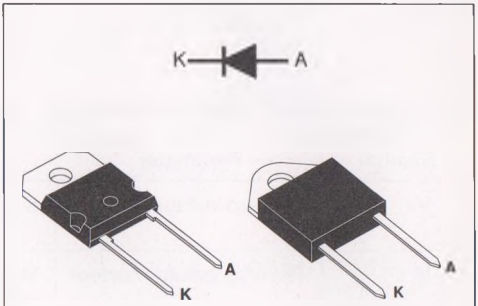
TURBOSWITCH ™ "B". ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCTS CHARACTERISTICS

$I_{F(AV)}$	20A
V_{RRM}	600V
t_{rr} (typ)	55ns
V_F (max)	1.3V



SOD93
(Plastic)

STTB2006P

Isolated
DOP3I
(Plastic)

STTB2006PI

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: Snubbing or clamping, demagnetization and rectification.
- ULTRA-FAST, SOFT AND NOISE-FREE RECOVERY.
- VERY LOW OVERALL POWER LOSSES AND PARTICULARY LOW FORWARD VOLTAGE.
- DESIGNED FOR HIGH PULSED CURRENT OPERATIONS.

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.
TURBOSWITCH, B family, drastically cuts losses in all high voltage operations which require extremely fast, soft and noise-free power diodes. They are particularly suitable in the primary circuit of an SMPS as snubber, clamping or demagnetizing diodes, and also in most power converters as high performance rectifier diodes.
Packaged in SOD93 and in isolated DOP3I, these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	600	V
V_{RSM}	Non repetitive peak reverse voltage	600	V
$I_{F(RMS)}$	RMS forward current	50	A
I_{FRM}	Repetitive peak forward current (tp = 5 µs, f = 1kHz)	680	A
T_j	Max operating junction temperature	-65 to 150	°C
T_{stg}	Storage temperature	-65 to 150	°C

TM : TURBOSWITCH is a trademark of SGS-THOMSON Microelectronics.

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	STTB2006P STTB2006PI	1.3 2.1	°C/W
P_1	Conduction power dissipation (see fig. 5)	$I_{F(AV)}$ = 20A δ =0.5 STTB2006P Tc= 108°C STTB2006PI Tc= 82°C	32	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	STTB2006P Tc= 98°C STTB2006PI Tc= 66°C	40	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig.5)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =20A	T_j = 25°C T_j = 125°C			1.4 1.3	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	T_j = 25°C T_j = 125°C			100 3.0	µA mA

Test pulses widths : * tp = 380 µs, duty cycle < 2%
** tp = 5 ms , duty cycle < 2%

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see Fig.6)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	T_j = 25°C I_F = 0.5 A I_R = 1A Irr = 0.25A I_F = 1A dI_F/dt =-50A/µs V_R = 30V		55	105	ns
I_{RM}	Maximum reverse recovery current	T_j = 125°C VR = 400V I_F =20A dI_F/dt = -160 A/µs dI_F/dt = -500 A/µs		33	30	A
S factor	Softness factor	T_j = 125°C V_R = 400V I_F =20A dI_F/dt = -500 A/µs		1.1		/

TURN-ON SWITCHING (see Fig.7)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	T_j = 25°C I_F =20 A, dI_F/dt = 160 A/µs measured at, 1.1 × $V_F$max			500	ns
V_{Fp}	Peak forward voltage	T_j = 25°C I_F =20A, dI_F/dt = 160 A/µs I_F =100A, dI_F/dt = 500 A/µs		10	8	V

APPLICATION DATA

The TURBOSWITCH "B" is especially designed to provide the lowest overall power losses in any application such as snubbing,clamping, demagnetization and rectification. In such applications (fig.1 to fig.4), the way of calculating the power losses is given below :

TOTAL LOSSES
due to the diode
P = P1+ P2+ P3+ P4 Watts

CONDUCTION LOSSES	REVERSE LOSSES	SWITCHING LOSSES
P1 Watts (Fig. 5)	P2 Watts (Fig. 5)	OFF : P3 Watts ON : P4 Watts (Fig. 6 & 7)

Fig. 1 : SNUBBER DIODE.

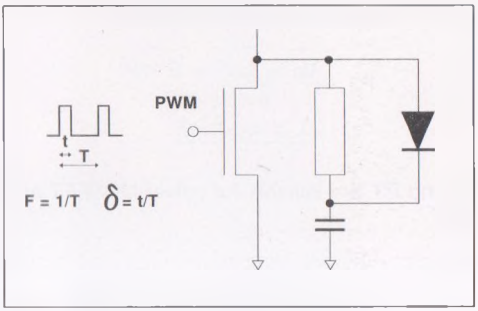


Fig. 2 : CLAMPING DIODE.

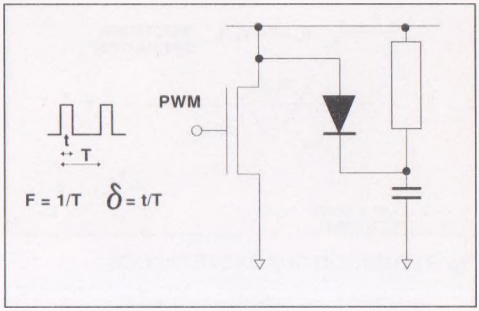


Fig. 3 : DEMAGNETIZING DIODE.

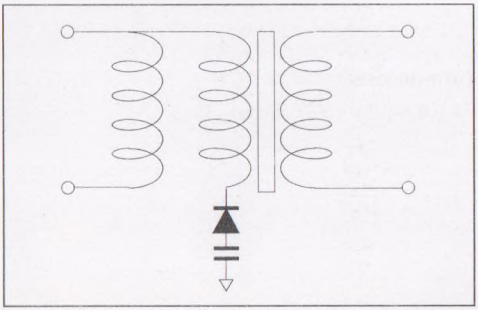
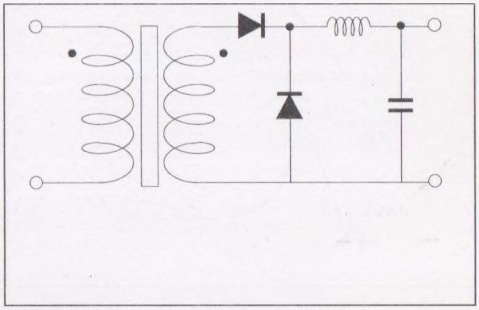
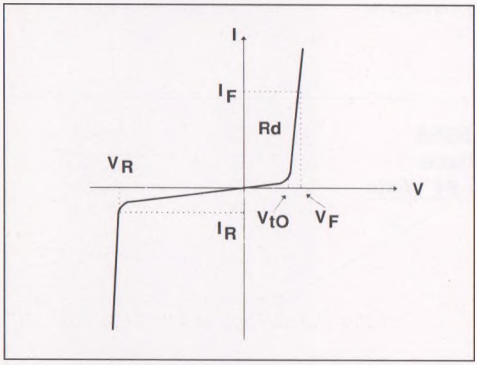


Fig. 4 : RECTIFIER DIODE.



APPLICATION DATA (Cont'd)

Fig. 5: STATIC CHARACTERISTICS



Conduction losses :

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

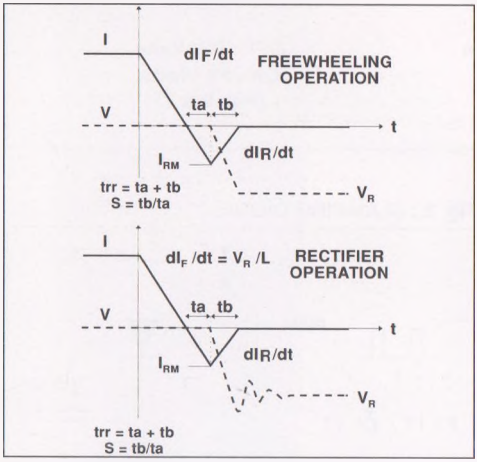
with

$V_{t0} = 1.00$ V
$R_d = 0.015$ Ohm
(Max values at 125°C)

Reverse losses :

$P2 = V_R \cdot I_R \cdot (1 - \delta)$

Fig. 6: TURN-OFF CHARACTERISTICS



Turn-off losses :

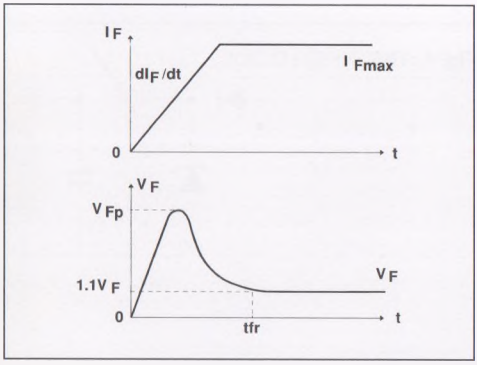
$$P3 = \frac{V_R \times I_{RM}{}^2 \times S \times F}{6 \times dI_F/dt}$$

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 and P3' are suitable for power MOSFET and IGBT

Fig. 7: TURN-ON CHARACTERISTICS



Turn-on losses :

$P4 = 0.4 (V_{FP} - V_F) \cdot I_{Fmax} \cdot t_{fr} \cdot F$

Fig 8 : Conduction losses versus average current

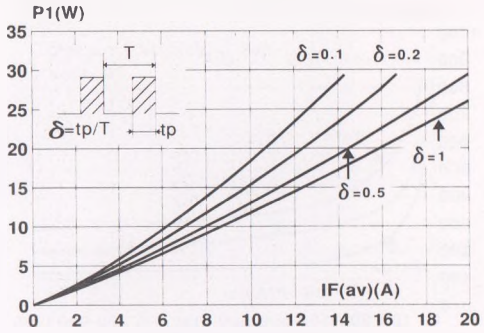


Fig 9 : Switching OFF losses versus dIF/dt

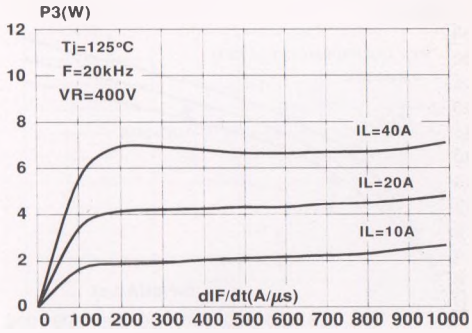


Fig 10 : Switching ON losses versus dIF/dt

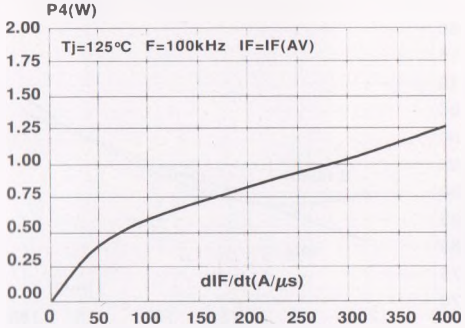


Fig 11 : Forward voltage drop versus forward current

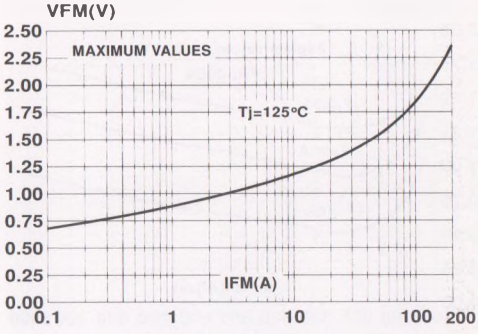


Fig 12 : Relative variation of thermal transient impedance junction to case versus pulse duration

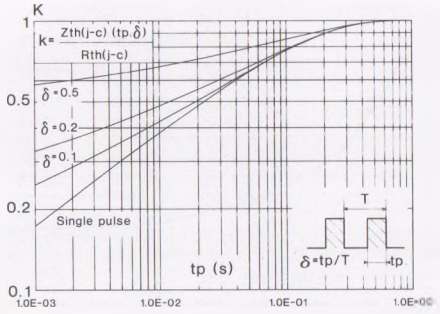


Fig 13 : Peak reverse recovery current versus dI_F/dt

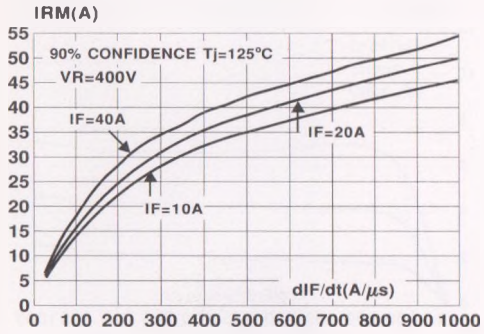


Fig 14 : Reverse recovery time versus dI_F/dt

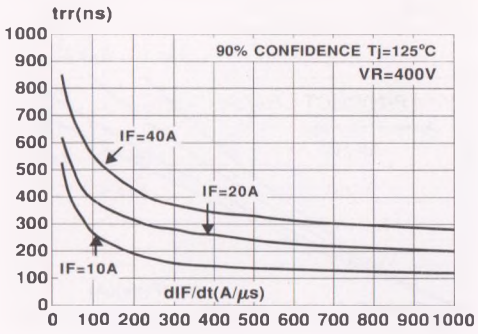


Fig 15 : Softness factor (tb/ta) versus dI_F/dt

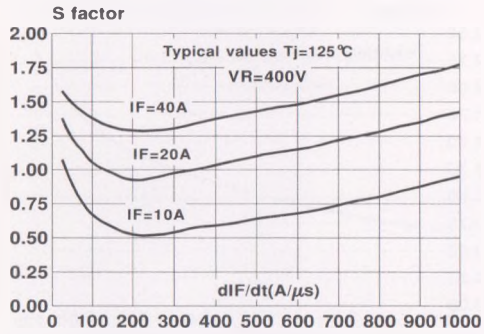


Fig 16 : Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C)

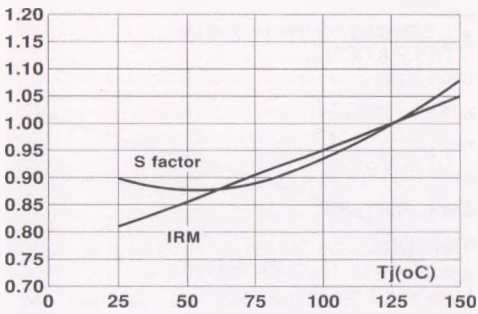


Fig 17 : Transient peak forward voltage versus dI_F/dt

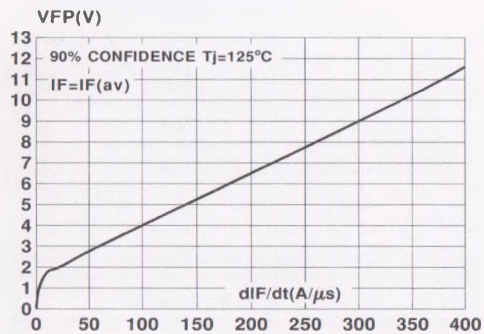


Fig 18 : Forward recovery time versus dI_F/dt