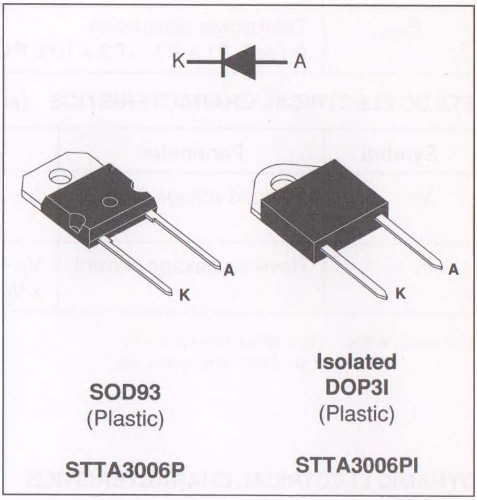
SGS-THOMSON MICROELECTRONICS

STTA3006P(I)

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

MAIN PRODUCTS CHARACTERISTICS

$I_{F(AV)}$	30A
V_{RRM}	600V
t_{rr} (typ)	35ns
V_F (max)	1.5V



FEATURES AND BENEFITS

- SPECIFIC TO "FREEWHEEL MODE" OPERATIONS: Freewheel or Booster Diode.
- ULTRA-FAST RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY OPERATIONS.

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.
TURBOSWITCH, A family, drastically cuts losses in both the diode and the associated switching IGBT or MOSFET in all "Freewheel Mode" operations and is particularly suitable and efficient in Motor Control Freewheel applications and in Booster diode applications in Power Factor Control circuitries.
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 = 5kHz)	300	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	STTA3006P STTA3006PI	1.2 1.8	°C/W
P_1	Conduction power dissipation (see fig. 2)	$I_{F(AV)}$ = 30A δ =0.5 STTA 3006P Tc= 85°C STTA3006PI Tc= 52°C	54	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	STTA 3006P Tc= 78°C STTA3006PI Tc= 42°C	60	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig.2)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =30A	Tj = 25°C Tj = 125°C			1.75 1.5	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	Tj = 25°C Tj = 125°C			150 8	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.3)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	Tj = 25°C I_F = 0.5 A I_R = 1A Irr = 0.25A I_F = 1 A dI_F/dt =-50A/µs V_R =30V		35	65	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C VR = 400V I_F =30A dI_F/dt = -240 A/µs dI_F/dt = -500 A/µs		20	19	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F =30A dI_F/dt = -500 A/µs		0.40		/

TURN-ON SWITCHING (see Fig.4)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F =30A, dI_F/dt = 240 A/µs measured at, 1.1 × $V_F$max			600	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =30A, dI_F/dt = 240 A/µs			12	V

APPLICATION DATA

The TURBOSWITCH “A” is especially designed to provide the lowest overall power losses in any “FREEWHEEL Mode” application (Fig.1) considering both the diode and the companion transistor, thus optimizing the overall performance in the end application.
The way of calculating the power losses is given below:

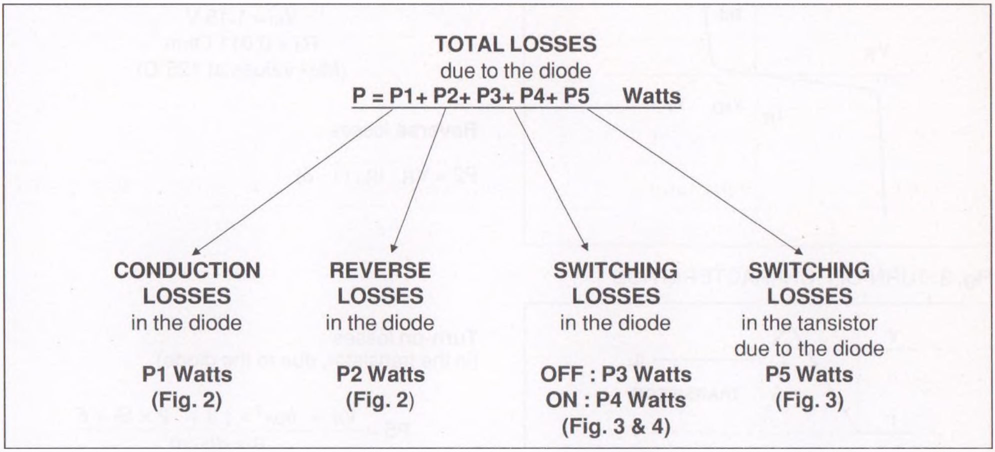
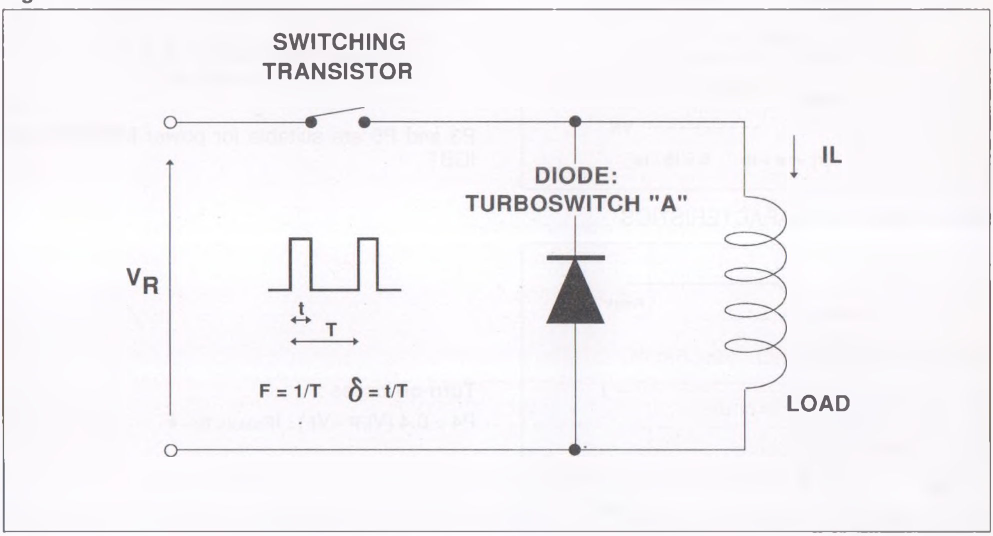
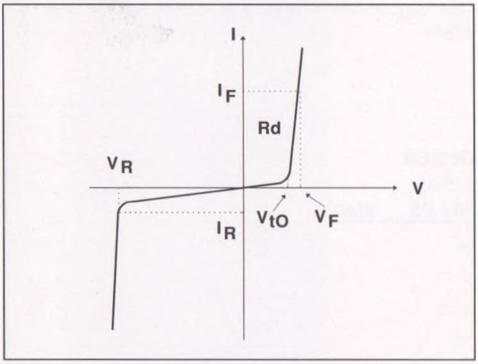


Fig. 1 : “FREEWHEEL” MODE.



APPLICATION DATA (Cont'd)

Fig. 2: STATIC CHARACTERISTICS



Conduction losses :

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

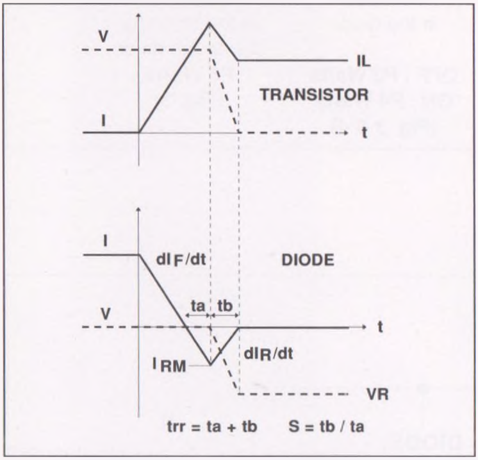
with

$V_{t0} = 1.15$ V
$R_d = 0.011$ Ohm
(Max values at 125°C)

Reverse losses :

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

Fig. 3: TURN-OFF CHARACTERISTICS



Turn-on losses :
(in the transistor, due to the diode)

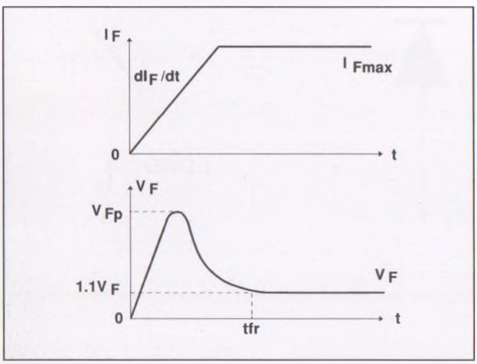
$$P5 = \frac{V_R \times I_{RM}{}^2 \times (3 + 2 \times S) \times F}{6 \times dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dI_F/dt}$$

Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

Fig. 4: TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig 5 : Conduction losses versus average current

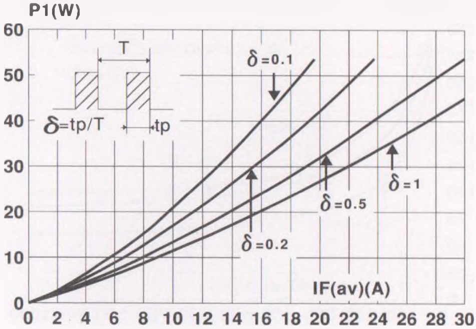


Fig 6 : Switching OFF losses versus dIF/dt

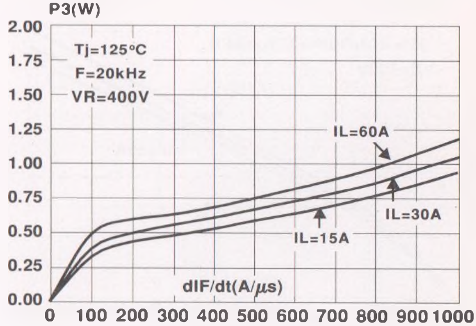


Fig 7 : Switching ON losses versus dIF/dt

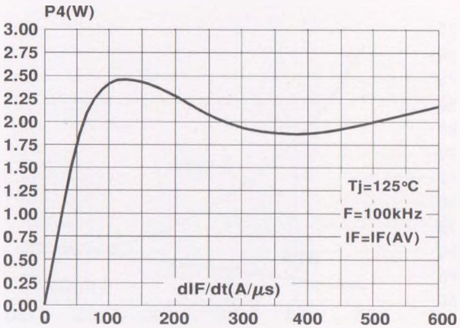


Fig 8 : Switching losses in transistor due to the diode

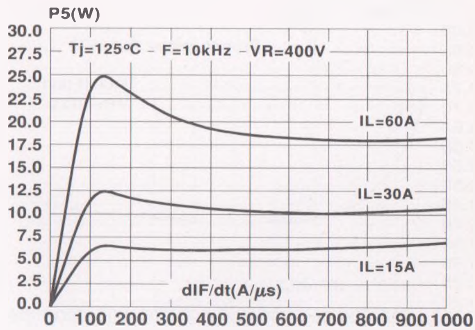


Fig 9 : Forward voltage drop versus forward current

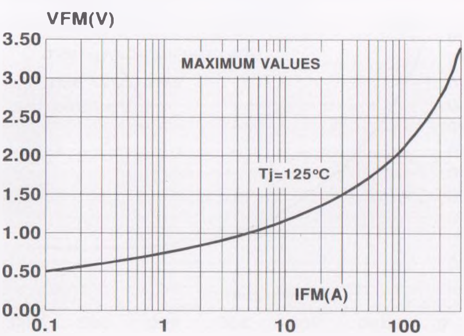


Fig 10 : Relative variation of thermal transient impedance junction to case versus pulse duration

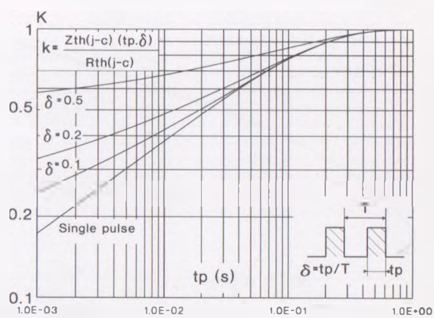


Fig 11 : Peak reverse recovery current versus dIF/dt

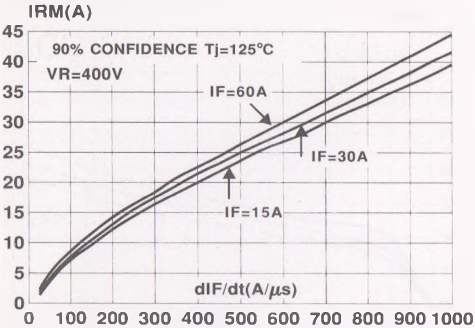


Fig 12 : Reverse recovery time versus dIF/dt

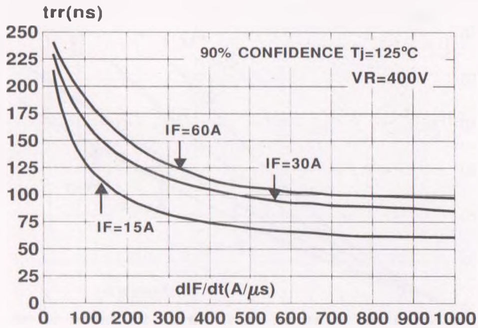


Fig 13 : Softness factor (tb/ta) versus dIF/dt

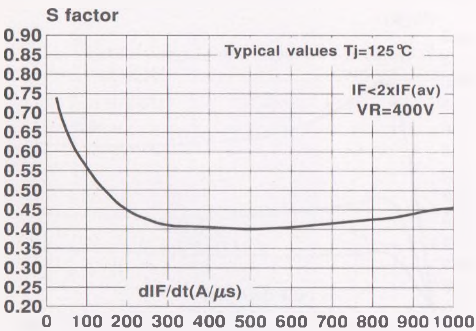


Fig 14 : Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C)

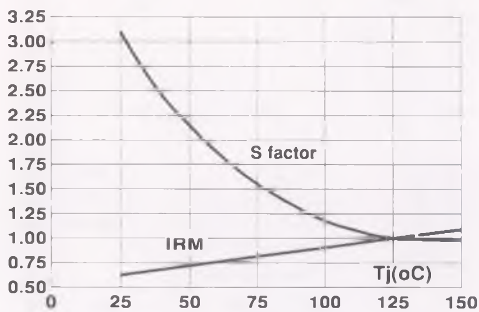


Fig 15 : Transient peak forward voltage versus dIF/dt

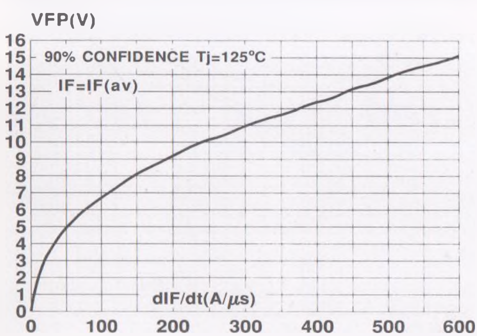


Fig 16 : Forward recovery time versus dIF/dt