Table 2. Thermal resistance parameters**

Symbol	Parameter	Value		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Junction to case	0.25	0.40	°C/W

For more information, please 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	$V_R = V_{RRM}$	-	20	300	µA
		$T_j = 150$ °C		-	67	1000	
		$T_j = 175$ °C		-	150		
$V_F^{(2)}$	Forward voltage drop	$T_j = 25$ °C	$I_F = 40$ A	-	1.35	1.50	V
		$T_j = 150$ °C		-	1.75	2.10	
		$T_j = 175$ °C		-	1.90		

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

2. Pulse test:  $t_p = 380$  µs,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 0.924 \times I_{F(AV)} + 0.029 \times I_{F(RMS)}^2$$

For more information, please 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

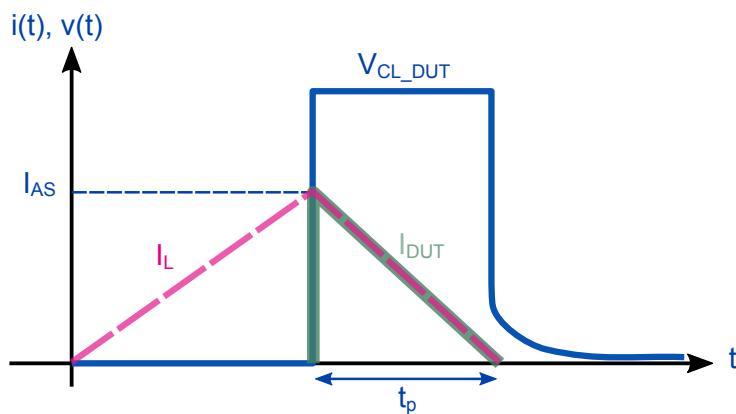
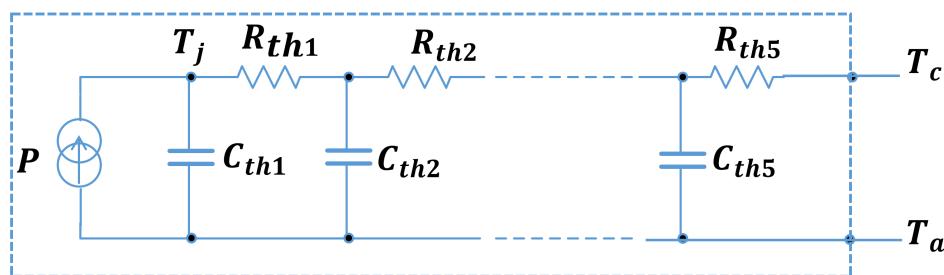
Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$Q_{Cj}$ <sup>(1)</sup>	Total capacitive charge	$V_R = 800$ V	-	202	-	nC
$C_j$	Total capacitance	$V_R = 0$ V, $T_c = 25$ °C, $F = 1$ MHz	-	3078	-	pF
		$V_R = 800$ V, $T_c = 25$ °C, $F = 1$ MHz	-	141	-	

1.

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

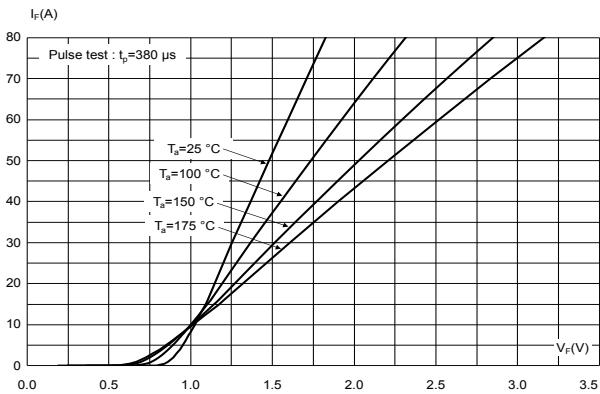
Figure 1. Current and voltage waveforms for avalanche energy test across D.U.T (device under test)

Figure 2. Thermal transient impedance model circuit of the diode –  $Z_{th(j-c)}$ Table 5. Components typical values of the diode thermal transient impedance model  $Z_{th(j-c)}$ 

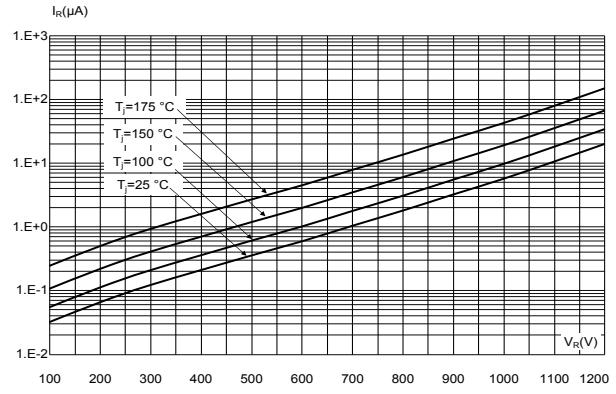
Ref.	Value (K/W)	Ref.	Value (J/K)
$R_{th1}$	11.3m	$C_{th1}$	3.52m
$R_{th2}$	63.6m	$C_{th2}$	4.04m
$R_{th3}$	89.7m	$C_{th3}$	18.5m
$R_{th4}$	66m	$C_{th4}$	87.2m
$R_{th5}$	19.4m	$C_{th5}$	1.13

## 1.1 Characteristics (curves)

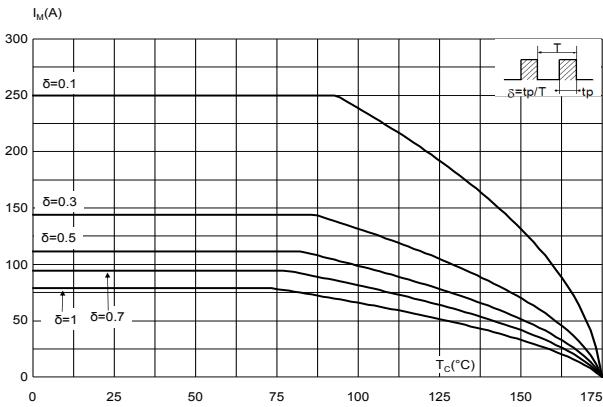
**Figure 3. Forward voltage drop versus forward current (typical values)**



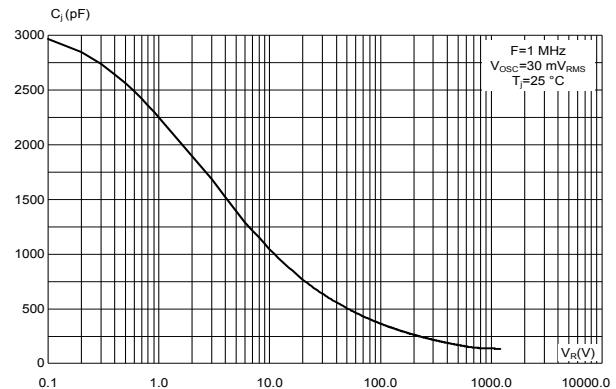
**Figure 4. Reverse leakage current versus reverse voltage applied (typical values)**



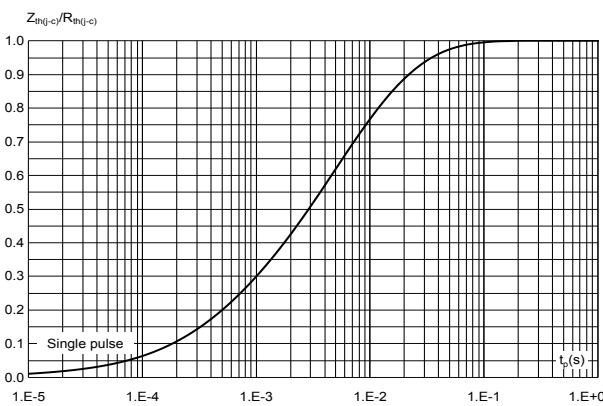
**Figure 5. Peak forward current versus case temperature**



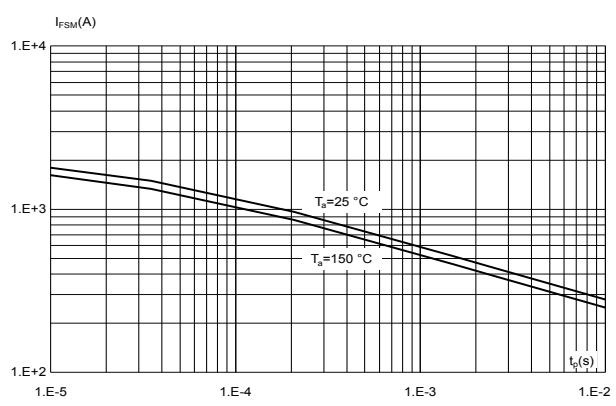
**Figure 6. Junction capacitance versus reverse voltage applied (typical values)**



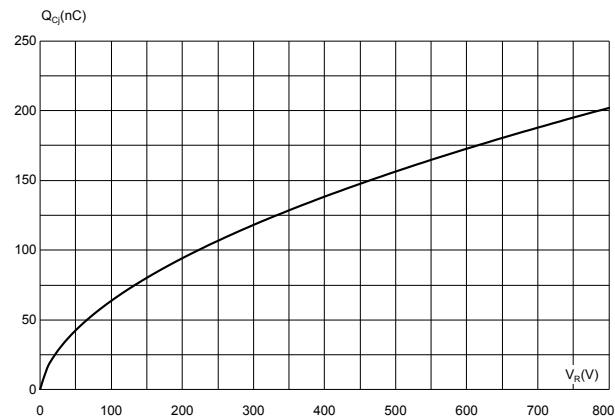
**Figure 7. Relative variation of thermal impedance junction to case versus pulse duration**



**Figure 8. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)**



**Figure 9. Total capacitive charges versus reverse voltage applied (typical values)**



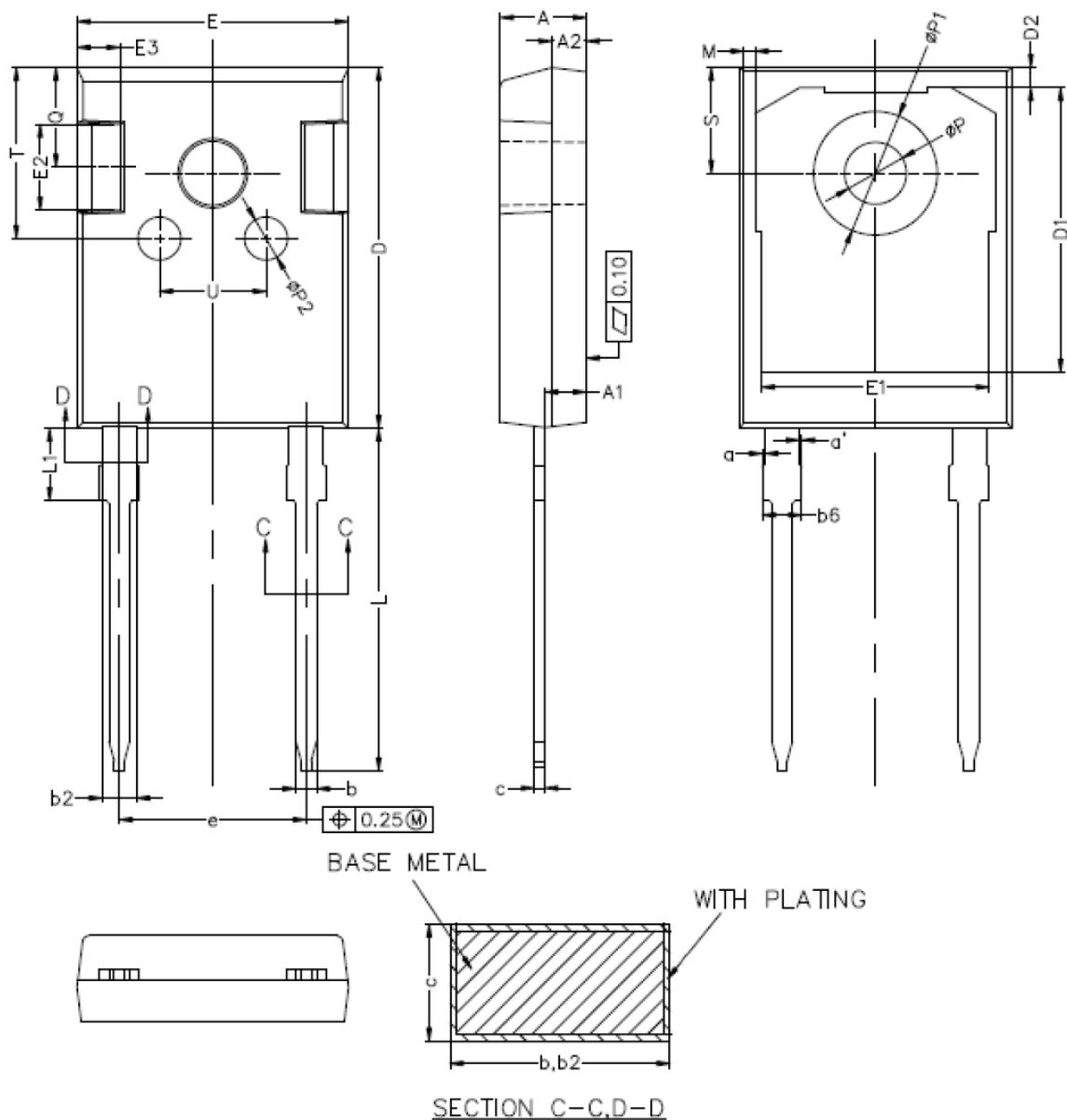
## 2 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 DO-247 LL package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

Figure 10. DO-247 LL package outline



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

**Table 6. DO-247 LL package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.90	5.00	5.10	0.192	0.197	0.201
A1	2.31	2.41	2.51	0.090	0.095	0.099
A2	1.90	2.00	2.10	0.074	0.079	0.083
a	0.00		0.15	0.000		0.006
a'	0.00		0.15	0.000		0.006
b	1.16		1.29	0.045		0.051
b2	1.96		2.06	0.077		0.082
b6			2.25			0.089
c	0.59		0.66	0.023		0.026
D	20.90	21.00	21.10	0.822	0.827	0.831
D1	16.25	16.55	16.85	0.639	0.652	0.664
D2	1.05	1.20	1.35	0.041	0.047	0.054
E	15.70	15.80	15.90	0.618	0.622	0.626
E1	13.06	13.26	13.46	0.514	0.522	0.530
E2	4.90	5.00	5.10	0.192	0.197	0.201
E3	2.40	2.50	2.60	0.094	0.098	0.103
e	10.78	10.88	10.98	0.424	0.428	0.433
L	19.80	19.92	20.10	0.779	0.784	0.792
L1	3.93		4.46	0.154		0.176
M	0.35		0.95	0.013		0.038
P	3.50	3.60	3.70	0.137	0.142	0.146
P1	7.00		7.40	0.275		0.292
P2	2.40	2.50	2.60	0.094	0.098	0.103
Q	5.60		6.00	0.220		0.237
S	6.05	6.15	6.25	0.238	0.242	0.247
T	9.80		10.20	0.385		0.402
U	6.00		6.40	0.236		0.252

### 3 Ordering information

**Table 7. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC40G12WL	STPSC40G12WL	DO-247LL	5.9 g	30	Tube

## Revision history

**Table 8. Document revision history**

Date	Revision	Changes
08-Nov-2022	1	Initial release.

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