



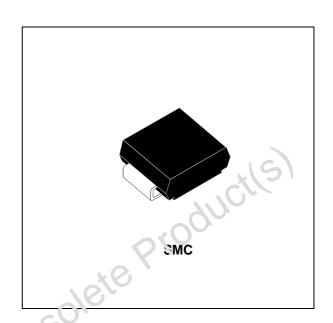
# TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODE

#### MAIN PRODUCT CHARACTERISTICS

I <sub>F(AV)</sub>	2A
V <sub>RRM</sub>	1200V
t <sub>rr</sub> (typ)	65ns
V <sub>F</sub> (max)	1.5V

#### **FEATURES AND BENEFITS**

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGHETIZATION AND RECTIFICATION
- ULTRA-FAST AND SOFT RECOVERY
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR
- HIGH FREQUENCY OPERATION
- HIGH REVERSE VOLTAGE CAPABILITY



#### **DESCRIPTION**

TURBOSWITCH 1200V drastically cuts losses in all high voltage operations which require extremely fast, soft and noise-free power diodes

Due to their optimized switching performances they aloso highly decrease power losses in any associated switching IGBT or MOSFET in all "freewheel mode" operations and is particulary

suitable and efficient in motor control circuitries, or in primary of SMPS as snubber, clamping or demagnetizing diodes secondary of SMPS as high voltage rectifier diodes. They are also suitable for the secondary of SMPS as high voltage rectifier diodes.

## ABSOLUTE R/CINGS (limiting values)

Symbo!	Parameter	Value	Unit	
Vizzin	Repetitive peak reverse voltage	1200	V	
V <sub>RSM</sub>	Non repetitive peak reverse voltage	1200	٧	
IF(RMS)	RMS forward current	10	Α	
I <sub>FRM</sub>	Repetitive peak forward current	tp = 5μs F=5kHz square	20	Α
I <sub>FSM</sub>	Surge non repetitive forward current	25	Α	
T <sub>stg</sub>	Storage temperature range	- 65 to + 150	Ç	
Tj	Maximum operating junction tempera	ture	125	Ç

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# **STTA212S**

## THERMAL AND POWER DATA

Symbol	Parameter	Test conditions	Value	Unit
R <sub>th(j-I)</sub>	Junction to lead thermal resistance		21	°C/W
P <sub>1</sub>	Conduction power dissipation	$I_{F(AV)} = 1.5A \delta = 0.5$ Tlead= 72°C	2.5	W
P <sub>max</sub>	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 67°C	2.8	W

## STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions		Min	Тур	Max	Unit
V <sub>F</sub> *	Forward voltage drop	I <sub>F</sub> = 2A	Tj = 25°C Tj = 125°C		1.1	1.65 1.5	V
I <sub>R</sub> **	Reverse leakage current	$V_R = 0.8$ x $V_{RRM}$	Tj = 25°C Tj = 125°C		150	20 400	μА
Vto	Threshold voltage	Ip < 3.I <sub>AV</sub>	Tj = 125℃			1.15	V
rd	Dynamic resistance					175	mΩ

Test pulses : \* tp = 380  $\mu$ s,  $\delta$  < 2%

To evaluate the maximum conduction losses use the following equation : P =  $V_{to}$  x  $I_{F(AV)}$  + rd x  $I_{F}^{2}$ (RMS)

## **DYNAMIC ELECTRICAL CHARACTERISTICS**

## **TURN-OFF SWITCHING**

Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
t <sub>rr</sub>	Reverse recovery time	$\begin{split} Tj &= 25^{\circ}C \\ I_F &= 0.5 \text{ A}  I_R = 1\text{A}  Irr = 0.25\text{A} \\ I_F &= 1 \text{ A}  dI_F/dt = -50\text{A}/\mu\text{s}  V_R = 30\text{V} \end{split}$		65	115	ns
I <sub>RM</sub>	Maximum recovery current	$Tj = 125^{\circ}C$ $V_R = 600V$ $I_F = 2A$ $dI_F/dt = -16$ $A/\mu s$ $dI_F/dt = -50$ $A/\mu s$		6.0	3.6	А
S factor	Softness factor	$Tj = 125$ °C $V_R = 600$ V $I_F = 2A$ $dI_F/dt = -50$ $A/\mu$ S		0.9		/

## **TURN-ON SWITCHING**

Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
tfr	Forward recovery time	Tj = 25°C			900	ns
V <sub>Fp</sub>	Peak forward voltage	IF = 2 A $dI_F/dt = 16 \text{ A/}\mu\text{s}$ measured at $1.1 \times V_F$ max			35	V

<sup>\*\*</sup> tp = 5 ms ,  $\delta$  < 2%

Fig. 1: Conduction losses versus average current.

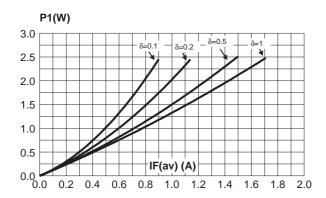


Fig. 2: Forward voltage drop versus forward current (maximum values).

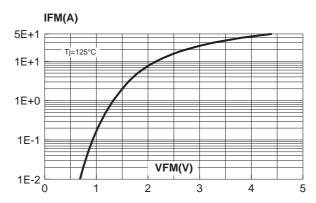
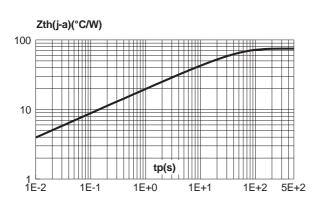
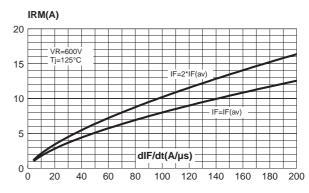


Fig. 3: Variation of thermal impedance junction to ambient versus pulse duration (epoxy printed circuit board FR4,  $e(Cu)=35\mu m$ , S(Cu)=1cm2).



**Fig. 4:** Peak reverse recovery current versus dI<sub>F</sub>/dt (90% confidence).



**Fig. 5:** Softness factor (tb/ta) versus dlr/dt (typical values).

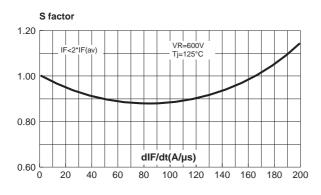
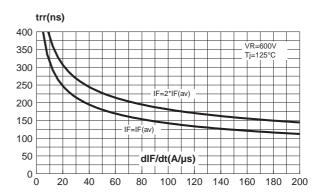
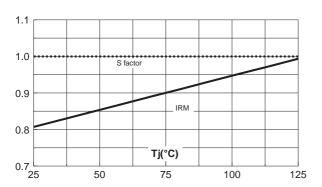


Fig. 6: Reverse recovery time versus dl<sub>F</sub>/dt (90% confidence).



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**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).



**Fig. 8:** Transient peak forward voltage versus dI<sub>F</sub>/dt.

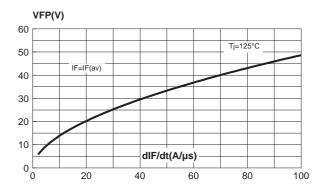
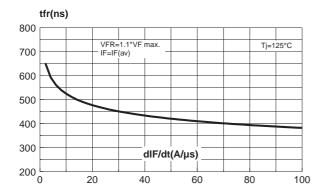


Fig. 9: Forward recovery time versus dl<sub>F</sub>/dt.



## **APPLICATION DATA**

The 1200V TURBOSWITCH has been designed to provide the lowest overall power losses in any all high frequency or high pulsed current operations.

In such applications (fig. A to D), the way of calculating the power losses is given below :

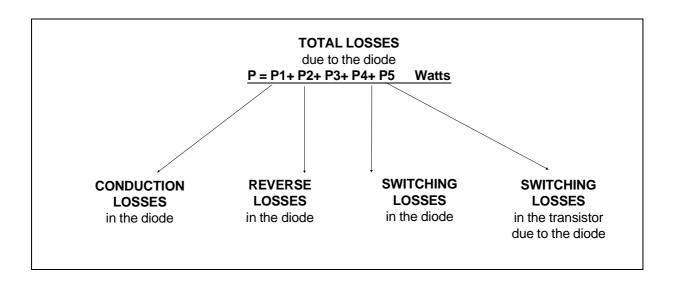
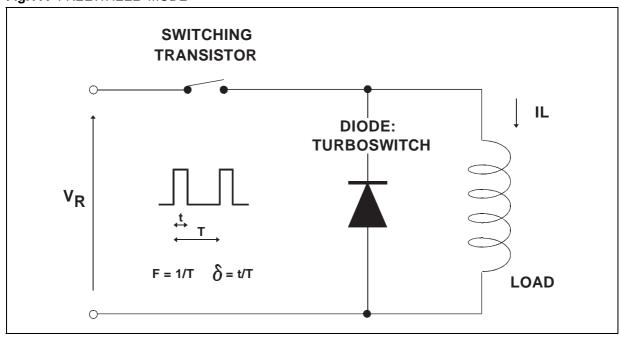


Fig. A: "FREEWHEEL" MODE



# **APPLICATION DATA (Cont'd)**

Fig. B: SNUBBER DIODE.

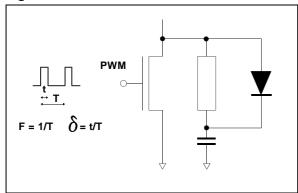


Fig. C: DEMAGNETIZING DIODE.

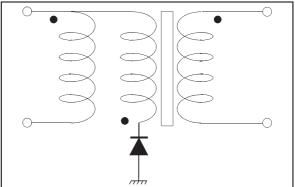


Fig. D: RECTIFIER DIODE.

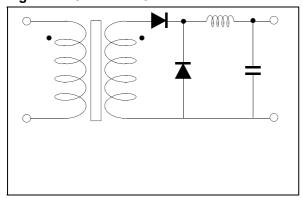
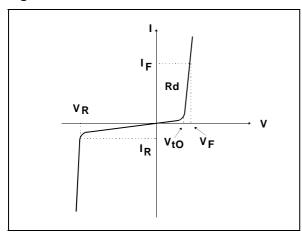


Fig. E: STATIC CHARACTERISTICS



## **Conduction** losses:

 $P1 = V_{t0} \times I_{F(AV)} + R_d \times I_{F}^2(RMS)$ 

## Reverse losses:

 $P2 = VR \times IR \times (1 - \delta)$ 

## **APPLICATION DATA (Cont'd)**

Fig. F: TURN-OFF CHARACTERISTICS

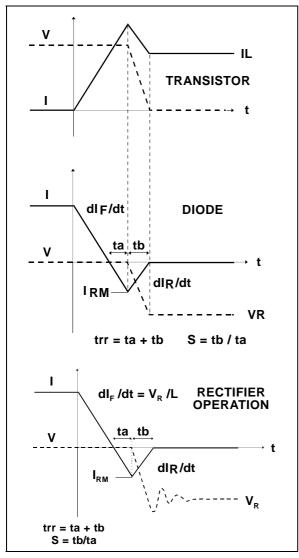
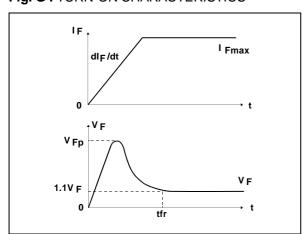


Fig. G: TURN-ON CHARACTERISTICS



#### Turn-on losses:

(in the transistor, due to the diode)

P5 = 
$$\frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dI_F / dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dI_F / dt}$$

Turn-off losses (in the diode):

$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

## Turn-off losses:

with non negligible serial inductance

P3' = 
$$\frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt} + \frac{L \times I_{RM}^2 \times F}{2}$$

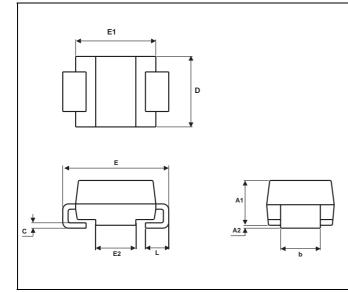
P3, P3' and P5 are suitable for power MOSFET and IGBT

## Turn-on losses:

P4 = 0.4 (VFP - VF) x IFmax x tfr x F

#### **PACKAGE MECHANICAL DATA**

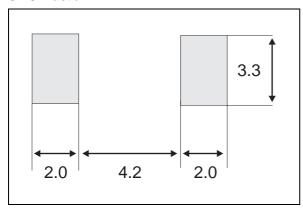
**SMC** 



	DIMENSIONS				
REF.	Millimeters		Inc	hes	
	Min.	Max.	Min.	Max.	
A1	1.90	2.45	0.075	0.096	
A2	0.05	0.20	0.002	0.008	
b	2.90	3.2	0.114	0.126	
С	0.15	0.41	0.006	0.016	
Е	7.75	8.15	0.305	0.321	
E1	6.60	7.15	0.260	0.281	
E2	4.40	4.70	0.173	0.185	
D	5.55	6.25	0.218	0.246	
L	0.75	1.60	0.030	0.063	

## **FOOTPRINT DIMENSIONS** (in millimeters)

**SMC Plastic** 



Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA212S	T53	SMC	0.243g	2500	Tape & reel

- Epoxy meets UL94,V0
- Band indicates cathode

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