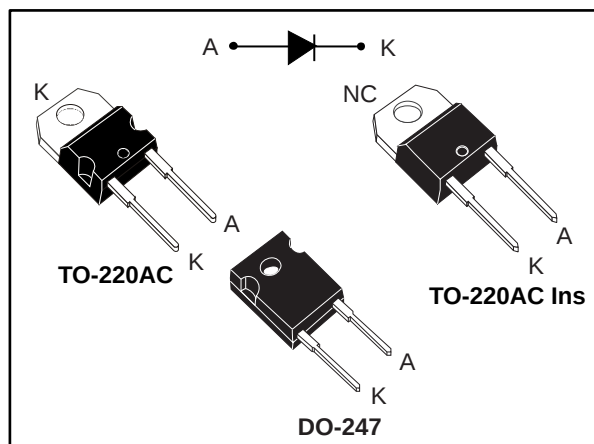


650 V power Schottky silicon carbide diode

Datasheet - production data



Description

The SiC diode 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.

Especially suited for use in PFC applications, this ST SiC diode will boost performance in hard switching conditions. Its high forward surge capability ensures good robustness during transient phases.

Features

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- Dedicated to PFC applications
- Insulated package TO-220AC ins:
 - Insulated voltage: 2500 V rms
 - Typical package capacitance: 7 pF
- High forward surge capability
- ECOPACK®2 compliant component
- Maximum operating: T_j 175 °C

Table 1: Device summary

Symbol	Value
$I_{F(AV)}$	20 A
V_{RRM}	650 V
T_j (max.)	175 °C
V_F (typ.)	1.30 V

1 Characteristics

Table 2: Absolute ratings (limiting values at 25 °C, unless otherwise specified)

Symbol	Parameter			Value	Unit
V_{RRM}	Repetitive peak reverse voltage			650	V
$I_{F(RMS)}$	Forward rms current			40	A
$I_{F(AV)}$	Average forward current	TO-220AC, DO-247	$T_C = 140\text{ °C}$, DC current	20	A
		TO-220AC Ins	$T_C = 85\text{ °C}$, DC current		
I_{FRM}	Repetitive peak forward current	TO-220AC, DO-247	$T_C = 140\text{ °C}$, $T_J = 175\text{ °C}$, $\delta = 0.1$	87	A
		TO-220AC Ins	$T_C = 85\text{ °C}$, $T_J = 175\text{ °C}$, $\delta = 0.1$	83	
I_{FSM}	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal	$T_C = 25\text{ °C}$	90	A
		$t_p = 10\text{ ms}$ sinusoidal	$T_C = 125\text{ °C}$	70	
		$t_p = 10\text{ }\mu\text{s}$ square	$T_C = 25\text{ °C}$	400	
T_{stg}	Storage temperature range			-55 to +175	°C
T_J	Operating junction temperature range ⁽¹⁾			-40 to +175	°C

Notes:

⁽¹⁾ $(dP_{tot}/dT_J) < (1/R_{th(j-a)})$ condition to avoid thermal runaway for a diode on its own heatsink.

Table 3: Thermal parameters

Symbol	Parameter	Package	Value		Unit
			Typ.	Max.	
$R_{th(j-c)}$	Junction to case	TO-220AC DO-247	0.60	0.90	°C/W
		TO-220AC Ins	1.60	2.50	

Table 4: Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_J = 25\text{ °C}$	$V_R = V_{RRM}$	-	30	300	μA
		$T_J = 150\text{ °C}$		-	280	2000	
		$T_J = 25\text{ °C}$	$V_R = 600\text{ V}$		15	150	
$V_F^{(2)}$	Forward voltage drop	$T_J = 25\text{ °C}$	$I_F = 20\text{ A}$	-	1.30	1.45	V
		$T_J = 150\text{ °C}$		-	1.45	1.65	
		$T_J = 175\text{ °C}$		-	1.5		

Notes:

⁽¹⁾Pulse test: $t_p = 5\text{ ms}$, $\delta < 2\%$

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

To evaluate the conduction losses use the following equation:

$$P = 1.02 \times I_{F(AV)} + 0.039 \times I_{F(RMS)}^2$$

Table 5: Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$Q_{cj}^{(1)}$	Total capacitive charge	$V_R = 400 \text{ V}$	-	62	-	nC
C_j	Total capacitance	$V_R = 0 \text{ V}, T_c = 25 \text{ °C}, F = 1 \text{ MHz}$	-	1250	-	pF
		$V_R = 400 \text{ V}, T_c = 25 \text{ °C}, F = 1 \text{ MHz}$	-	100	-	

Notes:

⁽¹⁾Most accurate value for the capacitive charge: $Q_{cj} = \int_0^{V_{OUT}} C_j(V_R) \cdot dV_R$

1.1 Characteristics (curves)

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

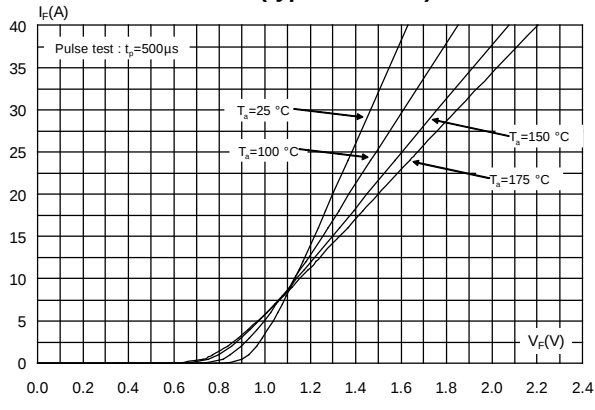


Figure 2: Reverse leakage current versus reverse voltage applied (typical values)

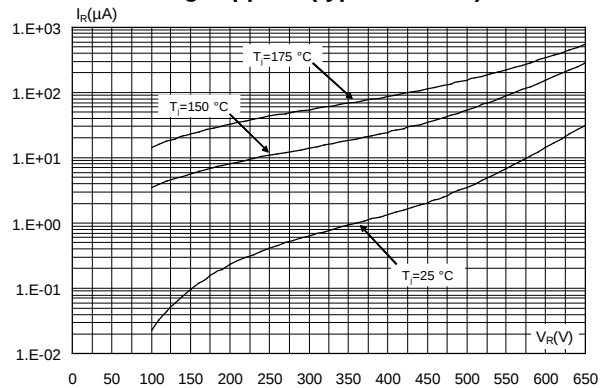


Figure 3: Peak forward current versus case temperature (TO-220AC and DO-247)

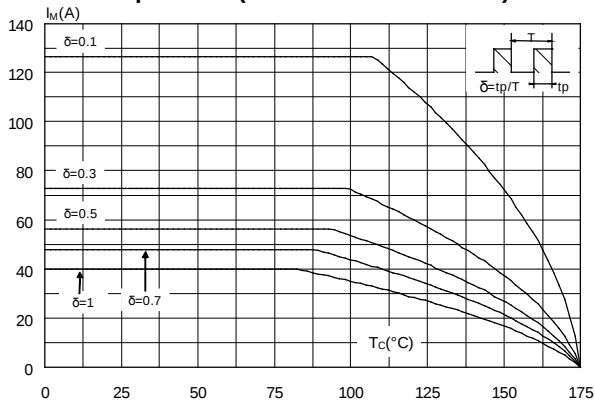


Figure 4: Peak forward current versus case temperature (TO-220AC Ins)

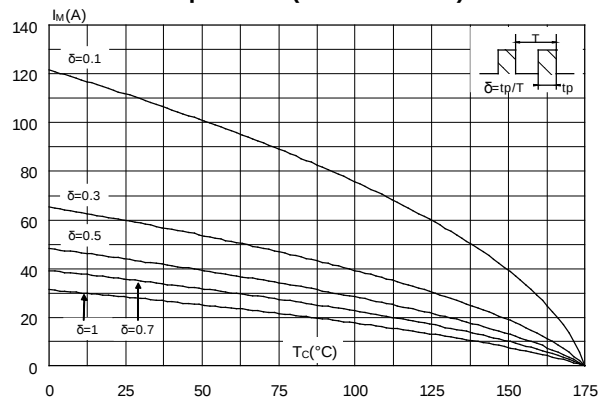


Figure 5: Junction capacitance versus reverse voltage applied (typical values)

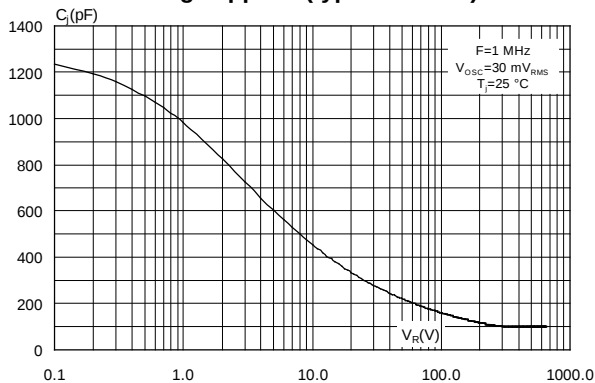


Figure 6: Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, DO-247)

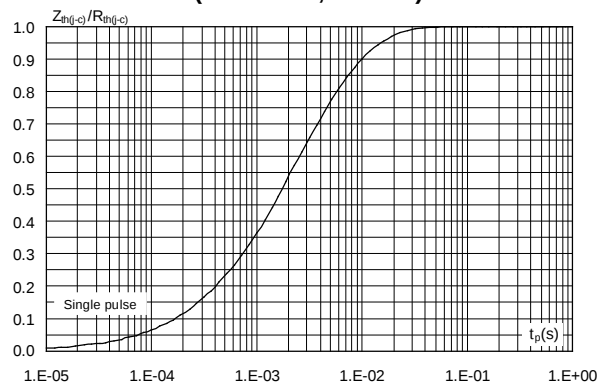


Figure 7: Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC Ins)

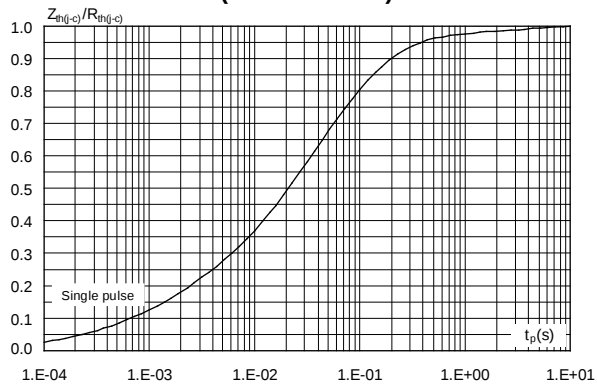


Figure 8: Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

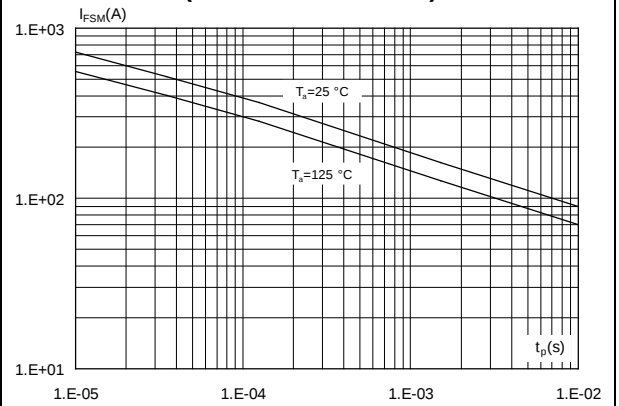
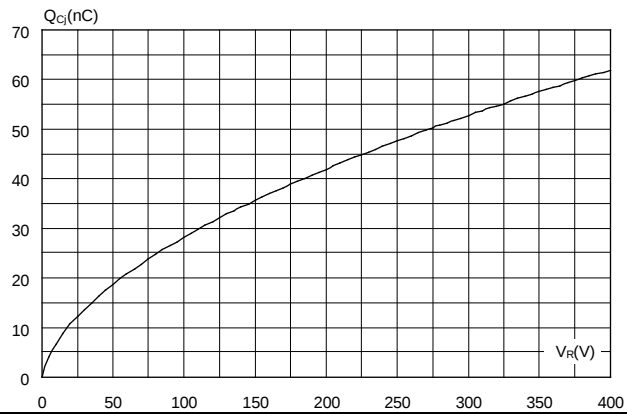


Figure 9: Total capacitive charges versus reverse voltage applied (typical values)



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. ECOPACK® is an ST trademark.

- Cooling method: by conduction (C)
- Epoxy meets UL 94,V0
- Recommended torque value: 0.55 N·m for TO-220AC and TO-220AC Ins
- Maximum torque value: 0.7 N·m for TO-220AC and TO-220AC Ins
- Recommended torque value: 0.8 N·m for DO-247
- Maximum torque value: 1 N·m for DO-247

2.1 TO-220AC package information

Figure 10: TO-220AC package outline

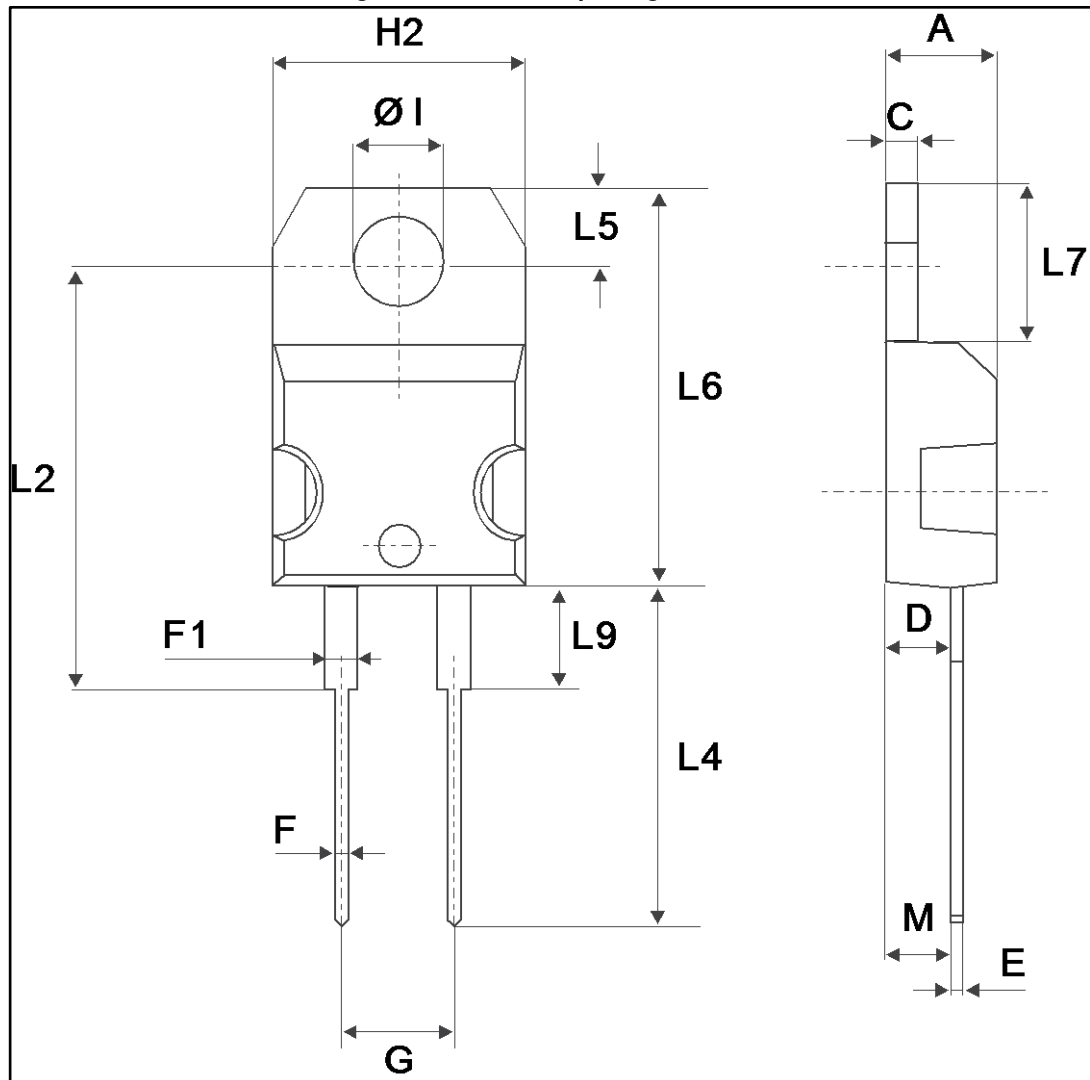


Table 6: TO-220AC package mechanical data

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.	
ØI	3.75	3.85	0.147	0.151

2.2 TO-220AC Ins package information

Figure 11: TO-220AC Ins package outline

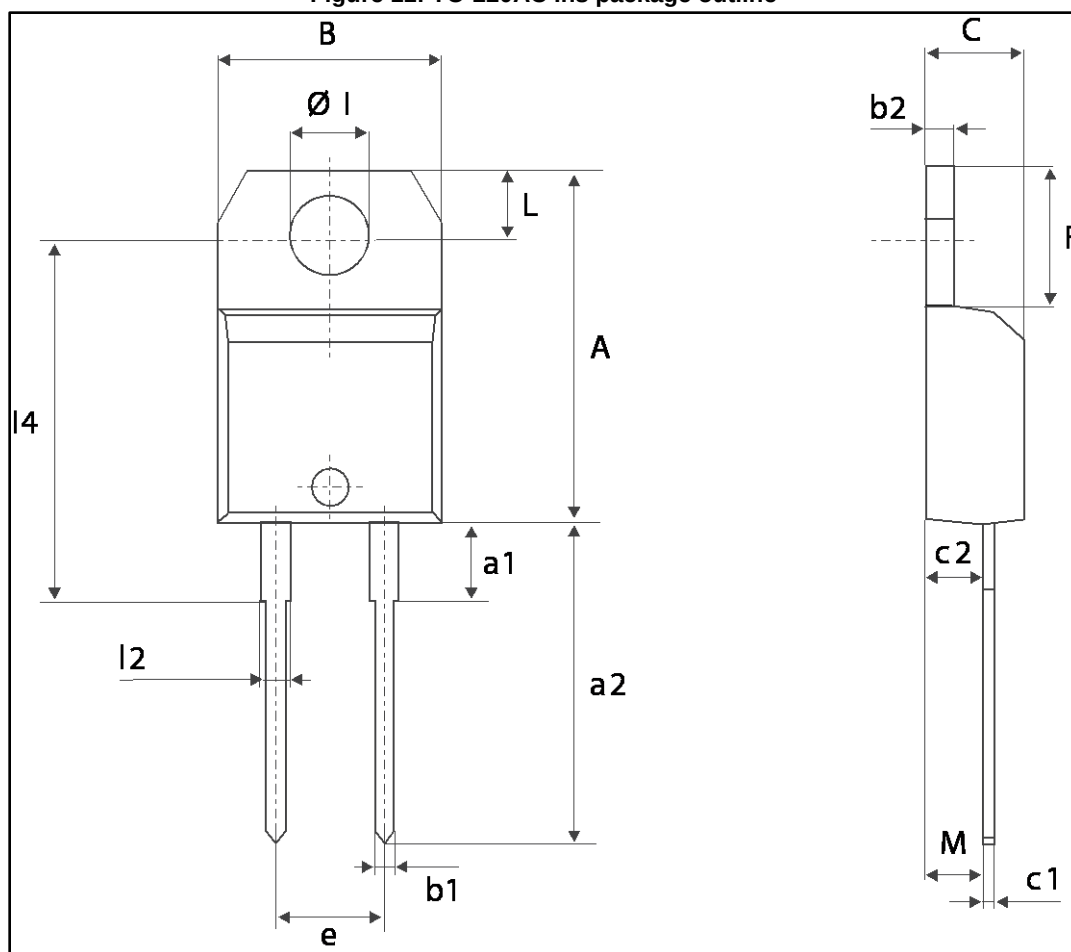


Table 7: TO-220AC Ins package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		0.107
e	4.80		5.40	0.189		0.212
F	6.20		6.60	0.244		0.259
L	2.65		2.95	0.104		0.116
l2	1.14		1.70	0.044		0.066
l4	15.80	16.40	16.80	0.622	0.645	0.661
M		2.60			0.102	
Øl	3.75		3.85	0.147		0.151

2.3 DO-247 package information

Figure 12: DO-247 package outline

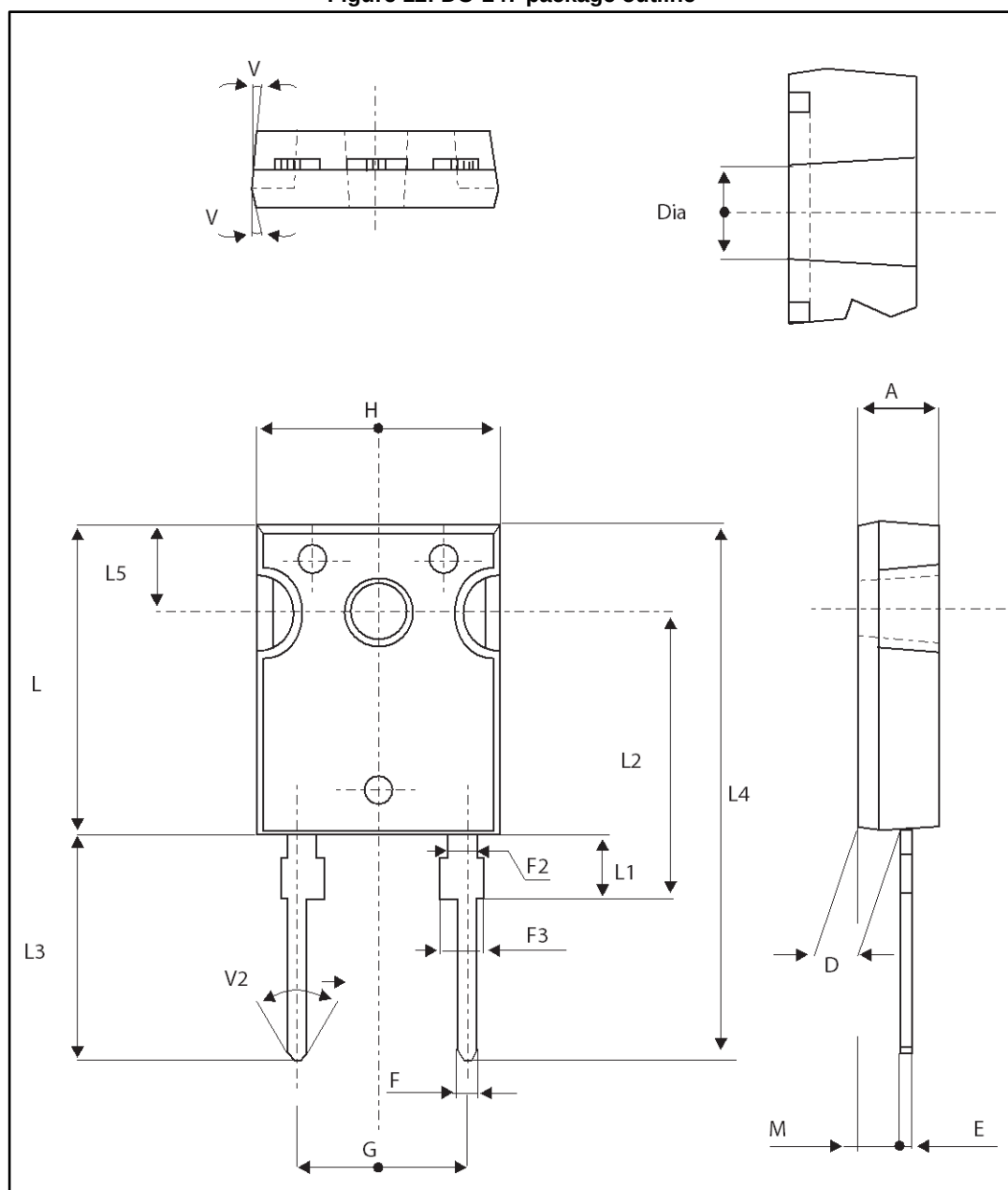


Table 8: DO-247 package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.85	5.15	0.191	0.203
D	2.20	2.60	0.086	0.102
E	0.40	0.80	0.015	0.031
F	1.00	1.40	0.039	0.055
F2	2.00 typ.		0.078 typ.	
F3	2.00	2.40	0.078	0.094
G	10.90 typ.		0.429 typ.	
H	15.45	15.75	0.608	0.620
L	19.85	20.15	0.781	0.793
L1	3.70	4.30	0.145	0.169
L2	18.50 typ.		0.728 typ.	
L3	14.20	14.80	0.559	0.582
L4	34.60 typ.		1.362 typ.	
L5	5.50 typ.		0.216 typ.	
M	2.00	3.00	0.078	0.118
V	5°		5°	
V2	60°		60°	
Dia.	3.55	3.65	0.139	0.143

3 Ordering information

Table 9: Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STPSC20065D	PSC20065D	TO-220AC	1.86 g	50	Tube
STPSC20065DI	PSC20065DI	TO-220AC Ins	2.12 g	50	Tube
STPSC20065W	PSC20065W	DO-247	4.4 g	30	Tube

4 Revision history

Table 10: Document revision history

Date	Revision	Changes
02-May-2016	1	First issue
21-Jul-2017	2	Updated Table 6: "TO-220AC package mechanical data" .

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2017 STMicroelectronics – All rights reserved