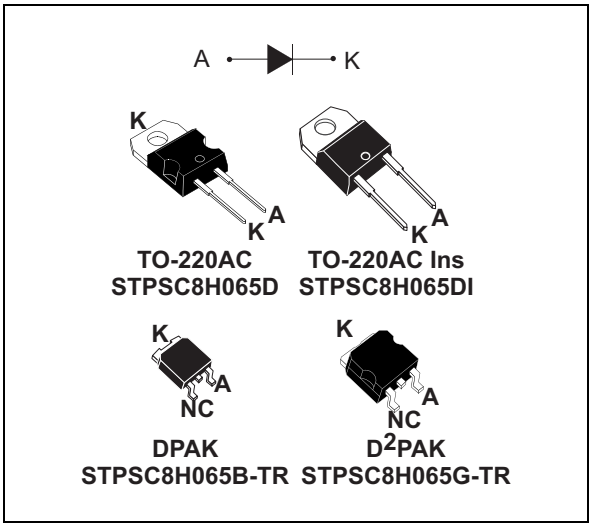
STPSC8H065

650 V power Schottky silicon carbide diode

Datasheet – production data



Features

- No reverse recovery charge in application current range
- Switching behavior independent of temperature
- High forward surge capability
- Insulated package TO-220AC Ins:
  - Insulated voltage: 2500 V rms
  - Typical package capacitance: 7 pF

Description

The SiC diode is an ultrahigh 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 the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	8 A
V_{RRM}	650 V
T_j (max)	175 °C

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		22	A
$I_{F(AV)}$	Average forward current	TO-220AC, DPAK, D^2PAK, T_c = 140 °C(1), DC	8	A
		TO-220AC Ins, T_c = 95 °C(1), DC		
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal, T_c = 25 °C t_p = 10 ms sinusoidal, T_c = 125 °C t_p = 10 µs square, T_c = 25 °C	75 69 420	A
I_{FRM}	Repetitive peak forward current	TO-220AC, DPAK, D^2PAK, T_c = 140 °C(1), T_j = 175 °C, δ = 0.1	33	A
		TO-220AC Ins, T_c = 95 °C(1), T_j = 175 °C, δ = 0.1		
T_{stg}	Storage temperature range		-55 to +175	°C
T_j	Operating junction temperature(2)		-40 to +175	°C

1. Value based on $R_{th(j-c)}$ max.
2. $\frac{dPtot}{dTj} < \frac{1}{Rth(j-a)}$ condition to avoid thermal runaway for a diode on its own heatsink

Table 3. Thermal resistance

Symbol	Parameter		Typ. value	Max. value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC, DPAK, D^2PAK	1.3	1.6	°C/W
		TO-220AC Ins	2.45	3.8	

Table 4. Static electrical characteristics

Symbol	Parameter	Tests conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-	7	80	µA
		T_j = 150 °C		-	65	335	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 8 A	-	1.56	1.75	V
		T_j = 150 °C		-	1.98	2.5	

1. t_p = 10 ms, δ < 2%
2. t_p = 500 µs, δ < 2%

To evaluate the conduction losses use the following equation: $P = 1.35 \times I_{F(AV)} + 0.144 \times I_{F^2(RMS)}$

Table 5. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Typ.	Unit
Q_{cj}(1)	Total capacitive charge	V_R = 400 V	23.5	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	414	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	38	

1. Most accurate value for the capacitive charge: $Q_{cj} = \int_0^{V_{OUT}} c_j(v_R).dv_R$

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

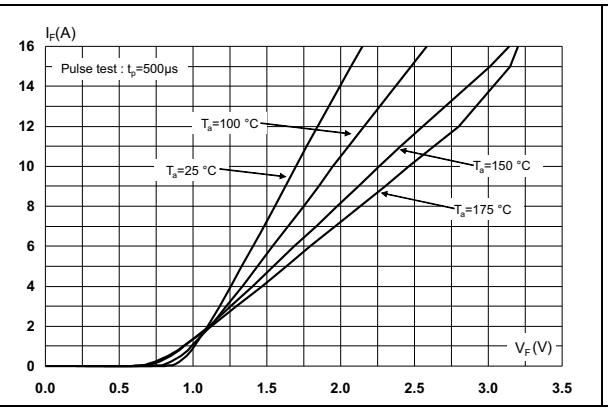


Figure 2. Forward voltage drop versus forward current (typical values, high level)

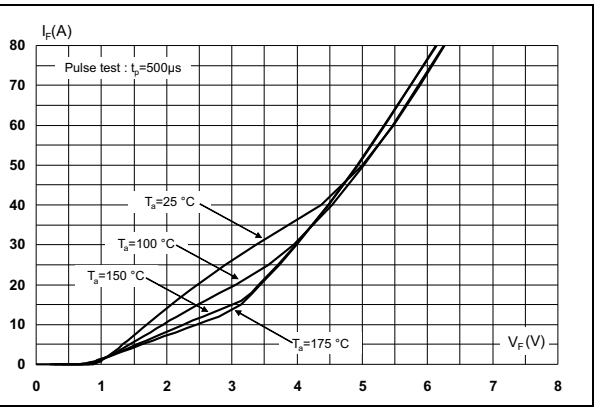


Figure 3. Reverse leakage current versus reverse voltage applied (typical values)

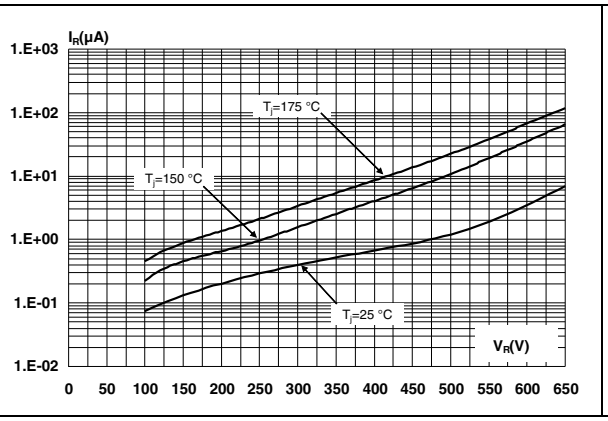


Figure 4. Peak forward current versus case temperature (TO-220AC, DPAK, D²PAK)

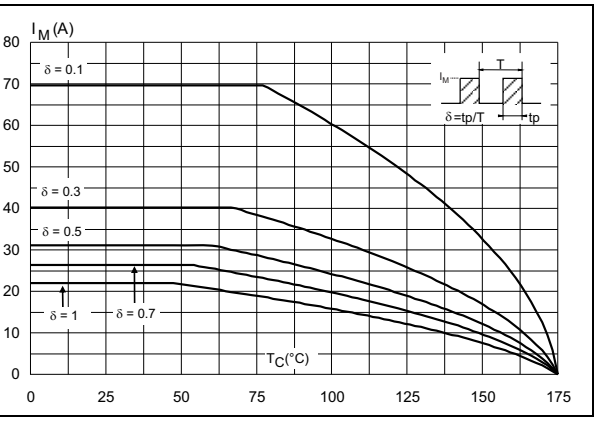


Figure 5. Peak forward current versus case temperature (TO-220AC Ins)

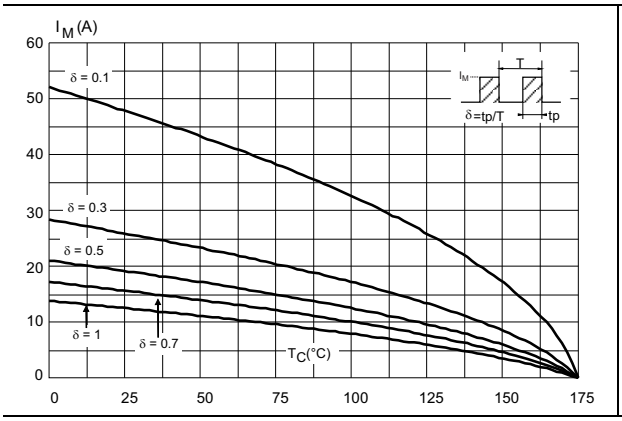


Figure 6. Junction capacitance versus reverse voltage applied (typical values)

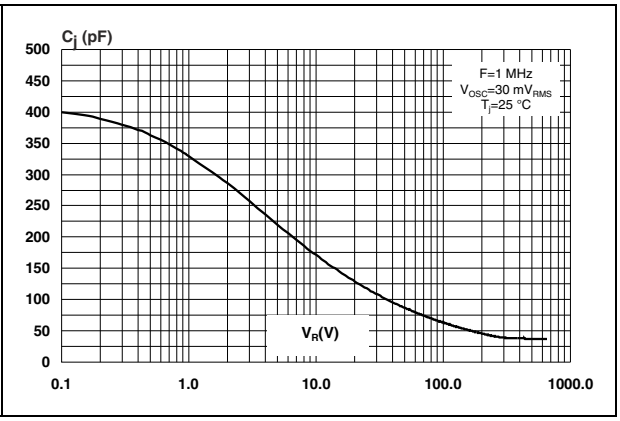


Figure 7. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, DPAK, D²PAK)

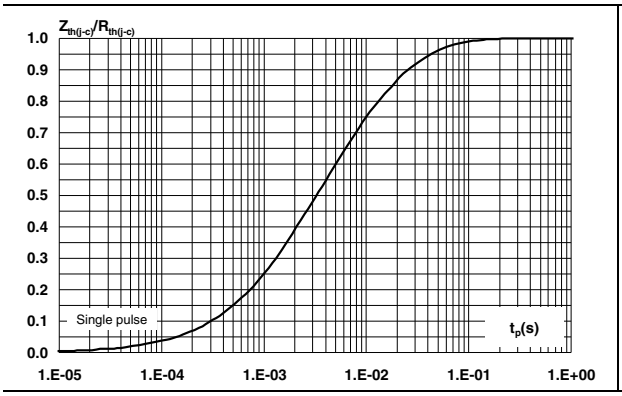


Figure 8. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC Ins)

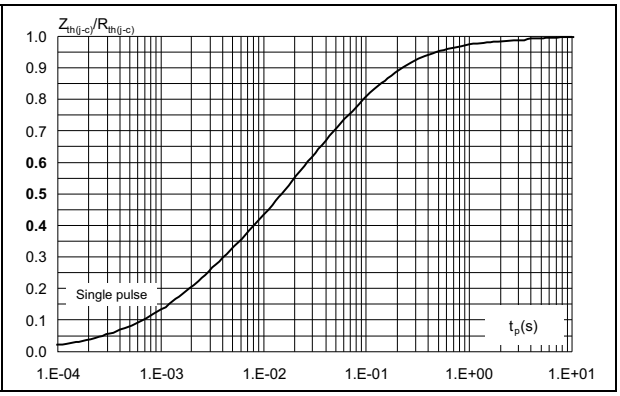


Figure 9. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

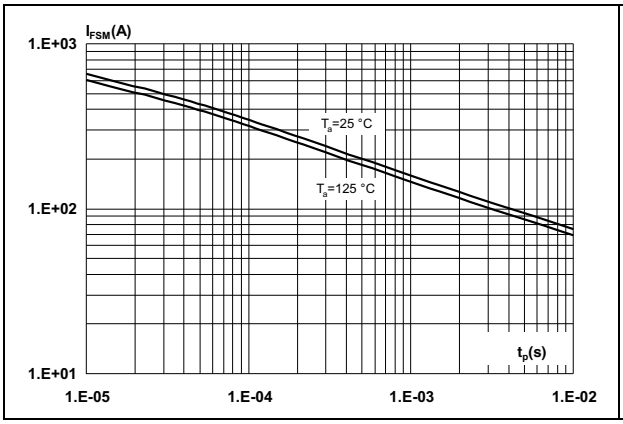
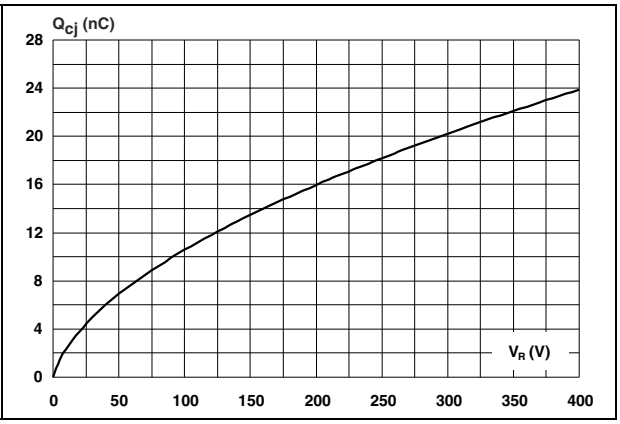


Figure 10. Total capacitive charges versus reverse voltage applied (typical values)



2 Package information

- Epoxy meets UL94, V0
- Recommended torque value (TO-220AC and TO-220AC Ins): 0.4 to 0.6 N·m
- Cooling method: conduction (C)

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.

Figure 11. TO-220AC dimension definitions

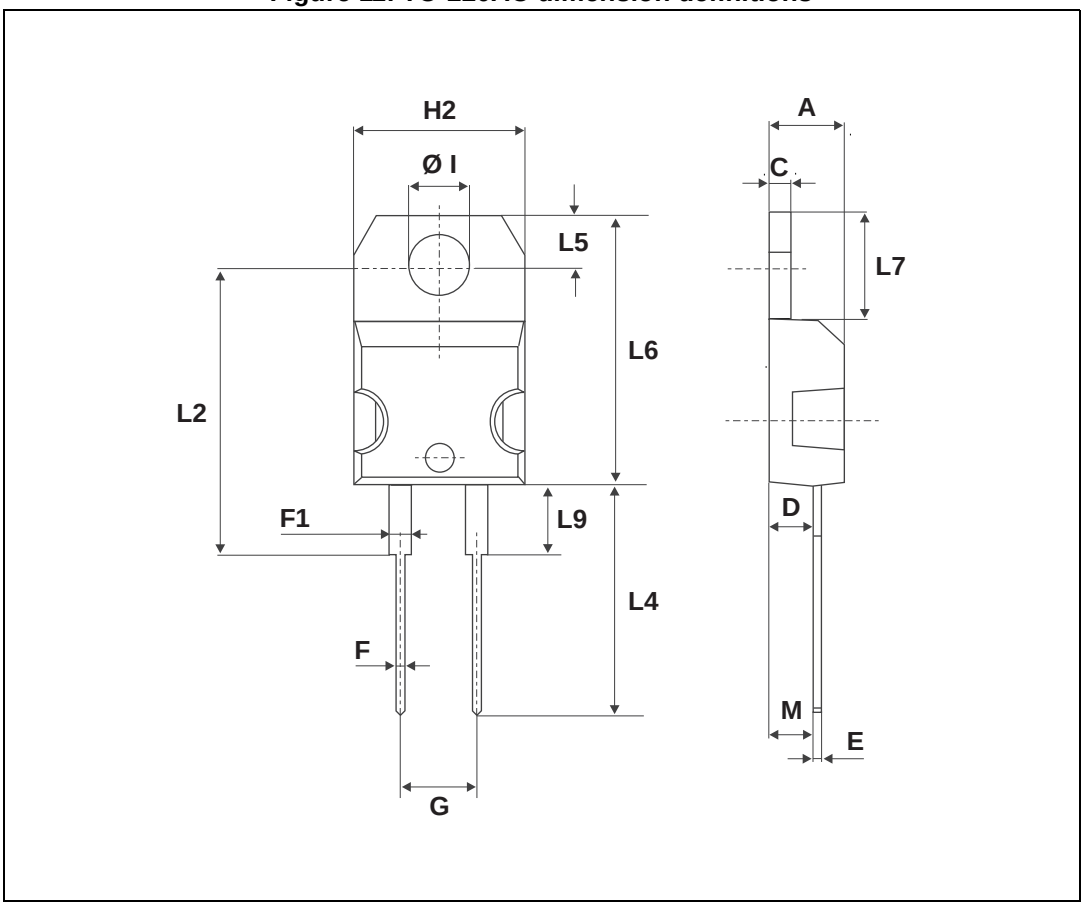


Table 6. TO-220AC dimension values

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. I	3.75	3.85	0.147	0.151

Figure 12. TO-220AC Ins dimension definitions

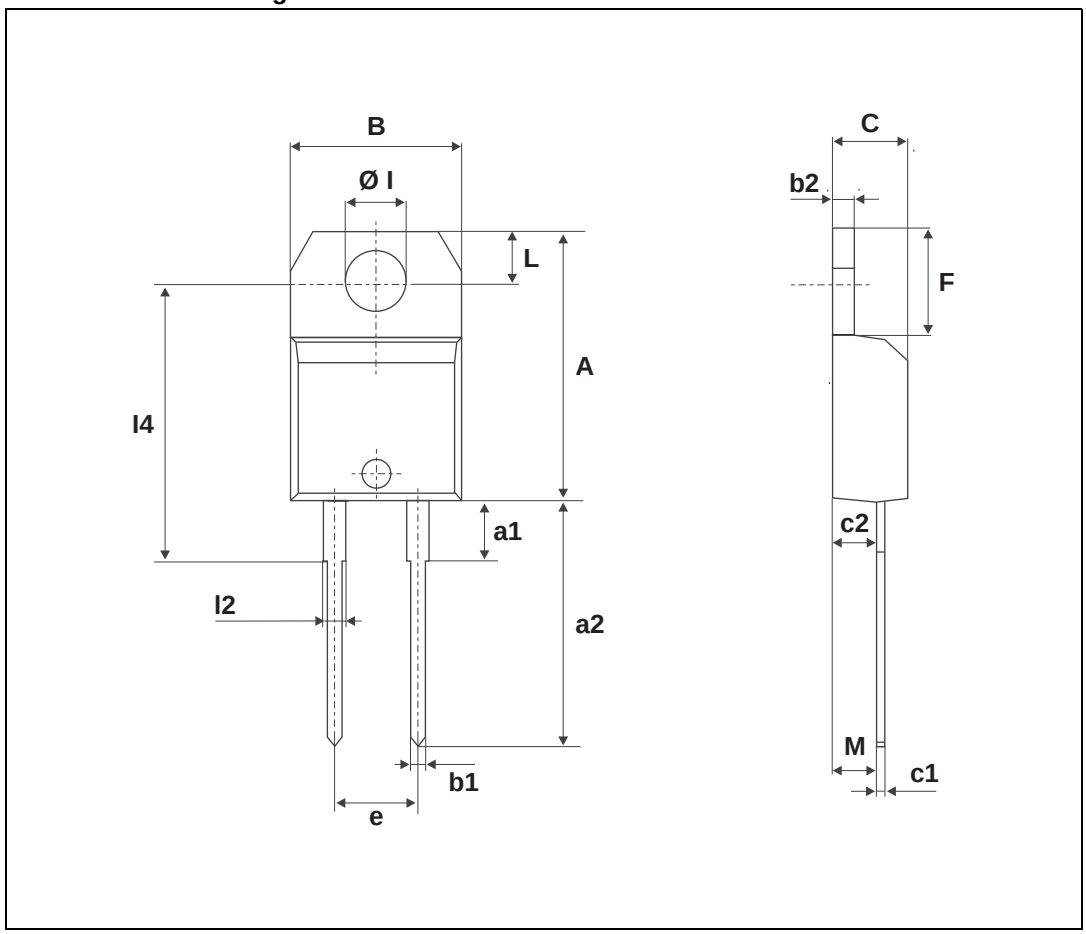


Table 7. TO-220AC Ins dimension values

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
ØI	3.75		3.85	0.147		0.151
l4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
l2	1.14		1.70	0.044		0.066
M		2.60			0.102	

Figure 13. DPAK dimension definitions

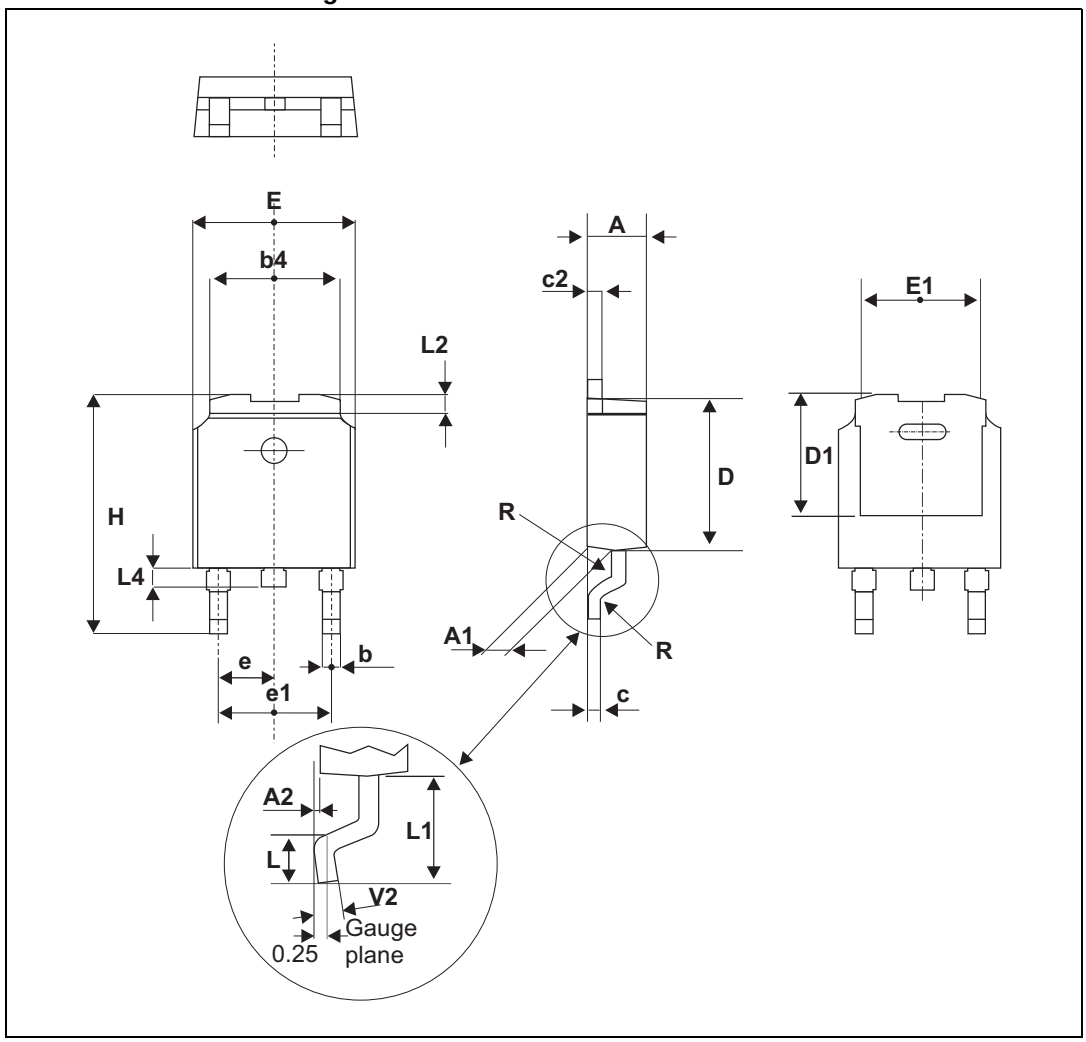
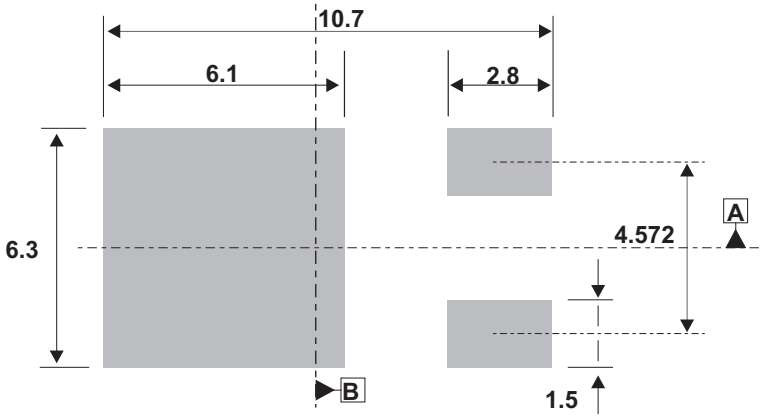


Table 8. DPAK dimension values

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.086		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
b	0.64		0.90	0.025		0.035
b4	5.20		5.40	0.204		0.212
c	0.45		0.60	0.017		0.023
c2	0.48		0.60	0.018		0.023
D	6.00		6.20	0.236		0.244
D1		5.10			0.201	
E	6.40		6.60	0.251		0.259
E1		4.70			0.185	
e		2.28			0.090	
e1	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.397
L	1.00		1.50	0.039		0.059
L1		2.80			0.11	
L2		0.80			0.032	
L4	0.60		1.00	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°

Figure 14. Footprint (dimensions in mm)



This footprint ensures insultation up to 630 V rms (according to IEC 664-1)
The device must be positioned within ⌖0.05 A B

Figure 15. D^{2}PAK dimension definitions

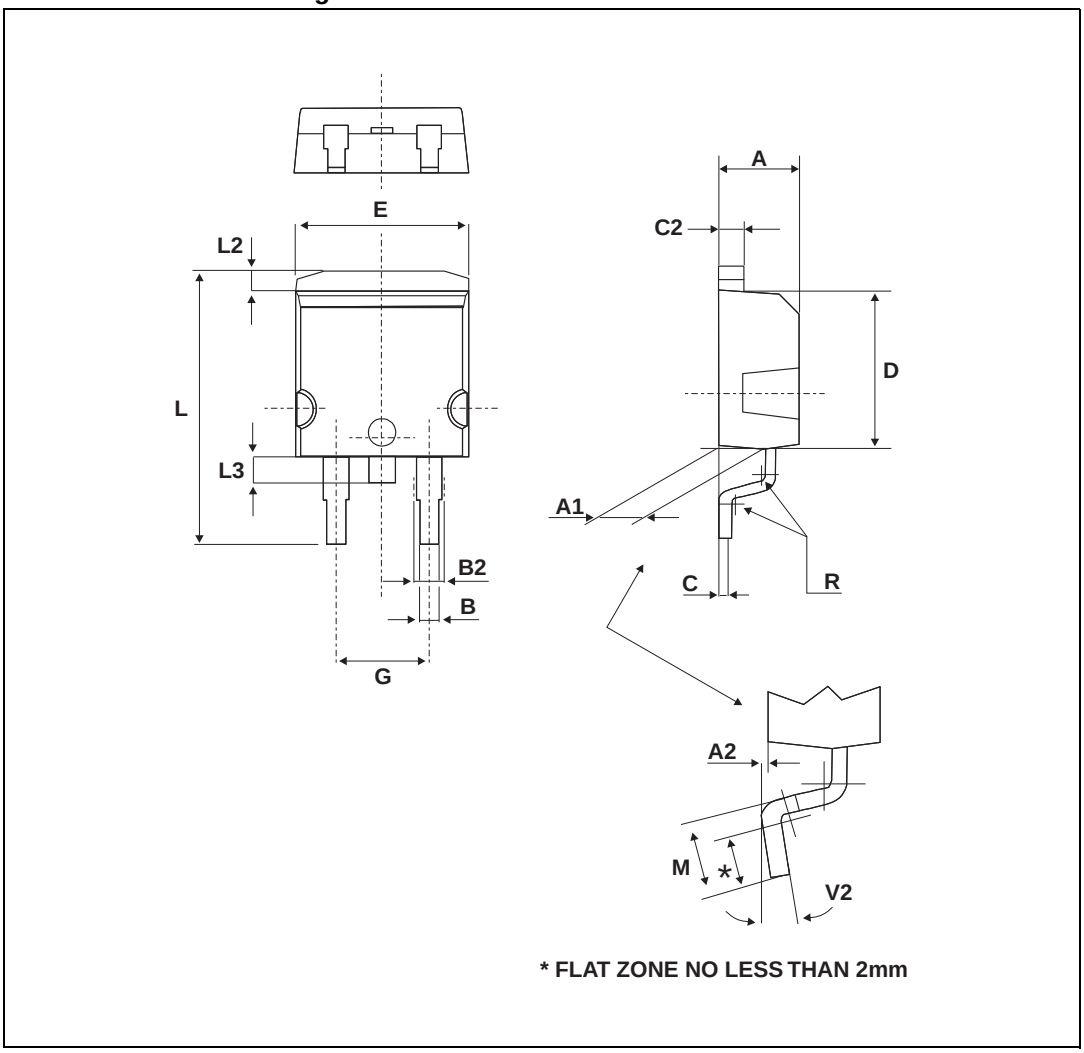
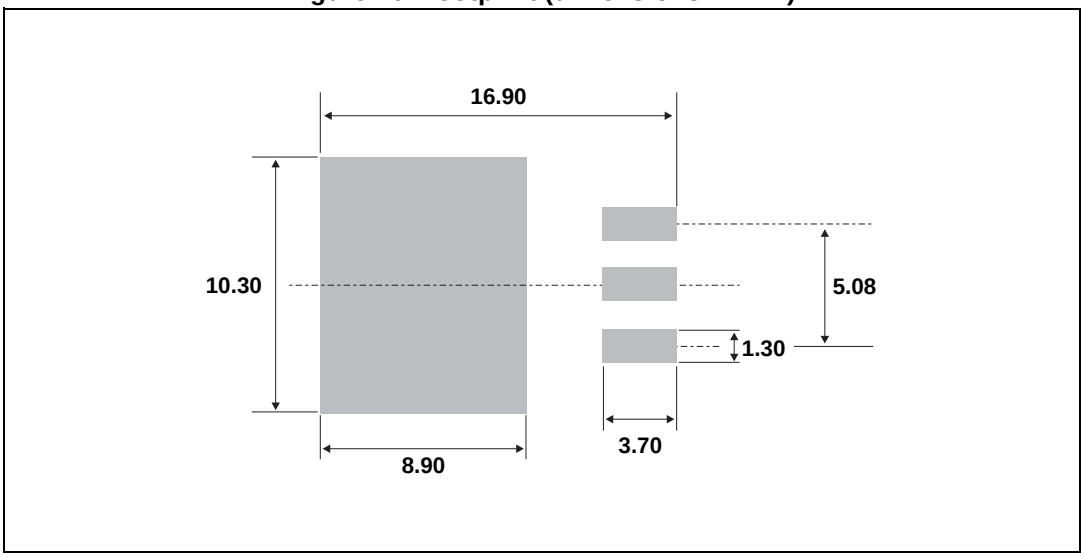


Table 9. D^{2}PAK dimension values

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40	4.60	0.173	0.181	A	4.40
A1	2.49	2.69	0.098	0.106	A1	2.49
A2	0.03	0.23	0.001	0.009	A2	0.03
B	0.70	0.93	0.027	0.037	B	0.70
B2	1.14	1.70	0.045	0.067	B2	1.14
C	0.45	0.60	0.017	0.024	C	0.45
C2	1.23	1.36	0.048	0.054	C2	1.23
D	8.95	9.35	0.352	0.368	D	8.95
E	10.00	10.40	0.393	0.409	E	10.00
G	4.88	5.28	0.192	0.208	G	4.88
L	15.00	15.85	0.590	0.624	L	15.00
L2	1.27	1.40	0.050	0.055	L2	1.27
L3	1.40	1.75	0.055	0.069	L3	1.40
M	2.40	3.20	0.094	0.126	M	2.40
R		0.40			0.016	
V2	0°		8°	0°		8°

Figure 16. Footprint (dimensions in mm)



3 Ordering information

Table 10. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPSC8H065D	STPSC8H065D	TO-220AC	1.86 g	50	Tube
STPSC8H065DI	STPSC8H065DI	TO-220AC Ins	2.12 g	50	Tube
STPSC8H065G-TR	STPSC8H065G	D^2PAK	1.48 g	1000	Tape and reel
STPSC8H065B-TR	STPSC 8H065	DPAK	0.32 g	2500	Tape and reel

4 Revision history

Table 11. Document revision history

Date	Revision	Changes
31-Aug-2012	1	First issue.
10-Oct-2012	2	Added Max. value to *Table 3*.
07-Nov-2013	3	Updated *Figure 1*, *Figure 2*, *Figure 13*, *Figure 14*, and *Table 9*.
07-Jan-2014	4	Added TO-220AC Ins package.

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