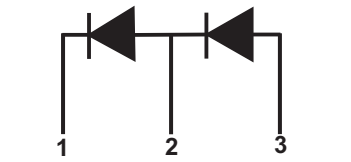
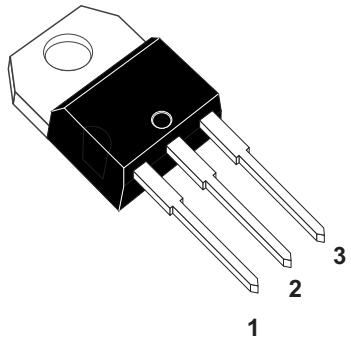
STPSC10TH13TI

Dual 650 V power Schottky silicon carbide diode in series

Datasheet - production data





Insulated TO-220AB
STPSC10TH13TI

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
$I_{F(AV)}$	10 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 = 70 °C(1), DC current	10	A
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 sinusoidal, T_c = 25 °C	90 80 470	A
I_{FRM}	Repetitive peak forward current	T_c = 70 °C(1), δ = 0.1	41	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	3.1	4.1	°C/W
		Total	1.8	2.3	
$R_{th(c)}$				0.5	°C/W

When the diodes are used simultaneously:

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

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	$V_R = V_{RRM}$	-	9	100	µA
		T_j = 150 °C		-	85	425	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 10A	-	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:

$P = 1.35 \times I_{F(AV)} + 0.115 \times I_{F}^{2}{}_{(RMS)}$

Table 5. Dynamic electrical characteristics (per diode)

Symbol	Parameter	Test conditions	Typ.	Unit
Q_{cj}(1)	Total capacitive charge	V_R = 400 V	28.5	nC
C_j	Total capacitance	V_R = 0 V, T_c = 25 °C, F = 1 MHz	480	pF
		V_R = 400 V, T_c = 25 °C, F = 1 MHz	48	

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)

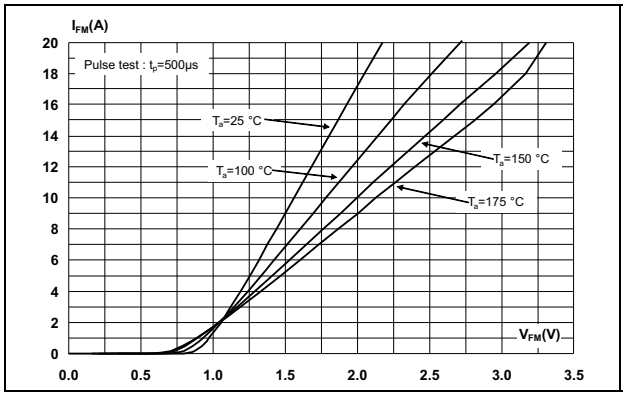


Figure 2. Forward voltage drop versus forward current (typical values, high level, per diode)

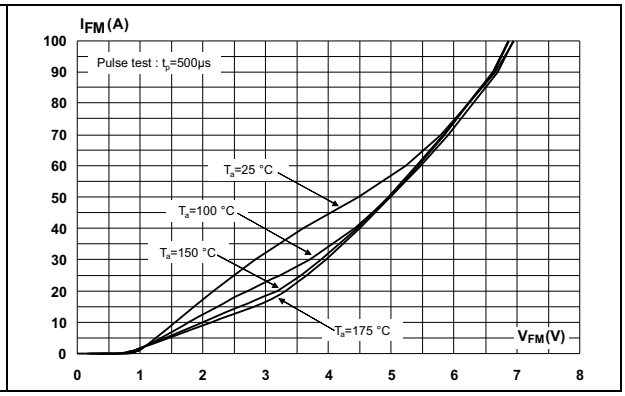


Figure 3. Reverse leakage current versus reverse voltage applied (typical values, per diode)

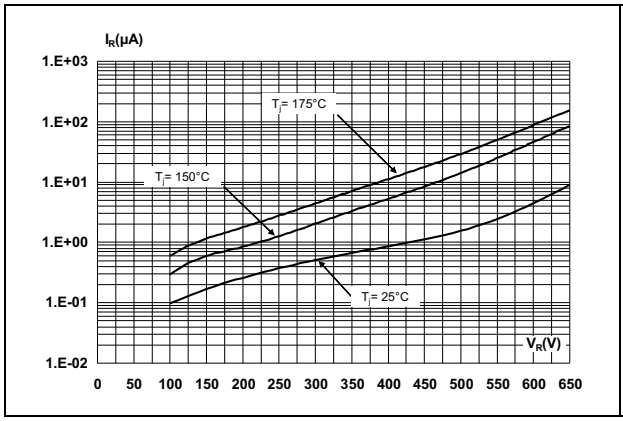


Figure 4. Peak forward current versus case temperature (per diode)

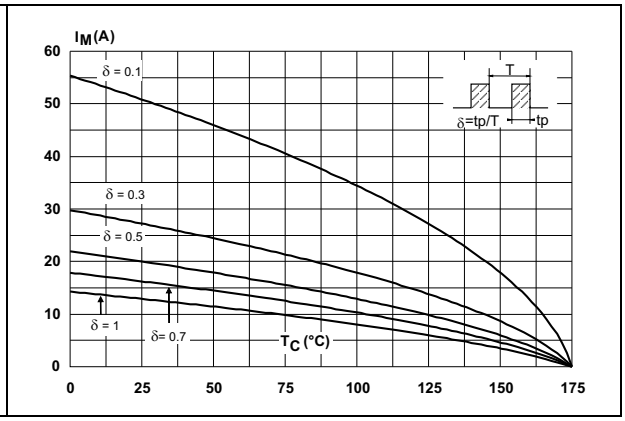


Figure 5. Junction capacitance versus reverse voltage applied (typical values, per diode)

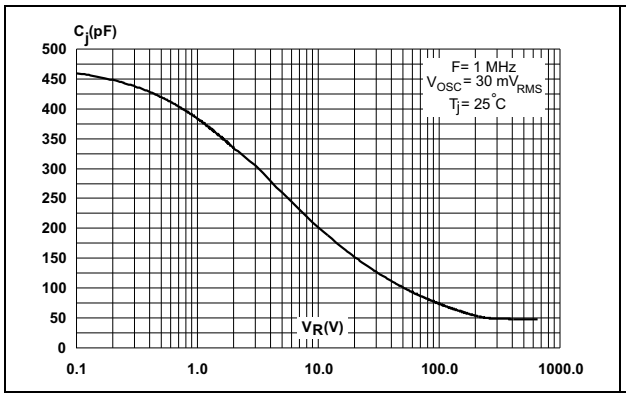


Figure 6. Relative variation of thermal impedance junction to case versus pulse duration

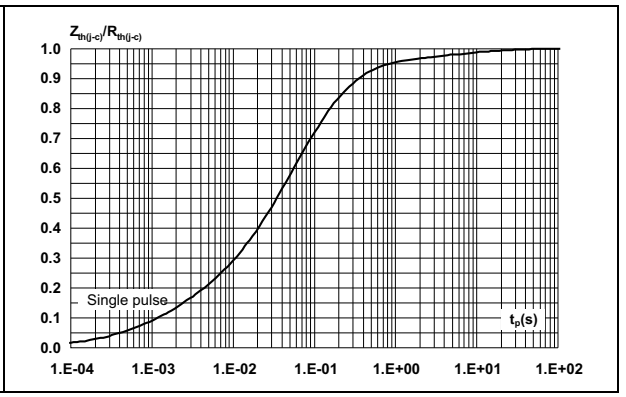


Figure 7. Non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform, per diode)

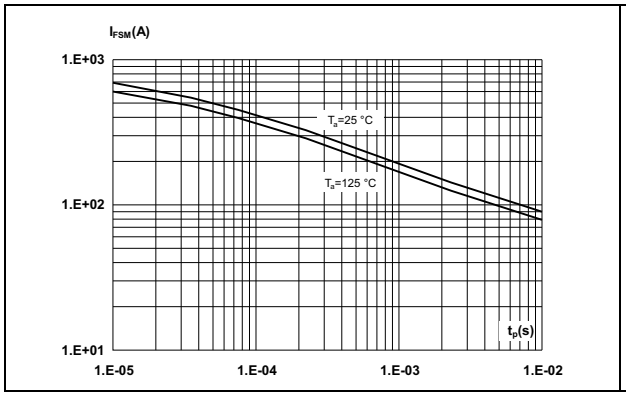
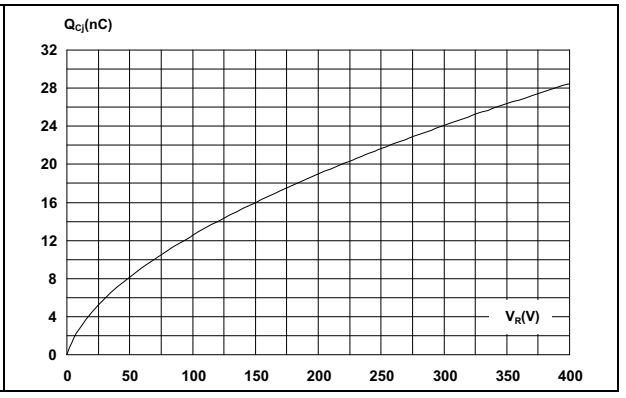


Figure 8. Total capacitive charges versus reverse voltage applied (typical values, per diode)



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

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Figure 9. Insulated TO-220AB dimension definitions

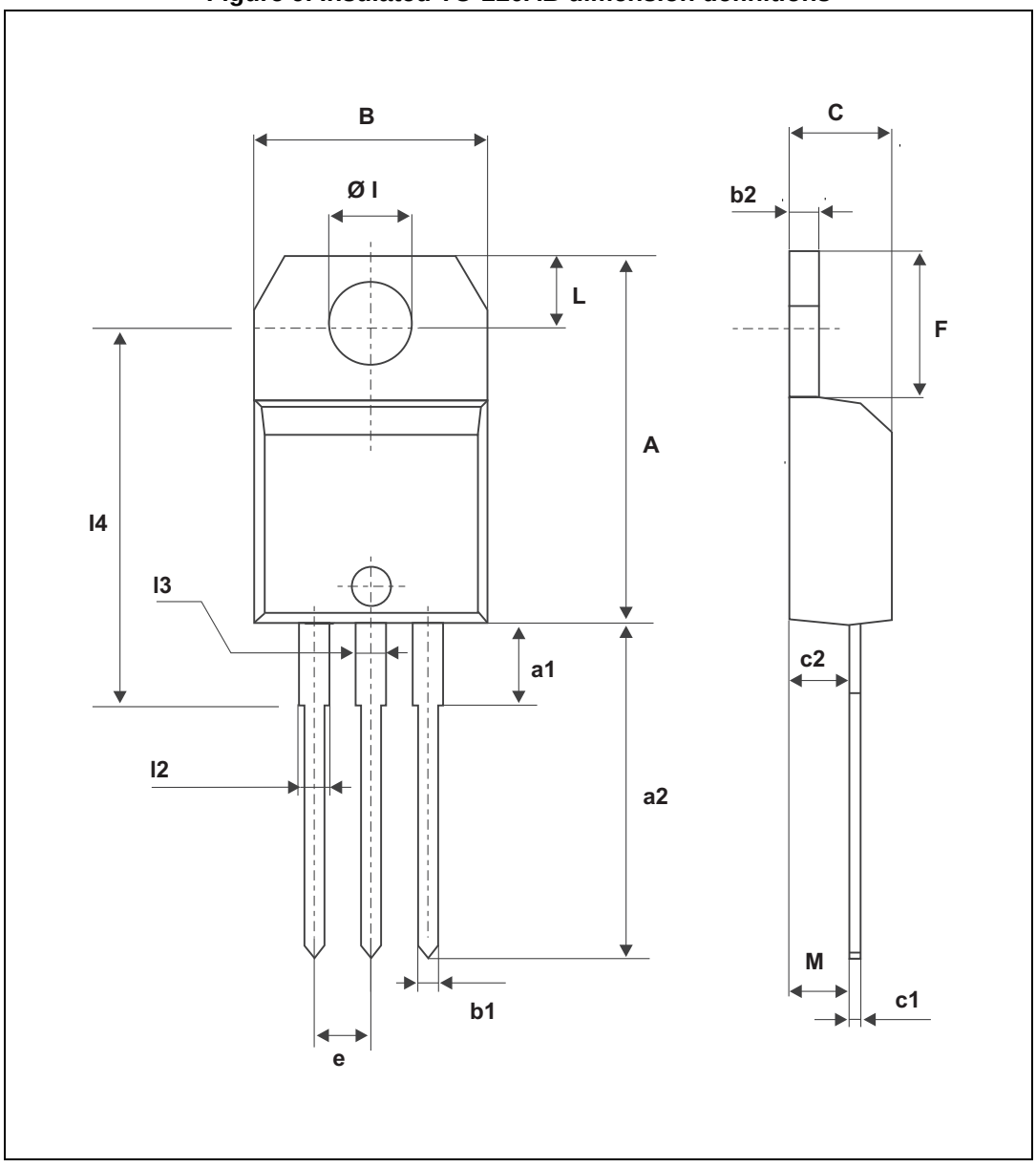

Table 6. Insulated TO-220AB dimension values

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	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
l2	1.14		1.70	0.044		0.066
l3	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
STPSC10TH13TI	STPSC10TH13TI	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*.

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