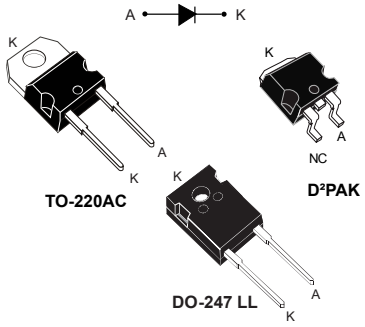
STPSC20H12

Datasheet

1200 V, 20 A power Schottky silicon carbide diode



STPOWER

Product label

SUSTAINABLE TECHNOLOGY

Product status link

STPSC20H12C

Product summary

$I_{F(AV)}$	20 A
V_{RRM}	1200 V
T_j (max.)	175 °C
V_F (typ.)	1.35 V

Features

- None or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating T_j from -40 °C to 175 °C
- 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 TO-220AC, D²PAK and TO-247 LL, 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. 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 and secondary side applications, this ST SiC diode boost the performance in hard switching conditions. This rectifier enhance the performance of the targeted application. 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 = -40 °C to +175 °C)			1200	V
$I_{F(RMS)}$	Forward rms current			38	A
$I_{F(AV)}$	Average forward current	TO-220AC, D²PAK, T_C = 155 °C, DC current (1)		20	A
		DO-247 LL, T_C = 150 °C, DC current(1)			
I_{FRM}	Repetitive peak forward current	TO-220AC, D²PAK, T_C = 155 °C, T_j = 175 °C, δ = 0.1		78	A
		DO -247 LL, T_C = 150 °C, T_j = 175 °C, δ = 0.1		79	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	T_C = 25 °C	140	A
			T_C = 150 °C	120	
		t_p = 10 µs square	T_C = 25 °C	700	
T_{stg}	Storage temperature range			-65 to +175	°C
T_j	Operating junction temperature range			-40 to +175	°C

1. *Value based on $R_{th(j-c)}$ max.*

Table 2. Thermal parameters

Symbol	Parameter		Typ. value	Max. value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC, D²PAK	0.30	0.45	°C/W
		DO-247 LL	0.40	0.55	°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	$V_R = V_{RRM}$	-	10	120	µA
		T_j = 150 °C		-	60	800	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 20 A	-	1.35	1.50	V
		T_j = 150 °C		-	1.75	2.25	

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:

$P = 1.07 \times I_{F(AV)} + 0.059 \times I_F{}^2{}_{(RMS)}$

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 = 800 V	-	129	-	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	-	1650	-	pF
		V_R = 800 V, T_c = 25 °C, F = 1 MHz	-	110	-	

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)

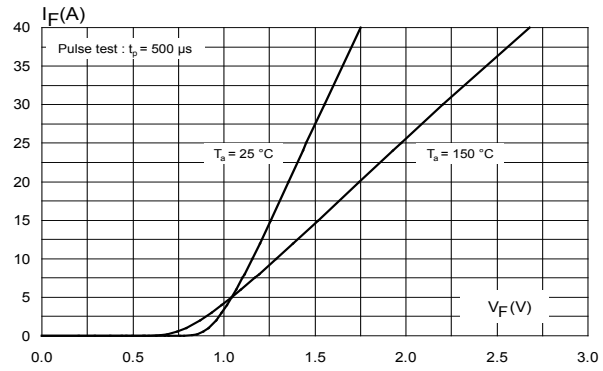


Figure 2. Reverse leakage current versus reverse voltage applied (typical values)

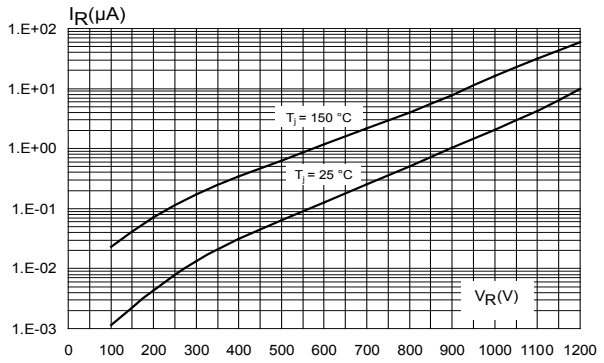


Figure 3. Peak forward current versus case temperature (TO-220AC, D²PAK)

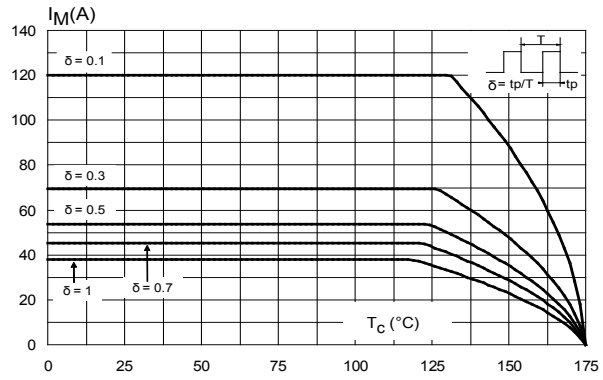


Figure 4. Peak forward current versus case temperature (DO-247 LL)

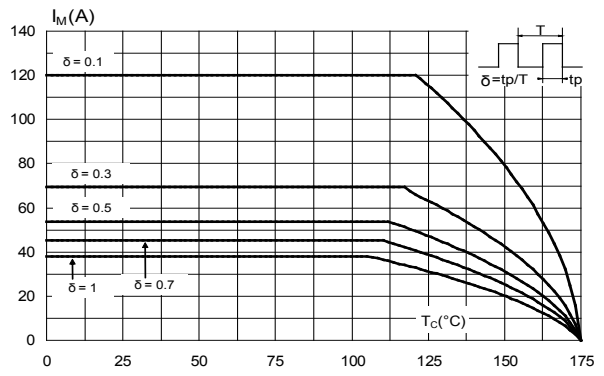


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

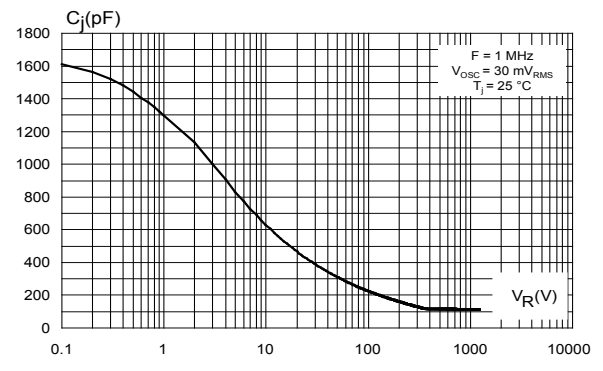


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, D²PAK)

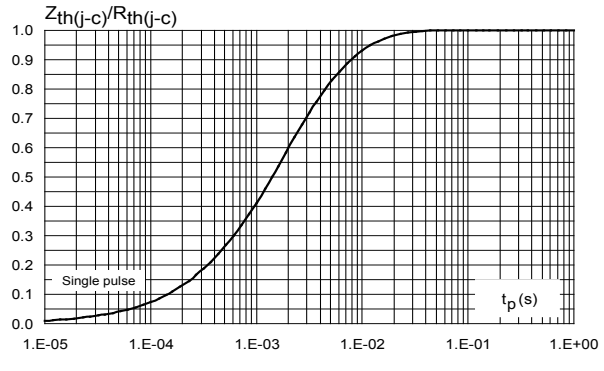


Figure 7. Relative variation of thermal impedance junction to case versus pulse duration (DO-247 LL)

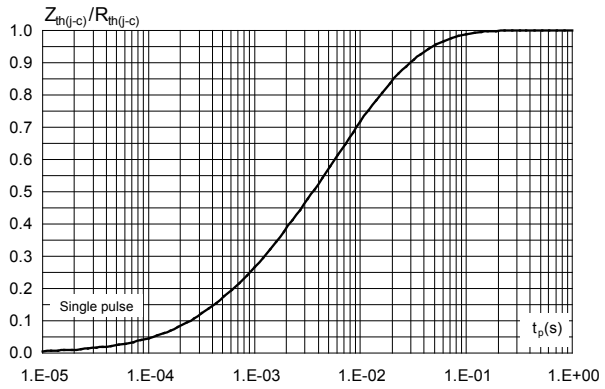


Figure 8. Non- repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

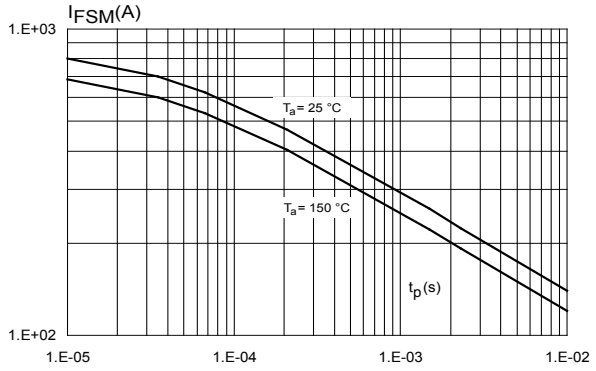


Figure 9. Total capacitive charges versus reverse voltage applied (typical values)

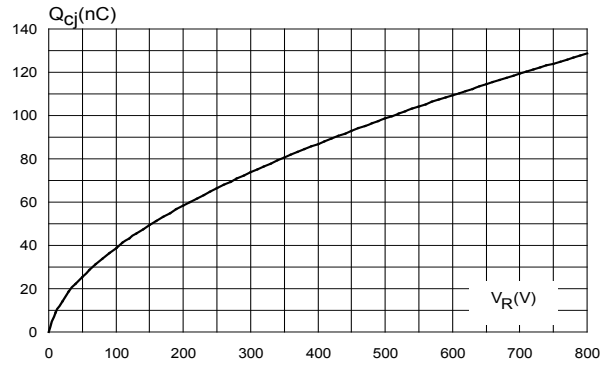
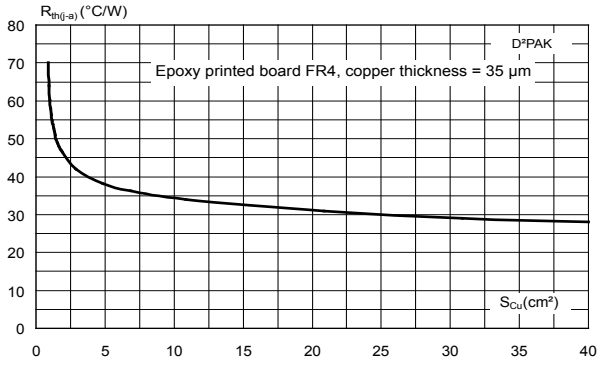


Figure 10. Thermal resistance junction to ambient versus copper surface under tab for D²PAK package (typical values)



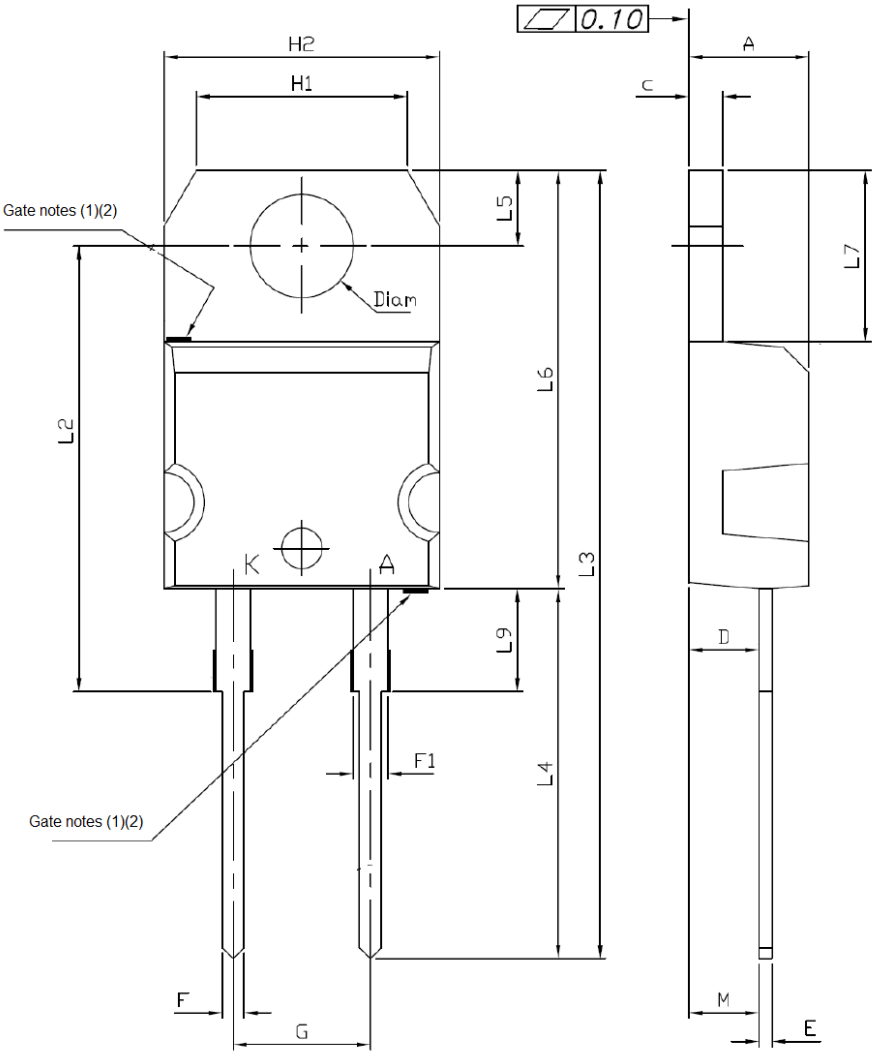
2 Package information

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. 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 11. 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.

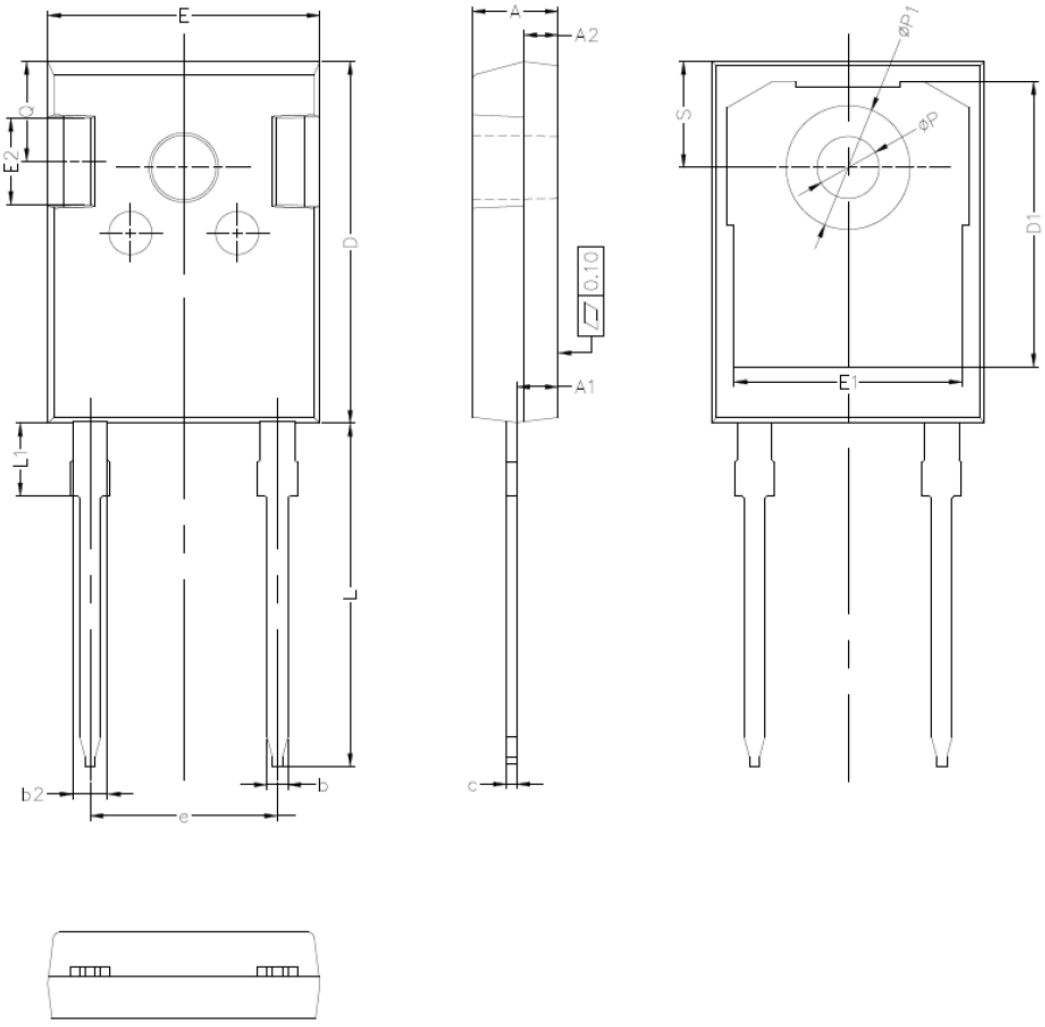
Table 5. **TO-220AC package mechanical data**

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

2.2 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 12. DO-247 LL package outline



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

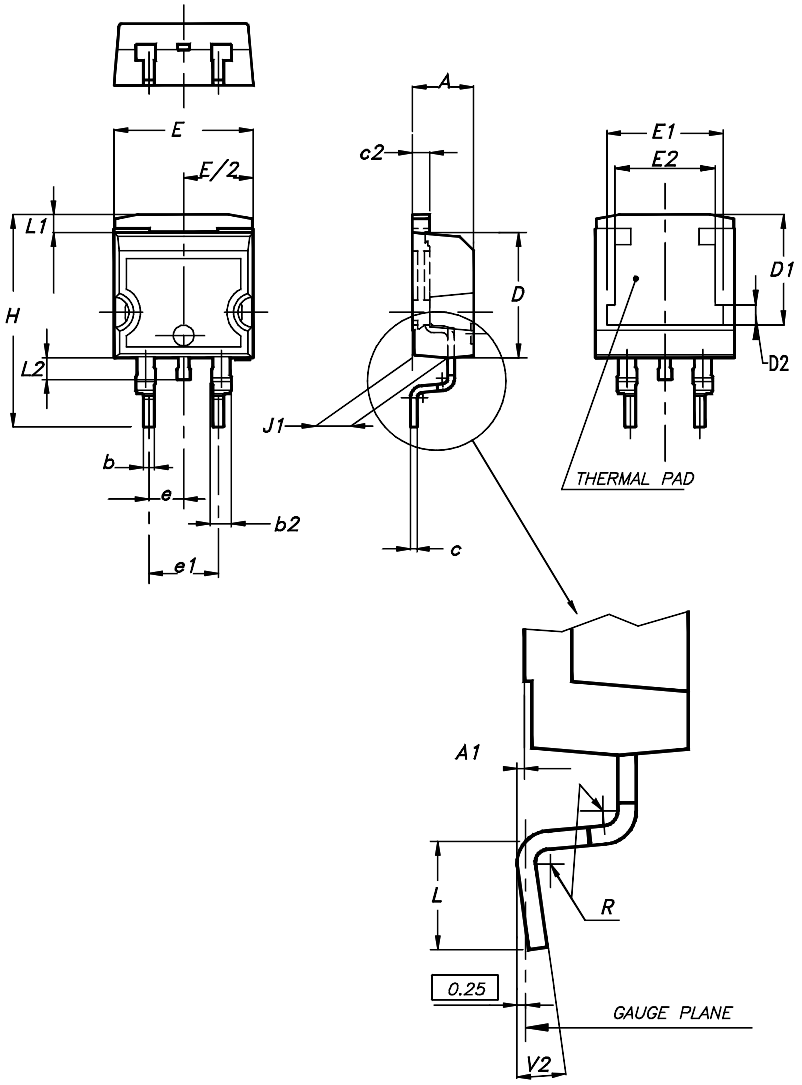
Table 6. **DO-247 LL package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.70	5.31	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
c	0.38	0.89	0.015	0.035
D	20.80	21.46	0.819	0.845
D1	13.08		0.515	
E	15.49	16.26	0.610	0.640
e	10.88 typ.		0.428	
E1	13.06		0.514	
E2	3.43	5.10	0.135	0.200
L	19.80	20.32	0.779	0.800
L1		4.50		0.177
P	3.50	3.70	0.137	0.146
P1	7.00	7.40	0.275	0.292
Q	5.38	6.20	0.219	0.244
S	6.16 typ.		0.243	

2.3 D²PAK package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)

Figure 13. D²PAK package outline

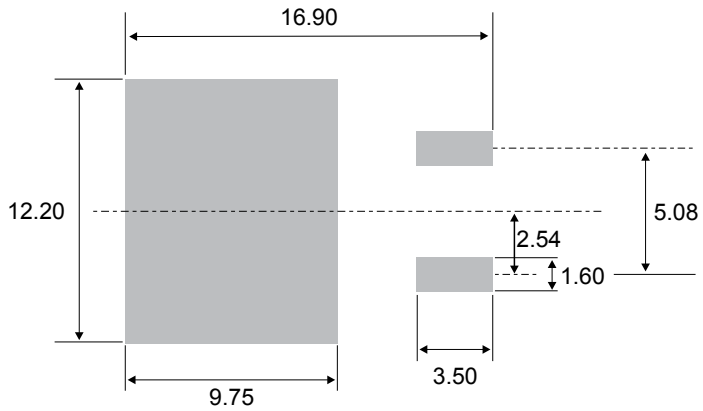


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 7. D²PAK package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.36	4.60	0.172	0.181
A1	0.00	0.25	0.000	0.010
b	0.70	0.93	0.028	0.037
b2	1.14	1.70	0.045	0.067
c	0.38	0.69	0.015	0.027
c2	1.19	1.36	0.047	0.053
D	8.60	9.35	0.339	0.368
D1	6.90	8.00	0.272	0.311
D2	1.10	1.50	0.043	0.060
E	10.00	10.55	0.394	0.415
E1	8.10	8.90	0.319	0.346
E2	6.85	7.25	0.266	0.282
e	2.54 typ.		0.100	
e1	4.88	5.28	0.190	0.205
H	15.00	15.85	0.591	0.624
J1	2.49	2.90	0.097	0.112
L	1.90	2.79	0.075	0.110
L1	1.27	1.65	0.049	0.065
L2	1.30	1.78	0.050	0.070
R	0.4 typ.		0.015	
V2	0°	8°	0°	8°

Figure 14. D²PAK recommended footprint (dimensions in mm)



3 Ordering information

Table 8. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC20H12D	STPSC20H12D	TO-220AC	1.86 g	50	Tube
STPSC20H12WL	STPSC20H12WL	DO-247 LL	5.9 g	30	Tube
STPSC20H12G-TR	STPSC20H12G	D²PAK	1.48 g	1000	Tape and reel

Revision history

Table 9. Document revision history

Date	Revision	Changes
13-May-2016	1	Initial release.
26-May-2016	2	Updated *Table 2: "Absolute ratings (limiting values at 25 °C, unless otherwise specified)"* and *Figure 8: "Non- repetitive peak surge forward current versus pulse duration (sinusoidal waveform)"*.
16-Mar-2017	3	Added D²PAK package.
05-Sep-2017	4	Added DO-247 LL package. Updated Section "*Features*" , Section 1:"Characteristics" and Table 9: "*Ordering information*".
10-Apr-2018	5	Updated *Section 2.2 DO-247 LL package information*.
15-Jul-2024	6	Updated Table 6.