

1200 V power Schottky silicon carbide diode

Features

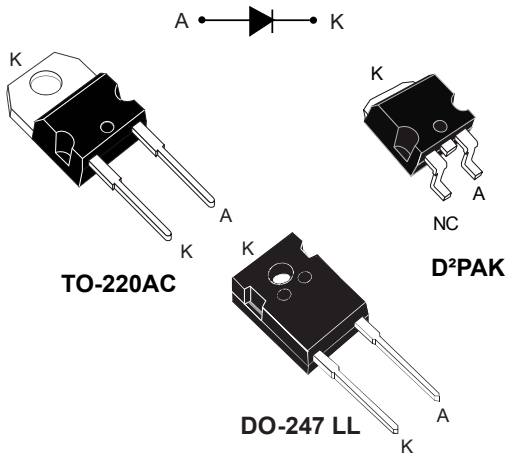
- No or negligible reverse recovery
- Switching behavior independent of temperature
- Robust high voltage periphery
- Operating from -40 °C to 175 °C
- Low V_F
- ECOPACK® compliant component

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 will boost the performance in hard switching conditions. This rectifier will enhance the performance of the targeted application. Its high forward surge capability ensures a good robustness during transient phases.



Product status link	
STPSC20H12	
Product summary	
Symbol	Value
$I_{F(AV)}$	20 A
V_{RRM}	1200 V
$T_{j(max.)}$	175 °C
$V_{F(max.)}$	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	
I _{F(RMS)}	Forward rms current		38	A	
I _{F(AV)}	Average forward current	TO-220AC, D ² PAK, T _C = 155 °C ⁽¹⁾ , DC current	20	A	
		DO-247 LL, T _c = 150 °C ,DC current			
I _{FRM}	Repetitive peak forward current	TO-220AC, D ² PAK, 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 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, D ² PAK	0.30	0.45	°C/W
		DO-247 LL	0.40	0.55	

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-	10	120	μA
		$T_j = 150\text{ °C}$		-	60	800	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 20\text{ A}$	-	1.35	1.50	V
		$T_j = 150\text{ °C}$		-	1.75	2.25	

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

2. Pulse test: $t_p = 500\text{ }\mu\text{s}$, $\delta < 2\%$

To evaluate the conduction losses use the following equation:

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

Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$Q_{Cj}^{(1)}$	Total capacitive charge	$V_R = 800 \text{ V}$	-	129	-	nC
C_j	Total capacitance	$V_R = 0 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$	-	1650	-	pF
		$V_R = 800 \text{ V}, T_c = 25 \text{ }^\circ\text{C}, F = 1 \text{ MHz}$	-	110	-	

1. Most accurate value for the capacitive charge:

$$Q_{Cj}(V_R) = \int_0^{V_R} C_j(V) dV$$

1.2 Characteristics (curves)

Figure 1. Forward voltage drop versus forward current (typical values)

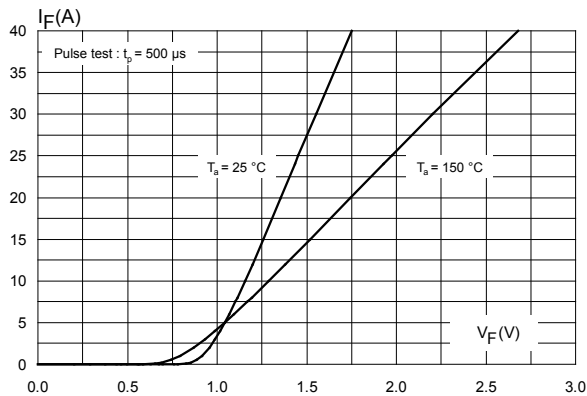


Figure 2. Reverse leakage current versus reverse voltage applied (typical values)

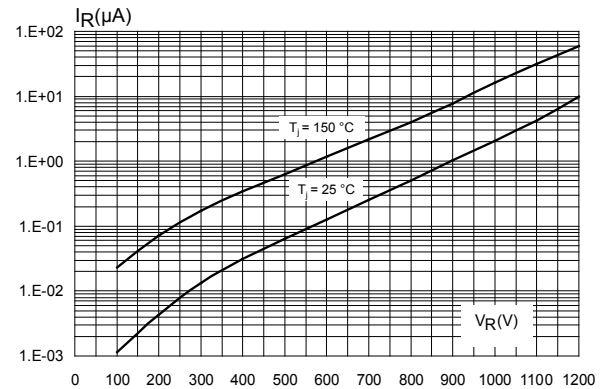


Figure 3. Peak forward current versus case temperature (TO-220AC, D²PAK)

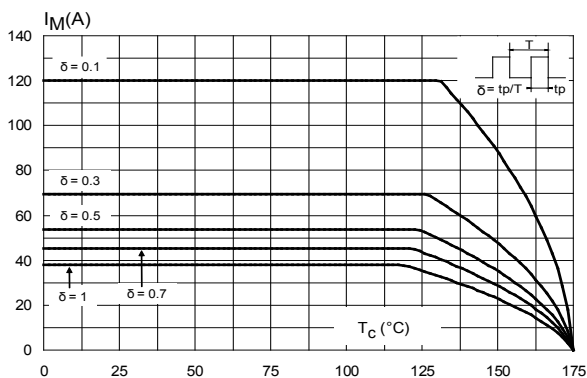


Figure 4. Peak forward current versus case temperature (DO-247 LL)

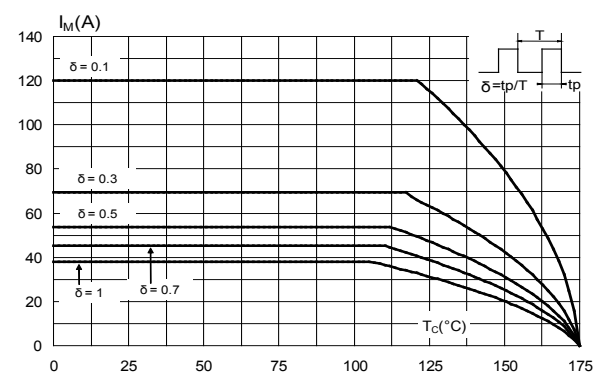


Figure 5. Junction capacitance versus reverse voltage applied (typical values)

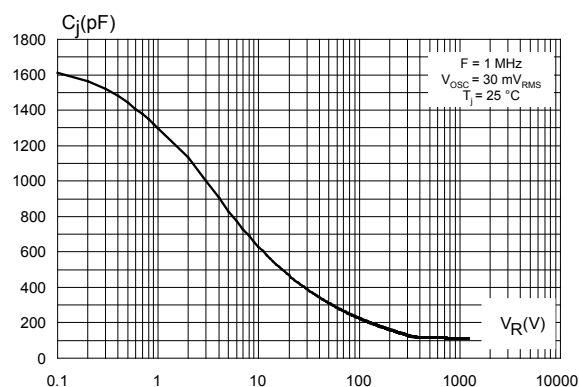


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, D²PAK)

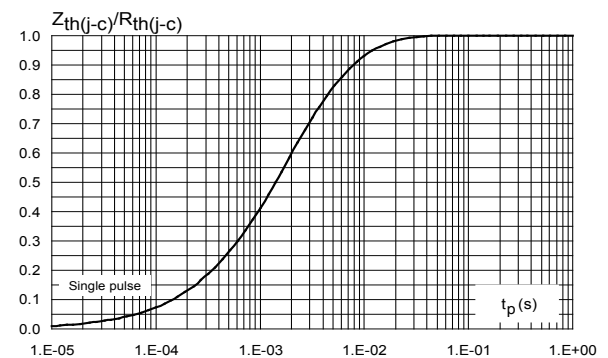


Figure 7. Relative variation of thermal impedance junction to case versus pulse duration (DO-247 LL)

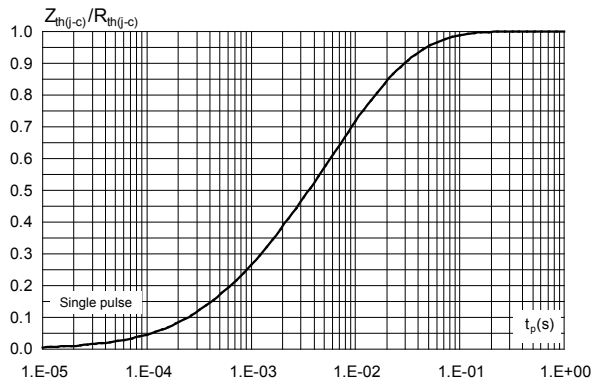


Figure 8. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

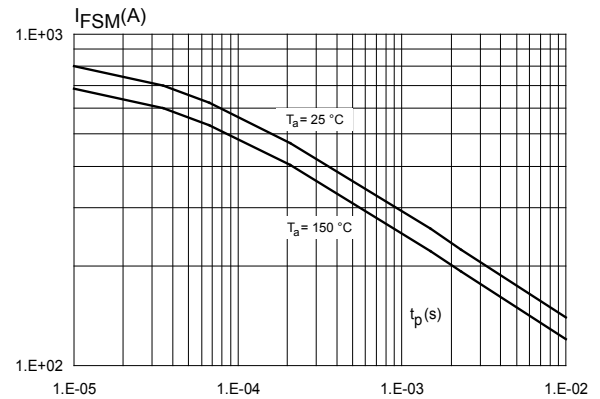


Figure 9. Total capacitive charges versus reverse voltage applied (typical values)

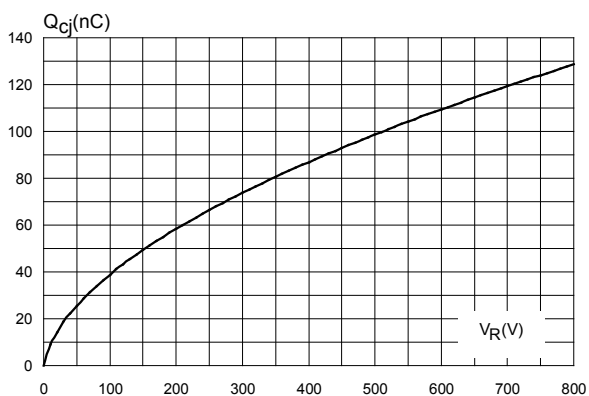
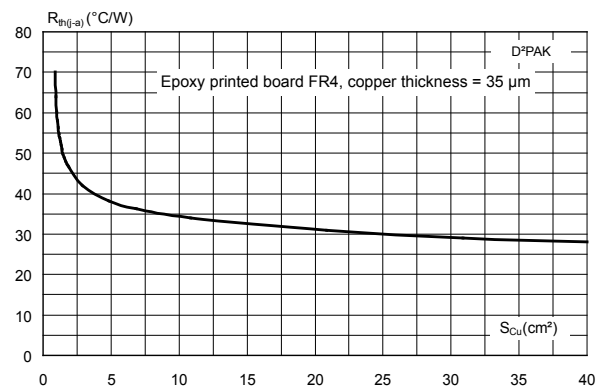


Figure 10. Thermal resistance junction to ambient versus copper surface under tab for D²PAK package (typical values)



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

- Cooling method: by conduction (C)
- Epoxy meets UL94,V0
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.7 N·m

Figure 11. TO-220AC package outline

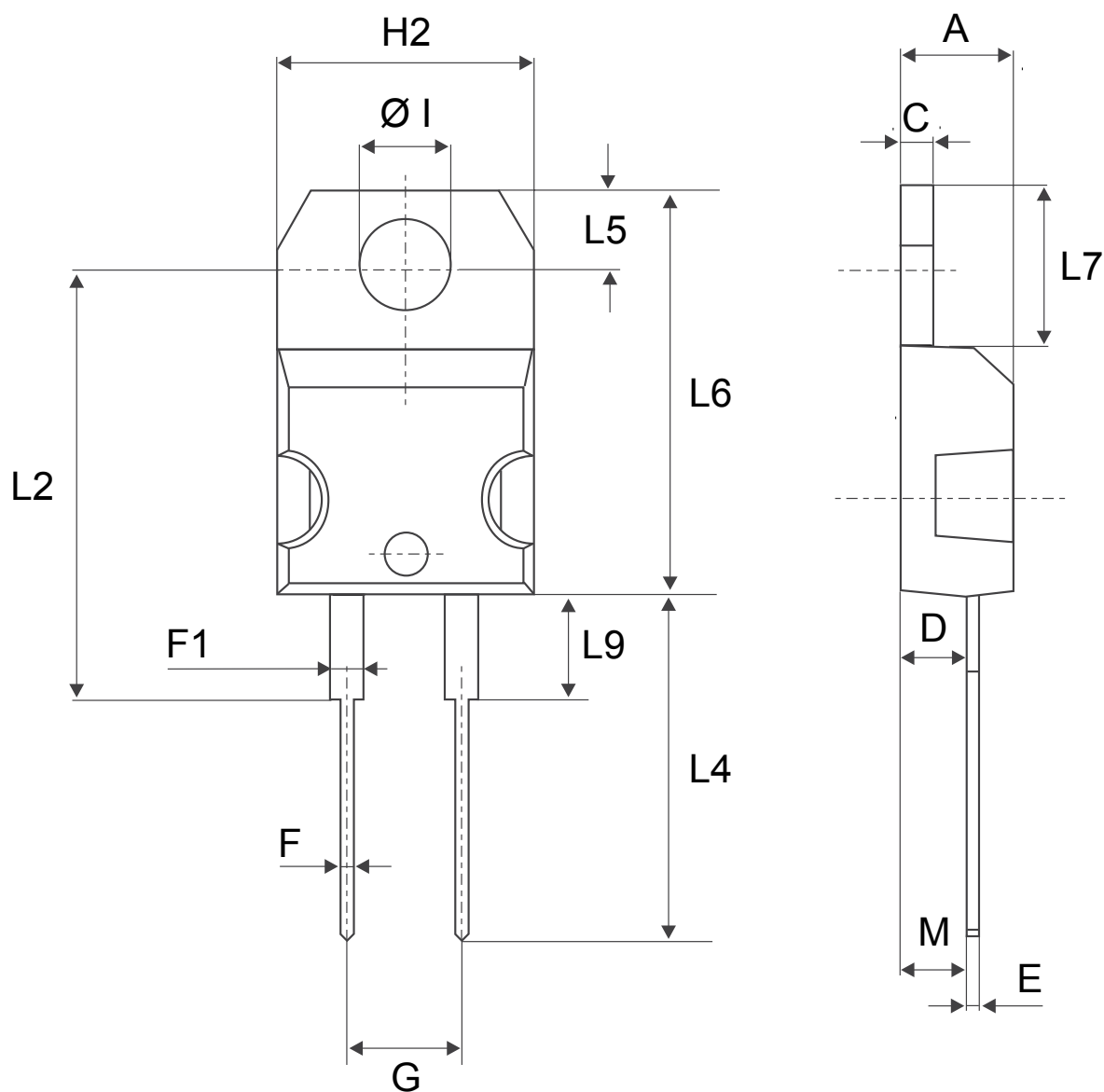


Table 5. TO-220AC package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	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 typ.		0.645 typ.	
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	2.6 typ.		0.102 typ.	
Diam	3.75	3.85	0.147	0.151

2.2 DO-247 LL package information

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

Figure 12. DO-247 LL package outline

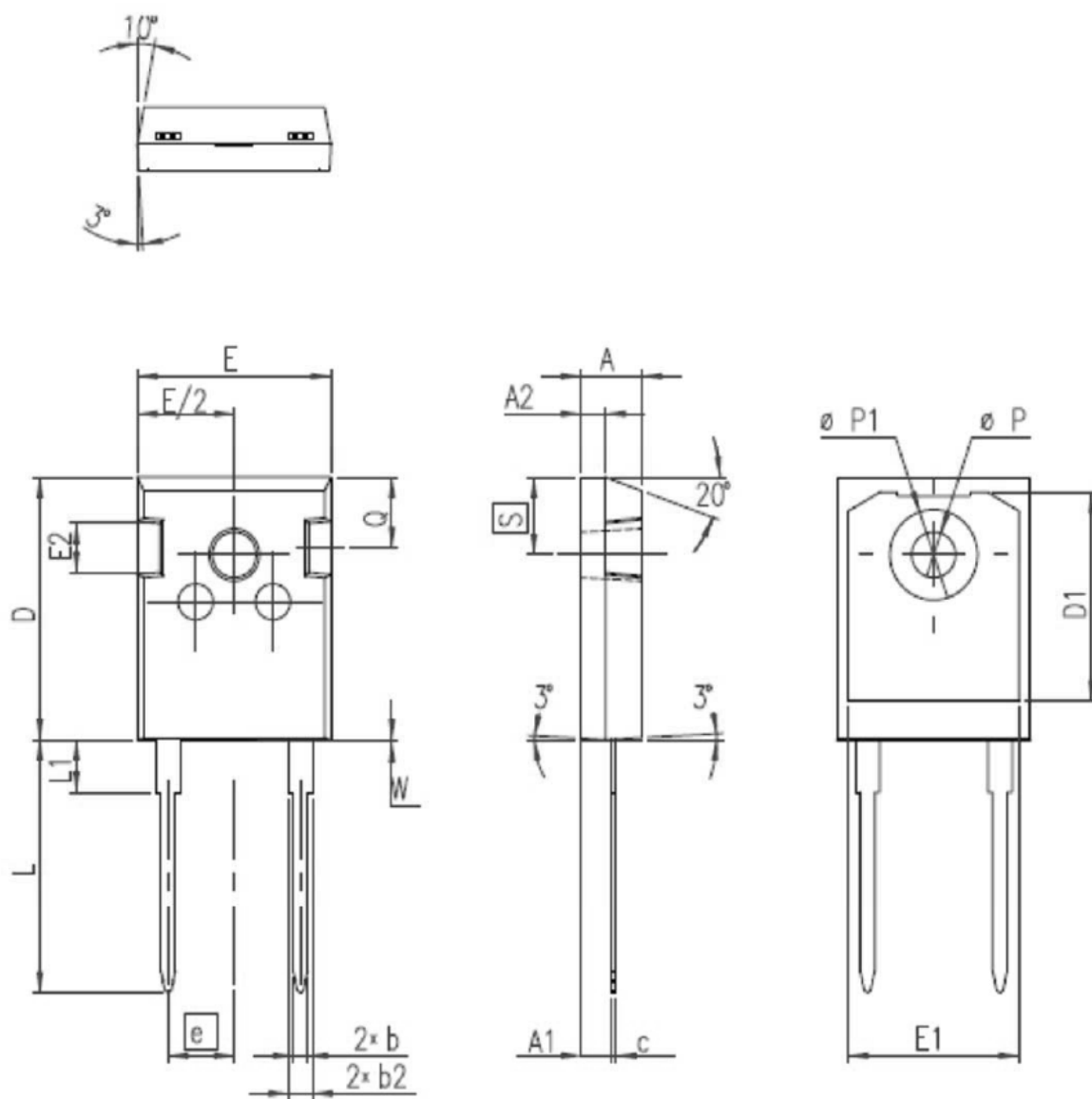


Table 6. DO-247 LL package mechanical data

Ref.	Dimensions			
	Millimeters		Inches ⁽¹⁾	
	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	5.44 typ.		0.214	
E1	13.46		0.530	
E2	3.43	3.99	0.135	0.157
L	19.81	20.32	0.780	0.800
L1		4.50		0.177
P	3.56	3.66	0.140	0.144
P1	7.06	7.39	0.278	0.291
Q	5.38	6.20	0.219	0.244
S	6.17 typ.		0.243	
W		0.15		0.006

1. Inches dimensions given for reference only

2.3 D²PAK package information

- Cooling method: by conduction (C)
- Epoxy meets UL 94,V0

Figure 13. D²PAK package outline

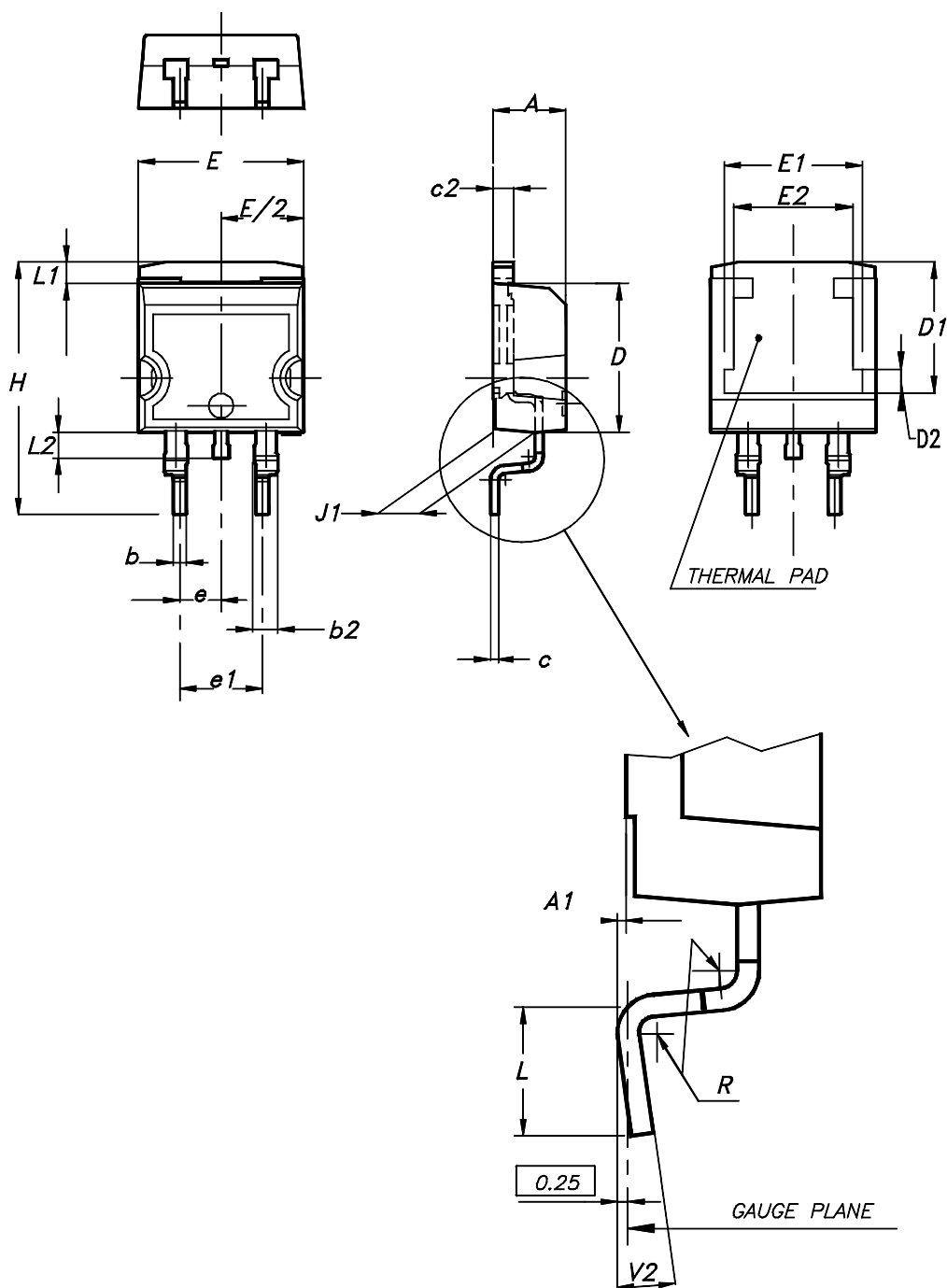
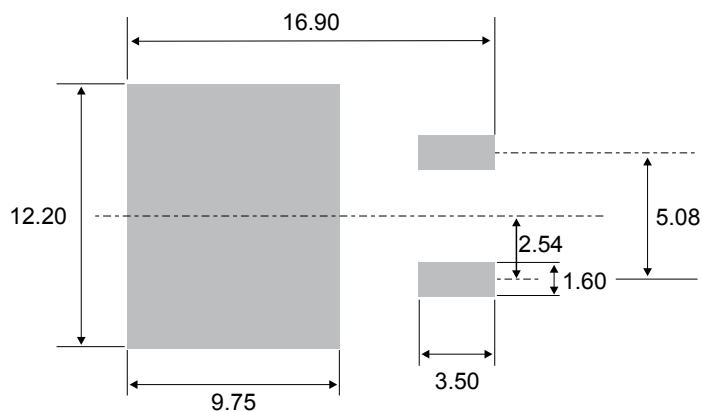


Table 7. D²PAK package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	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


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	D ² PAK	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 D ² PAK 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 .

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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.