STPSC8TH13TI

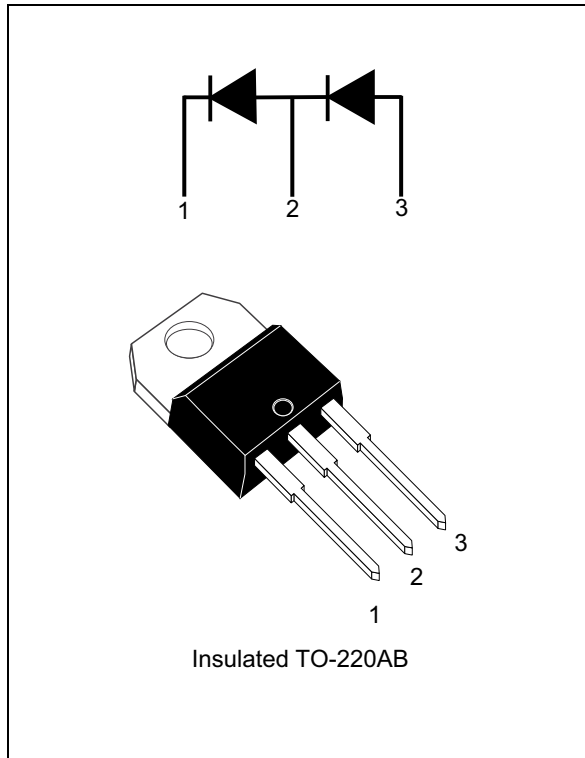## Dual 650 V power Schottky silicon carbide diode in series

Insulated TO-220AB

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 specific bridge-less topologies, this dual 650 V rectifier will boost the performance in hard switching conditions. Its high forward surge capability ensures a good robustness during transient phases.

Table 1. Device summary (per diode)

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

Features

- No or negligible reverse recovery
- Switching behavior independent of temperature
- Suited for specific bridge-less topologies
- High forward surge capability
- Insulated package:
  - Capacitance: 7 pF
  - Insulated voltage: 2500 V rms

1   Characteristics

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

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	T_c = 85 °C[1], DC current	8	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal, T_c = 25 °C	75	A
		t_p = 10 ms sinusoidal, T_c = 125 °C	69	
		t_p = 10 µs sinusoidal, T_c = 25 °C	420	
I_{FRM}	Repetitive peak forward current	T_c = 85 °C[1], δ = 0.1	33	A
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 (per diode)

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.	Max.	Unit
$R_{th(j-c)}$	Junction to case	Per diode	3.5	4.3	°C/W
		Total	1.95	2.35	
$R_{th(c)}$				0.4	°C/W

When the diodes are used simultaneously:

$\Delta T_{j(diode1)} = P_{(diode1)}$ x $R_{th(j-c)}$ (per diode) + $P_{(diode2)}$ x $R_{th(c)}$

Table 4. Static electrical characteristics (per diode)

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. 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 = 1.35 x $I_{F(AV)}$ + 0.144 x $I_F^2{}_{(RMS)}$

Table 5. Dynamic electrical characteristics (per diode)

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, per diode)
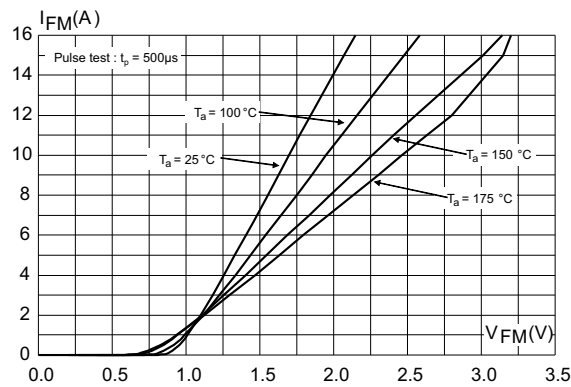
Figure 2. Forward voltage drop versus forward current (typical values, high level, per diode)
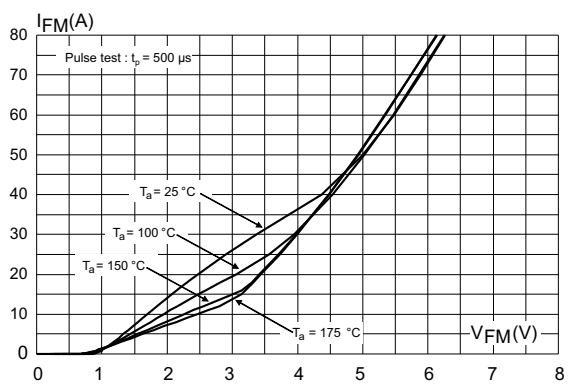
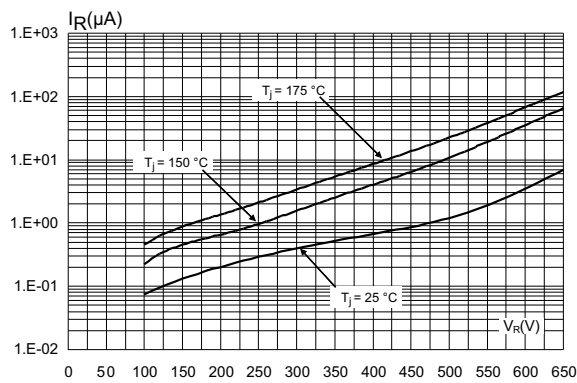**Figure 3. Reverse leakage current versus reverse voltage applied (typical values, per diode)**

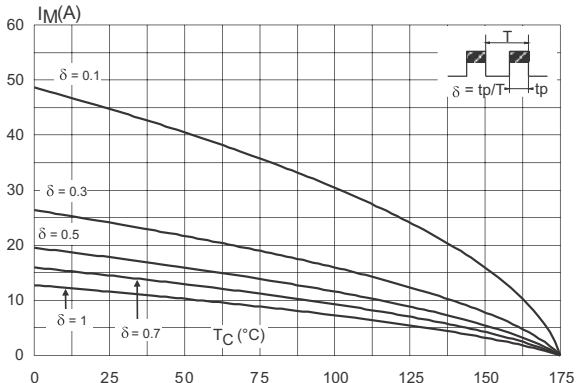**Figure 4. Peak forward current versus case temperature (per diode)**

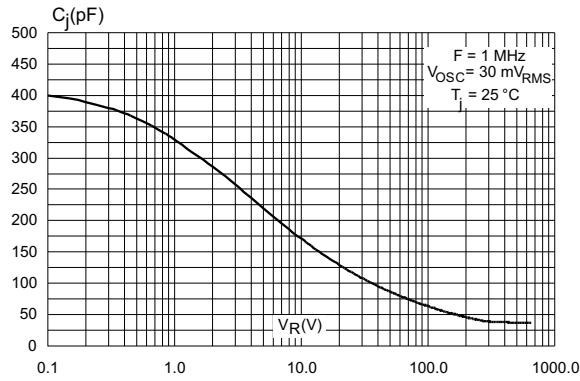**Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)**

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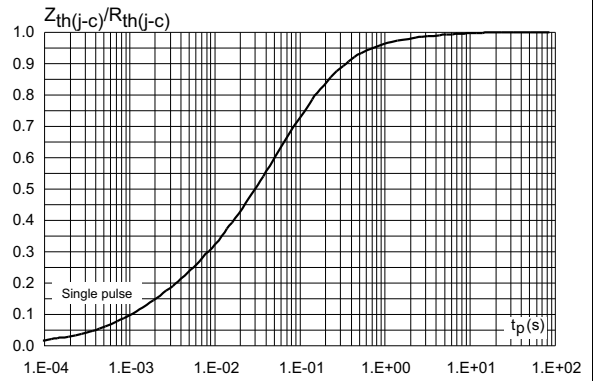

Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)
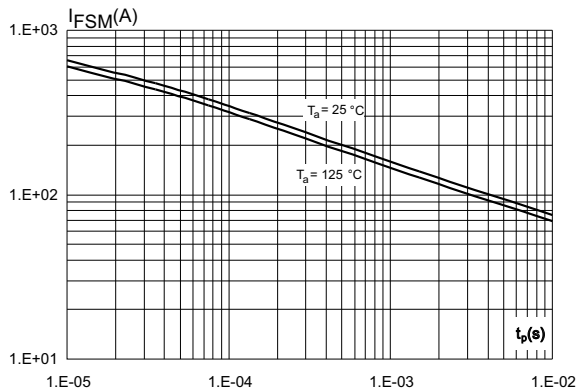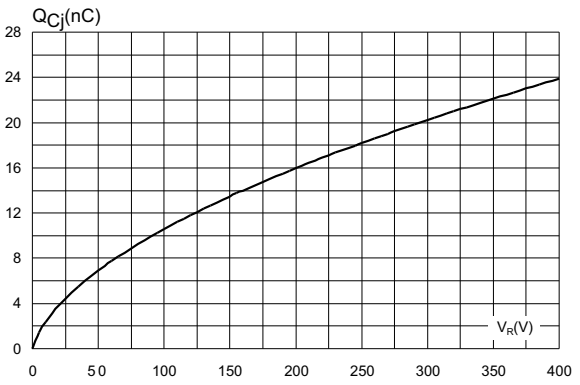

Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)

2   Package information

- Epoxy meets UL94, V0
- Lead-free package
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

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   Insulated TO-220AB package information

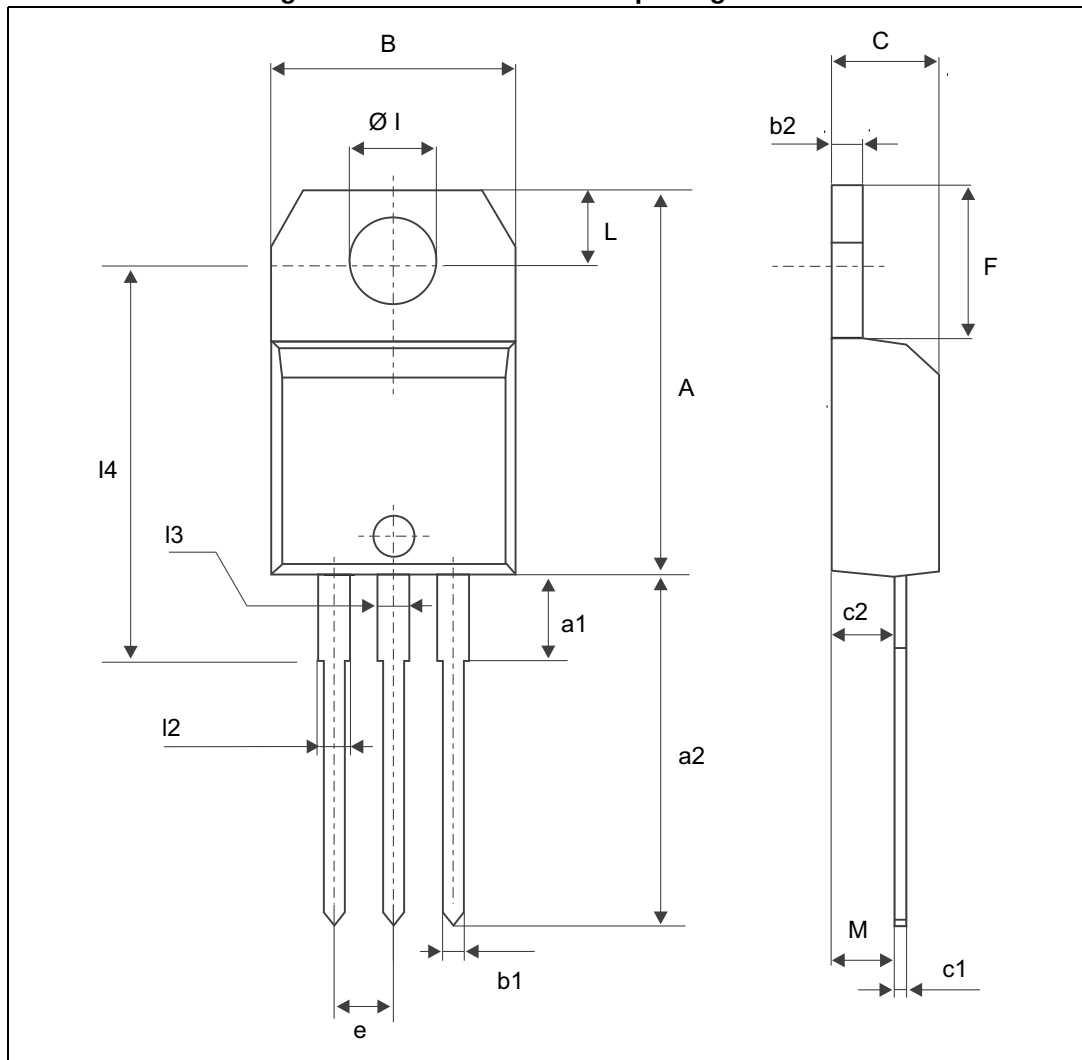**Figure 9. Insulated TO-220AB package outline**

Table 6. Insulated TO-220AB 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	2.40		2.70	0.094		0.106
F	6.20		6.60	0.244		0.259
ØI	3.75		3.85	0.147		0.151
I4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
I2	1.14		1.70	0.044		0.066
I3	1.14		1.70	0.044		0.066
M		2.60			0.102	

3   Ordering information

Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STPSC8TH13TI	STPSC 8TH13TI	Insulated TO-220AB	2.3g	50	Tube

4   Revision history

Table 8. Document revision history

Date	Revision	Changes
24-Jun-2013	1	First issue.
07-Nov-2013	2	Updated Figure 1 and Figure 2.
05-Jan-2016	3	Updated *Table 7*. Format updated to current standard.

IMPORTANT NOTICE – PLEASE READ CAREFULLY