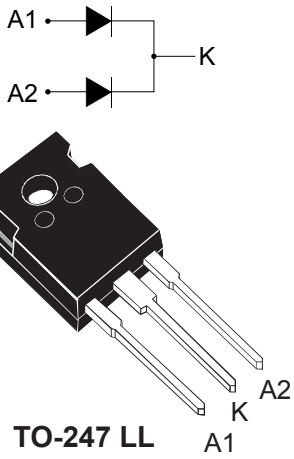
STPSC20H065CWLY

Datasheet

Automotive 20 A 650 V power Schottky silicon carbide diode



TO-247 LL

Features

- AEC-Q101 qualified
- PPAP capable
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Dedicated to PFC applications
- High forward surge capability
- ECOPACK2 compliant component

Applications

- On board charger (OBC)
- Charging stations
- PFC applications
- UPS
- Inverters
- Telecom power supplies

Description

The STPSC20H065CWLY is an ultra-high-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 and are ideal for automotive applications.

Especially suited for use in PFC applications, UPS, inverters, telecom power supplies and battery chargers (either integrated in the vehicle or in a charging station), this diode will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.

Product status link
STPSC20H065CWLY

Product summary	
$I_{F(AV)}$	2 x 10 A
V_{RRM}	650 V
T_j (max.)	175 °C
V_F (typ.)	1.45 V

Product label
SUSTAINABLE TECHNOLOGY

1 Characteristics

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

Symbol	Parameter			Value	Unit
V_{RRM}	Repetitive peak reverse voltage (T_j = -40 °C to +175 °C)			650	V
$I_{F(RMS)}$	Forward rms current			22	A
$I_{F(AV)}$	Average forward current	T_c = 140 °C(1), DC current	Per diode	10	A
		T_c = 140 °C(2), DC current	Per device	20	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	T_c = 25 °C	90	A
		t_p = 10 ms sinusoidal	T_c = 125 °C	80	
		t_p = 10 µs square	T_c = 25 °C	470	
I_{FRM}	Repetitive peak forward current, δ = 0.1	T_c = 140 °C(1)	T_j = 175 °C	42	A
T_{stg}	Storage temperature range			-55 to +175	°C
T_j	Operating junction temperature range(3)			-40 to +175	°C

1. *Value based on $R_{th(j-c)}$ max.(per diode)*
2. *Value based on $R_{th(j-c)}$ max.(per device)*
3. *$(dP_{tot}/dT_j) < (1/R_{th(j-a)})$ condition to avoid thermal runaway for a diode on its own heatsink.*

Table 2. Thermal resistance parameters

Symbol	Parameter		Value		Unit
			Typ.	Max.	
$R_{th(j-c)}$	Junction to case	Per diode	1.25	1.5	°C/W
		Per device	0.63	0.75	

For more information, please refer to the following application note:

- AN5088: Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-	9	100	µA
		T_j = 150 °C		-	85	425	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 10 A	-	1.45	1.65	V
		T_j = 150 °C		-	1.7	2.05	

1. *Pulse test: t_p = 10 ms, δ < 2%*
2. *Pulse test: t_p = 500 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

$P = 0.972 \times I_{F(AV)} + 0.108 \times I_F{}^2{}_{(RMS)}$

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 (per diode)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Q_{Cj} (1)	Total capacitive charge	V_R = 400 V	-	28.5	-	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	-	480	-	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	-	48	-	

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

1.1 Characteristics (curves)

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

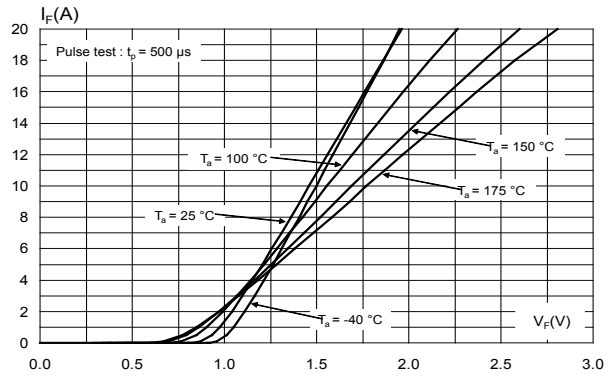


Figure 2. Forward voltage drop versus forward current (typical values, high level, per diode)

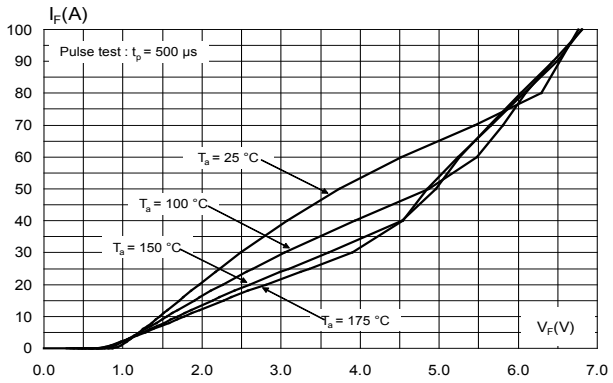


Figure 3. Reverse leakage current versus reverse voltage applied (typical values, per diode)

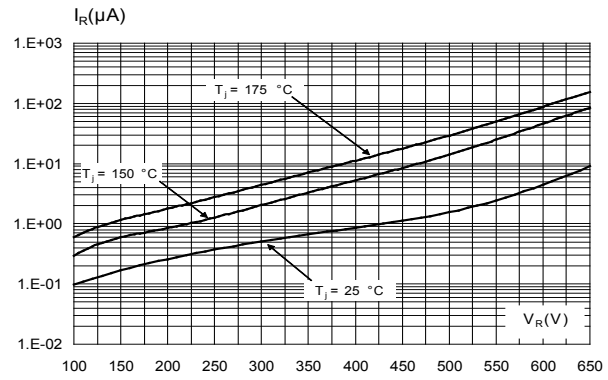


Figure 4. Peak forward current versus case temperature (per diode)

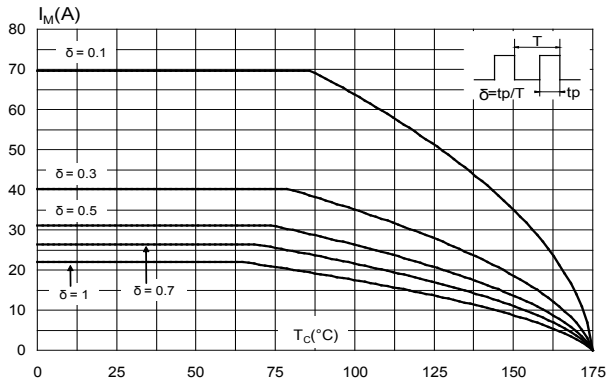


Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)

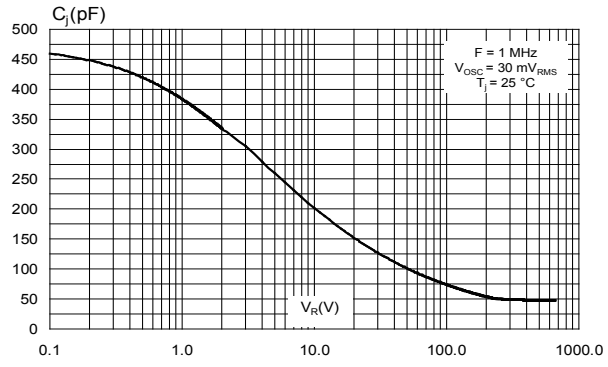


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration

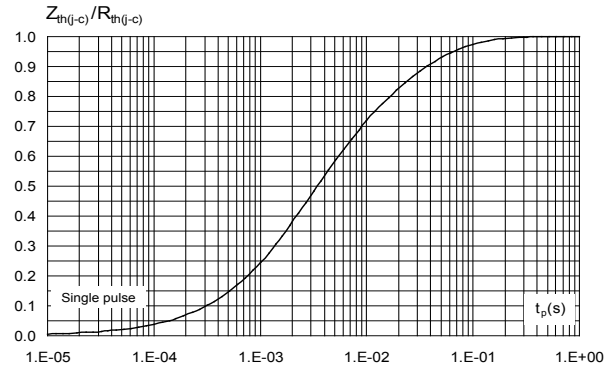


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

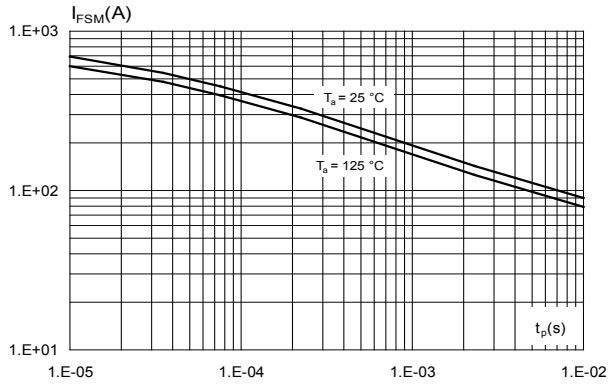
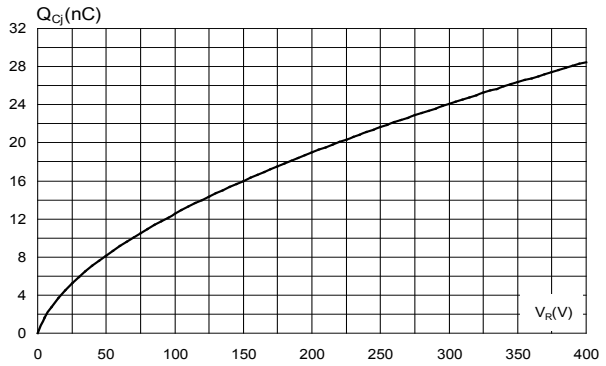


Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)



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. ECOPACK is an ST trademark.

2.1 TO-247 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 9. TO-247 long leads package outline

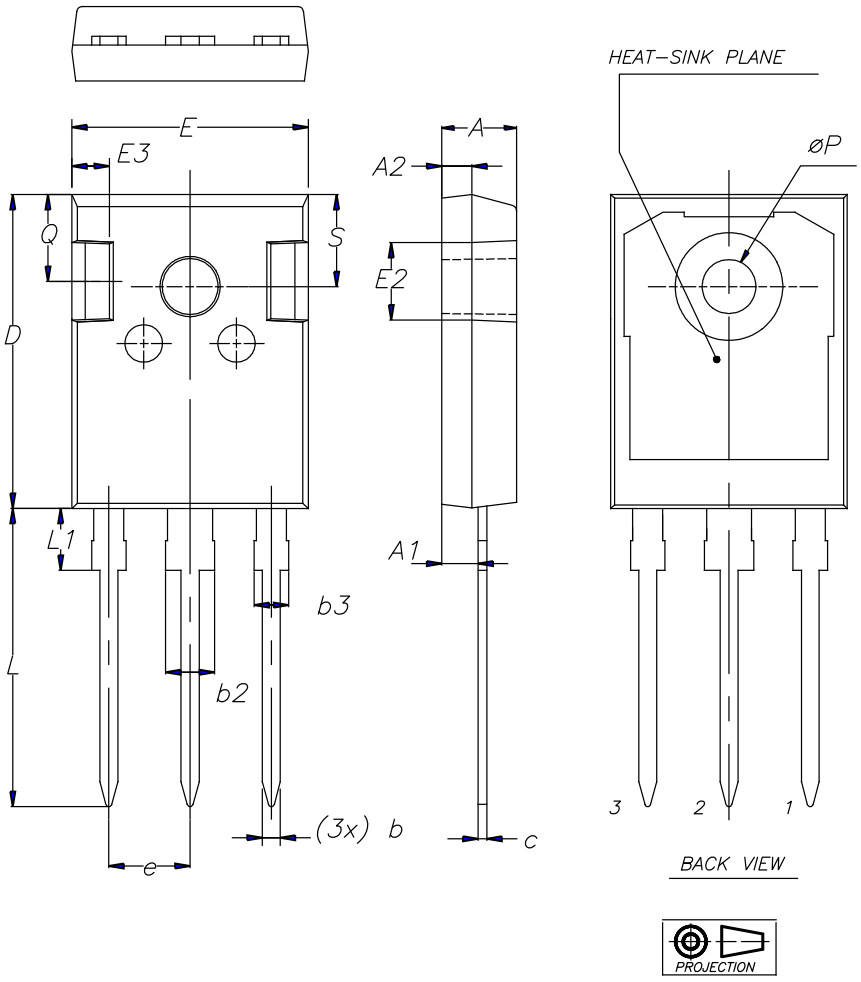


Table 5. **TO-247 long leads package mechanical data**

Dim.	mm.			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.90	-	5.15	0.192	-	0.203
A1	2.25	-	2.55	0.088	-	0.101
A2	1.85	-	2.10	0.072	-	0.083
B	1.07	-	1.32	0.042	-	0.052
B2	2.87	-	3.38	0.112	-	0.134
B3	1.90	-	2.38	0.074	-	0.094
C	0.55	-	0.67	0.021	-	0.027
D	20.82	-	21.10	0.819	-	0.831
E	15.70	-	16.02	0.618	-	0.631
E2	4.90	-	5.10	0.192	-	0.201
E3	2.40	-	2.60	0.094	-	0.103
e	5.34	-	5.54	0.210	-	0.219
L	19.80	-	20.30	0.779	-	0.800
L1	4.16	-	4.47	0.163	-	0.176
P	3.50	-	3.70	0.137	-	0.146
Q	5.49	-	6.00	0.216	-	0.237
S	6.04	-	6.29	0.237	-	0.248

3 Ordering information

Table 6. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC20H065CWLY	PSC20H065CWLY	TO-247LL	6.13 g	30	Tube

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
13-Apr-2021	1	First issue.