

# STTA112U

# TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODE

#### MAIN PRODUCT CHARACTERISTICS

I <sub>F(AV)</sub>	1A
V <sub>RRM</sub>	1200V
t <sub>rr</sub> (typ)	65ns
V <sub>F</sub> (max)	1.5V

#### **FEATURES AND BENEFITS**

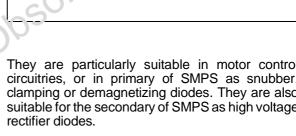
- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- ULTRA-FAST AND SOFT RECOVERY
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION **TRANSISTOR**
- HIGH FREQUENCY OPERATION
- HIGH REVERSE VOLTAGE CAPABILITY



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 also highly decrease power losses in any associated switching IGET o MOSFET in all freewheel mode operations

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



#### **ABSOLUTE RATINCS** (limiting values)

Symbol	Parameter	Value	Unit	
VRKM	Repetitive peak reverse voltage	1200	V	
F(RMS)	RMS forward current		6	Α
I <sub>FRM</sub>	Repetitive peak forward current	Repetitive peak forward current $tp = 5 \mu s F = 5kHz square$		
I <sub>FSM</sub>	Surge non repetitive forward current	20	Α	
T <sub>stg</sub>	Storage temperature range	- 65 to + 150	$^{\circ}$	
Tj	Maximum operating junction temperatu	125	°C	

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### THERMAL AND POWER DATA

Symbol	Parameter	Test conditions	Value	Unit
R <sub>th(j-l)</sub>	Junction to lead thermal resistance		23	°C/W
P <sub>1</sub>	Conduction power dissipation	$I_{F(AV)} = 0.8A$ $\delta = 0.5$ Tlead= 93°C	1.4	W
P <sub>max</sub>	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 90°C	1.5	W

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Тур	Max	Unit
V <sub>F</sub> *	Forward voltage drop	I <sub>F</sub> = 1A	Tj = 25°C Tj = 125°C		1.1	1.65 1.5	V
I <sub>R</sub> **	Reverse leakage current	V <sub>R</sub> = 0.8 x V <sub>RRM</sub>	Tj = 25°C Tj = 125°C		90	10 300	μΑ
V <sub>to</sub>	Threshold voltage	Ip < 3.I <sub>F(AV)</sub>	Tj = 125°C			1.15	V
Rd	Dynamic resistance					350	mΩ

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**

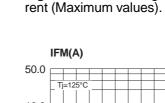
Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
t <sub>rr</sub>	Reverse recovery time	$\begin{split} Tj &= 25^{\circ}C \\ I_F &= 0.5 \text{ A}  I_R = 1\text{A}  Irr = 0.25\text{A} \\ I_F &= 1 \text{ A}  dI_F/dt = -50\text{A}/\mu\text{s}  V_R = 30\text{V} \end{split}$		65	115	ns
I <sub>RM</sub>	Maximum recovery current	$Tj = 125$ °C $V_R = 600$ V $I_F = 1$ A $dI_F/dt = -8$ $A/\mu$ S $dI_F/dt = -50$ $A/\mu$ S		5	1.8	A
S factor	Softness factor	Tj = 125°C V <sub>R</sub> = 600V I <sub>F</sub> =1A dI <sub>F</sub> /dt = -50 A/μs		0.7		-

### **TURN-ON SWITCHING**

Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
t <sub>fr</sub>	Forward recovery time	Tj = 25°C			900	ns
V <sub>Fp</sub>	Peak forward voltage	$I_F$ = 1 A, $dI_F/dt$ = 8 A/ $\mu$ s measured at 1.1 $ imes$ V <sub>F</sub> max			35	V

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

Fig. 1: Conduction losses versus average current.



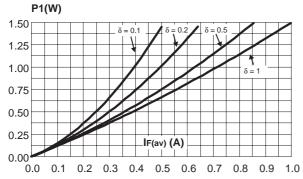
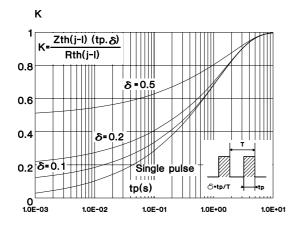
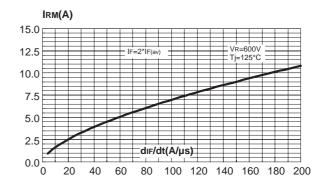


Fig. 2: Forward voltage drop versus forward cur-

**Fig. 3:** Relative variation of thermal transient impedance junction to lead versus pulse duration.

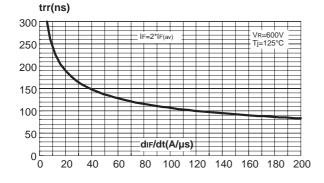
**Fig. 4:** Peak reverse recovery current versus dl<sub>F</sub>/dt (90% confidence).

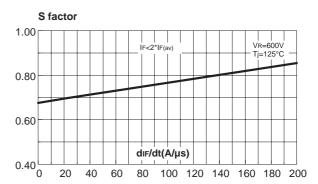




**Fig. 5:** Reverse recovery time versus dI<sub>F</sub>/dt (90% confidence).

**Fig. 6:** Softness factor (tb/ta) versus dI<sub>F</sub>/dt (Typical values).

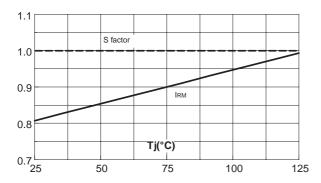


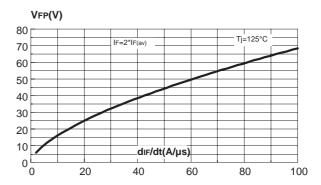


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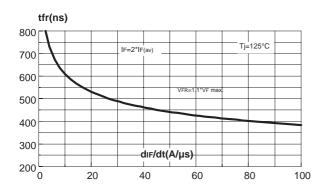
**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C).

Fig. 8: Transient peak forward voltage versus  $dI_F/dt$  (90% confidence).





**Fig. 9:** Forward recovery time versus  $dI_F/dt$  (90% confidence).



#### **APPLICATION DATA**

The 1200V TURBOSWITCH<sup>TM</sup> series has been designed to provide the lowest overall power losses in all frequency or high pulsed current operations.

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

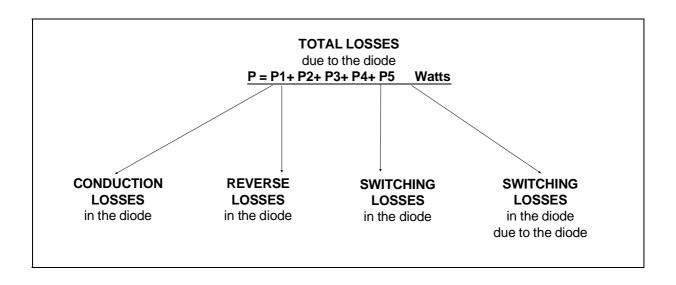
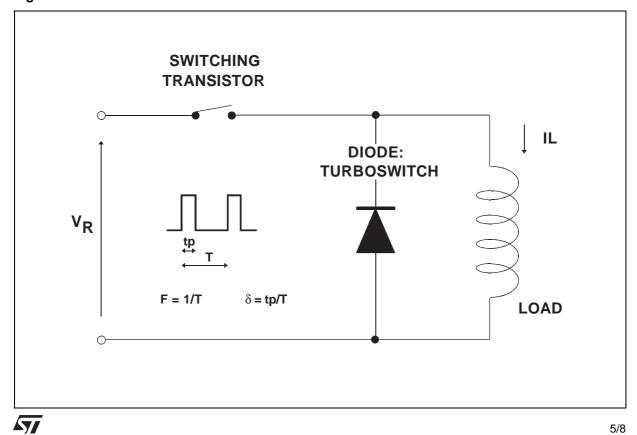


Fig. A: "FREEWHEEL MODE".



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

Fig. B: SNUBBER DIODE.

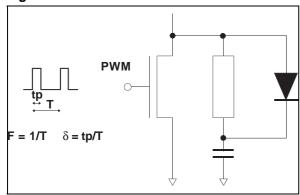


Fig. C : DEMAGNETIZING DIODE.

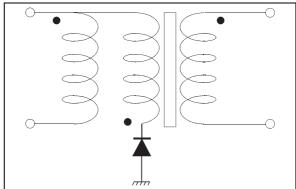


Fig. D: RECTIFIER DIODE.

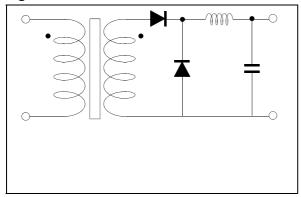
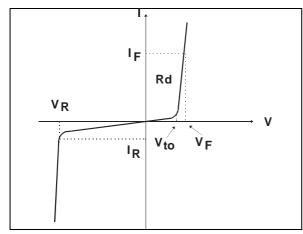


Fig. E: STATIC CHARACTERISTICS.



### Conduction losses:

 $P1 = V_{to} \times I_{F(AV)} + R_{d} \times I_{F}^{2}(RMS)$ 

### Reverse losses:

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

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

Fig. F: TURN-OFF CHARACTERISTICS.

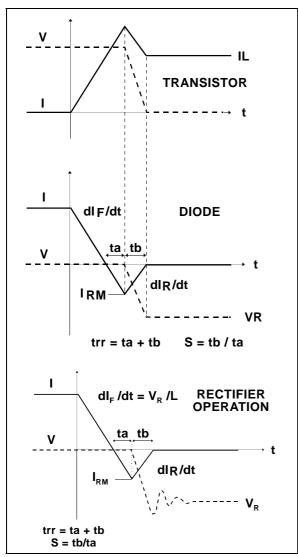
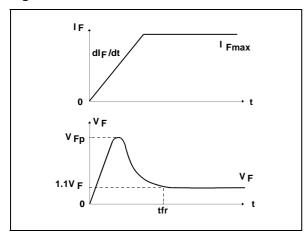


Fig. G: TURN-ON CHARACTERISTICS.



### Turn-on losses:

(in the transistor, due to the diode)

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

#### Turn-off losses:

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

### Turn-off losses:

with non negligible serial inductance

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

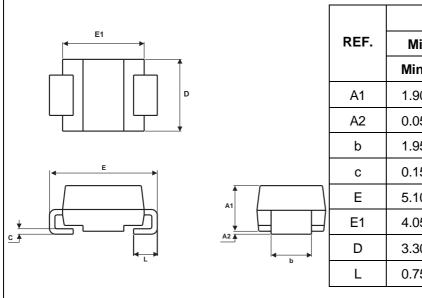
P3, P3' and P5 are suitable for power MOSFET and IGBT

#### Turn-on losses:

 $P4 = 0.4 (VFP - VF) \times IFmax \times tfr \times F$ 

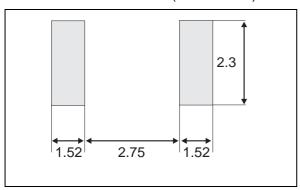
#### **PACKAGE MECHANICAL DATA**

**SMB** 



	DIMENSIONS					
REF.	Millim	Millimeters		hes		
	Min.	Max.	Min.	Max.		
A1	1.90	2.45	0.075	0.096		
A2	0.05	0.20	0.002	0.008		
b	1.95	2.20	0.077	0.087		
С	0.15	0.41	0.006	0.016		
E	5.10	5.60	0.201	0.220		
E1	4.05	4.60	0.159	0.181		
D	3.30	3.95	0.130	0.156		
L	0.75	1.60	0.030	0.063		

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



Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA112U	T03	SMB	0.107g	2500	Tape & reel

- Epoxy meets UL94,V0
- Band indicates cathode

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