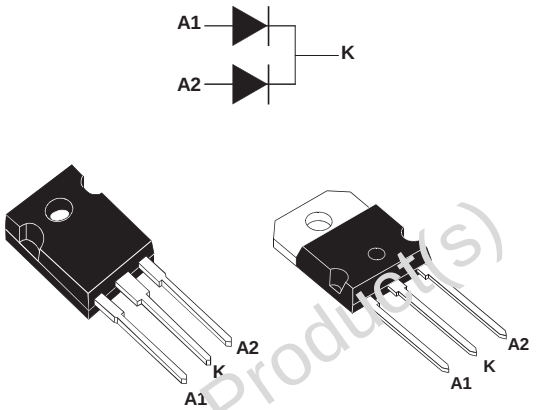
STTA3006CW/CP

TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODES

MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	2 x 15A
V_{RRM}	600V
t_{rr} (typ)	35ns
V_F (max)	1.6V



TO-247
STTA3006CW

SOT93
STTA3006CP

FEATURES AND BENEFITS

- SPECIFIC TO "FREEWHEEL MODE" OPERATIONS: FREEWHEEL OR BOOSTER DIODE.
- ULTRA-FAST AND SOFT 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 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 either in TO-247 or SOT93, these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE RATINGS (limiting values, per diode)

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		30	A
I_{FRM}	Repetitive peak forward current	tp = 5 µs F = 5kHz square	200	A
I_{FSM}	Surge non repetitive forward current	tp=10 ms sinusoidal	230	A
T_j	Maximum operating junction temperature		150	°C
T_{stg}	Storage temperature range		-65 to 150	°C

TM : TURBOSWITCH is a trademark of STMicroelectronics

THERMAL AND POWER DATA

Symbol	Parameter	Test conditions	Value	Unit
$R_{th(j-c)}$	Junction to case	Per diode Total Coupling	1.9 1.0 0.1	°C/W
P_1	Conduction power dissipation	Per diode $I_{F(AV)}$ = 30A δ =0.5 Tc= 110°C	20.5	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Per diode Tc=105°C	22.5	W

STATIC ELECTRICAL CHARACTERISTICS (per diode)

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =15A	Tj = 25°C Tj = 125°C		 1.3	1.8 1.6	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 2	100 5	µA mA
V_{to}	Threshold voltage	Ip < 3.I_{AV}	Tj = 125°C			1.06	V
rd	Dynamic resistance					177	mΩ

Test pulse : * tp = 380 µs, δ < 2%
** tp = 5 ms, δ < 2%

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

DYNAMIC ELECTRICAL CHARACTERISTICS (per diode)

TURN-OFF SWITCHING

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 = 1A dI_F/dt =-50A/µs V_R = 30V		35 	 65	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C V_R = 400V I_F = 15A dI_F/dt = -120 A/µs dI_F/dt = -500 A/µs		 17.5	12.5	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F = 15A dI_F/dt = -500 A/µs		 0.5		/

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F = 15A, dI_F/dt = 120 A/µs measured at, 1.1 × $V_F$max			500	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F = 15A, dI_F/dt = 120 A/µs			9	V

Fig. 1: Conduction losses versus average current.

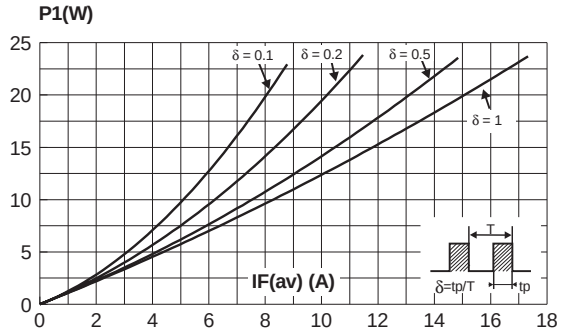


Fig. 2: Forward voltage drop versus forward current (maximum values).

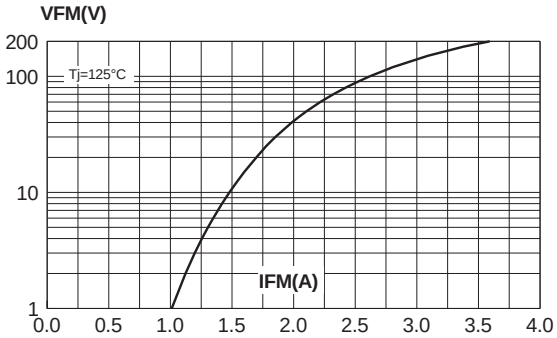


Fig. 3: Relative variation of thermal transient impedance junction to case versus pulse duration.

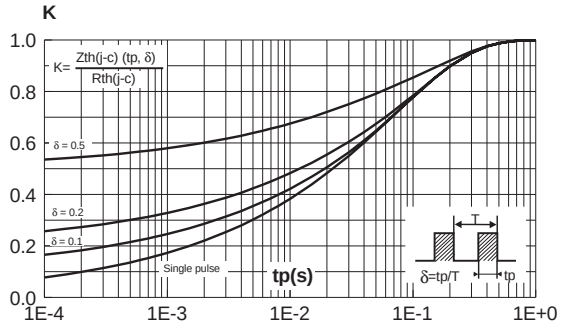


Fig. 4: Peak reverse recovery current versus dIF/dt (90% confidence).

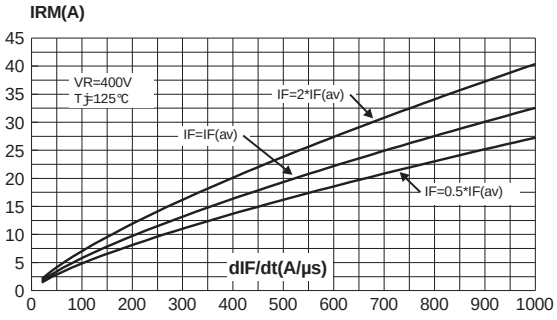


Fig. 5: Reverse recovery time versus dIF/dt (90% confidence).

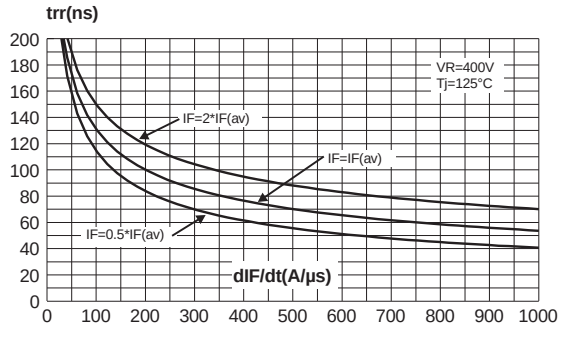


Fig. 6: Softness factor (tb/ta) versus dIF/dt (typical values).

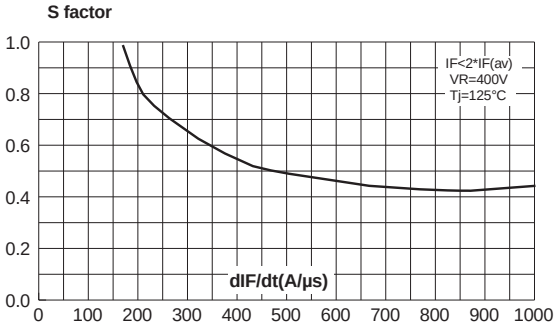


Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

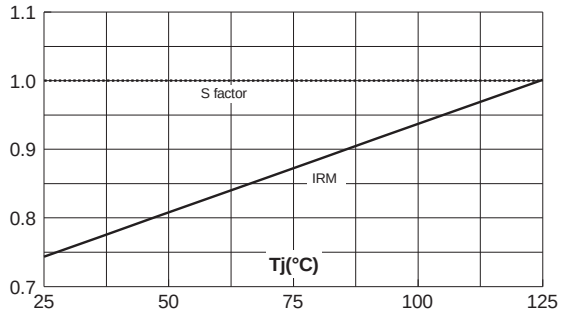


Fig. 8: Transient peak forward voltage versus dIF/dt (90% confidence).

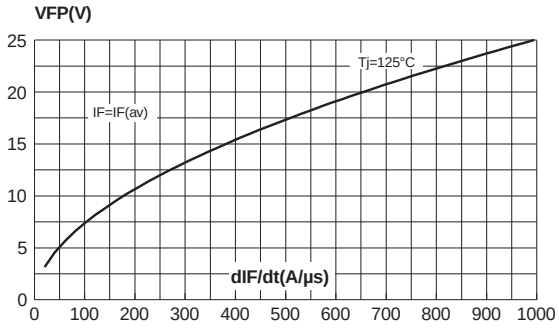
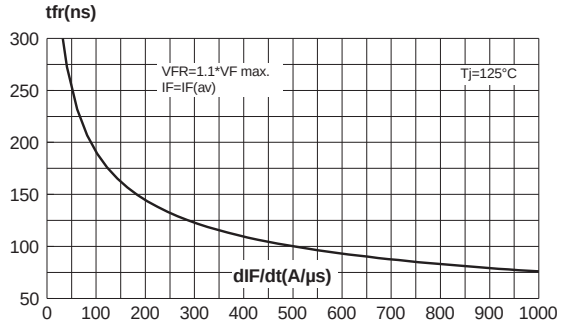


Fig. 9: Forward recovery time versus dIF/dt (90% confidence).



APPLICATION DATA

The TURBOSWITCH is especially designed to provide the lowest overall power losses in any "FREEWHEEL Mode" application (Fig.A) 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:

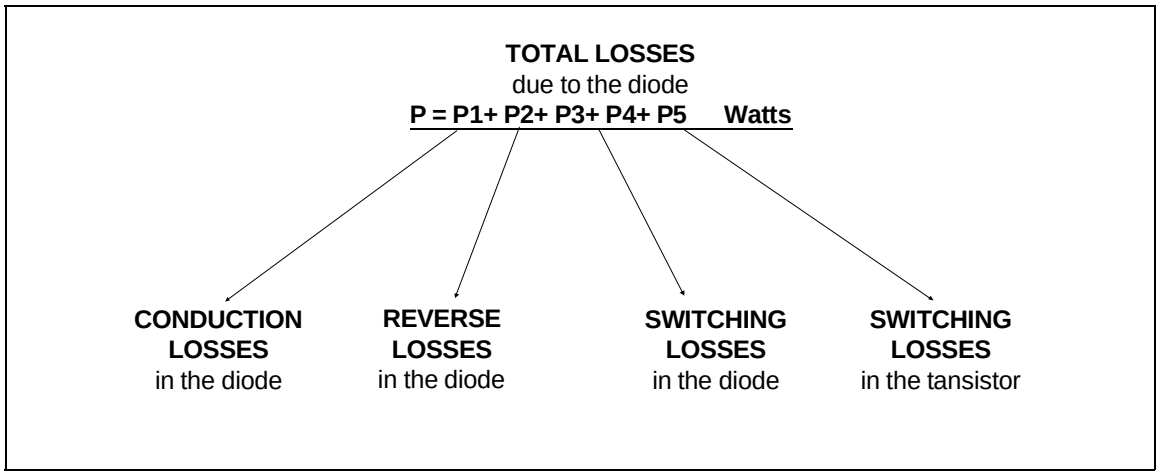
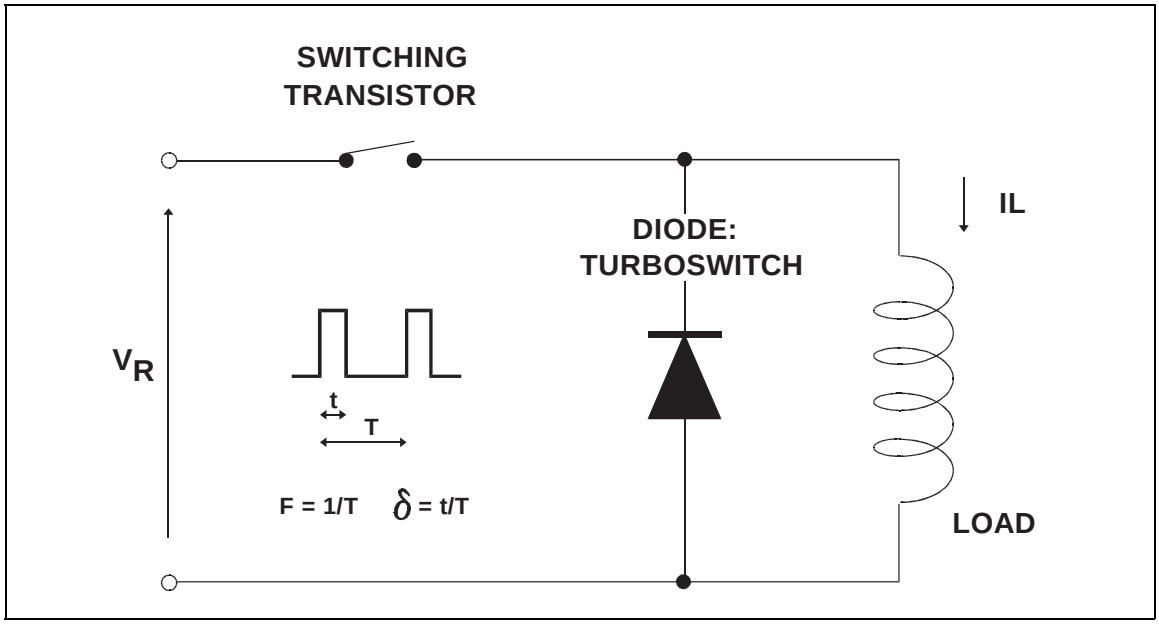
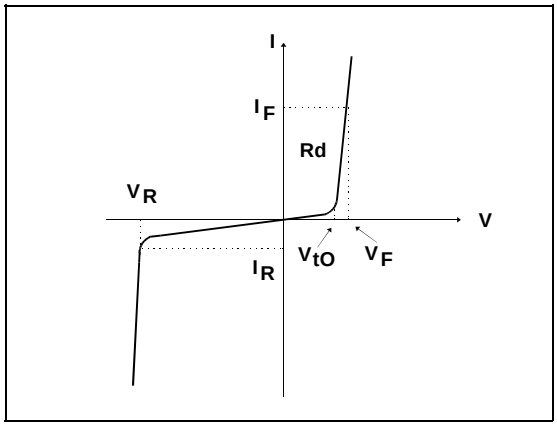


Fig. A : "FREEWHEEL" MODE.



APPLICATION DATA (Cont'd)

Fig. B: STATIC CHARACTERISTICS



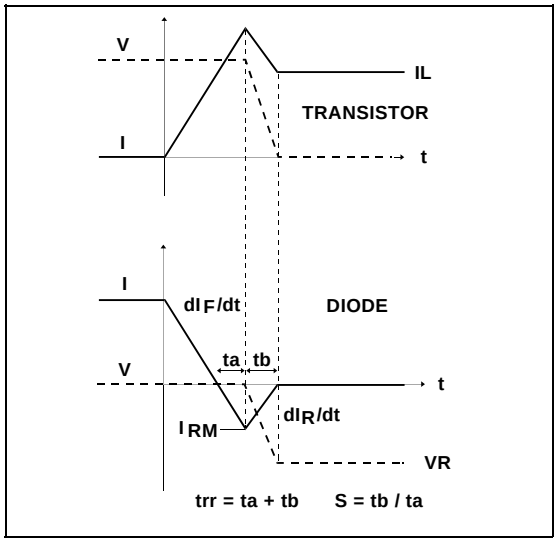
Conduction losses :

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

Reverse losses :

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

Fig. C: TURN-OFF CHARACTERISTICS



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

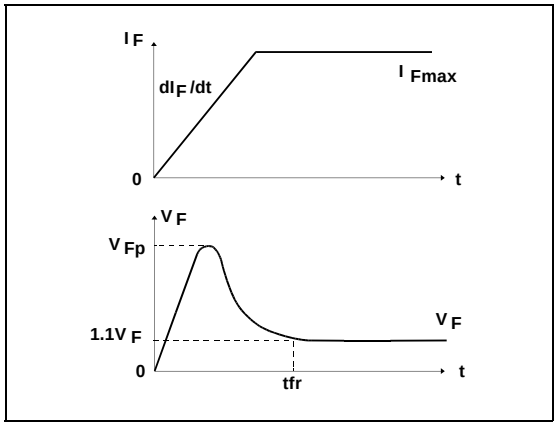
$$P5 = \frac{V_R \times I_{RM}{}^2 \times (3 + 2 \times S) \times F}{6 \; x \; dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \; x \; dI_F/dt}$$

Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

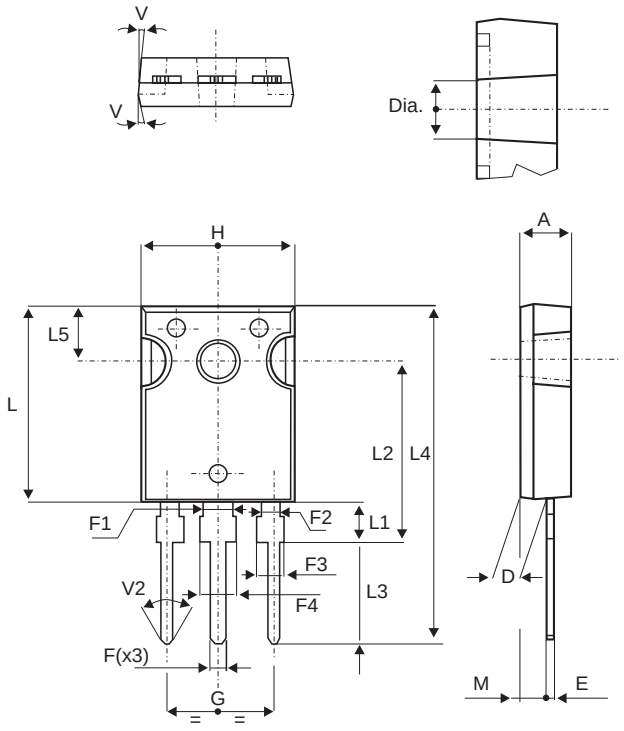
Fig. C: TURN-ON CHARACTERISTICS



Turn-on losses :

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

PACKAGE DATA
TO-247 Plastic

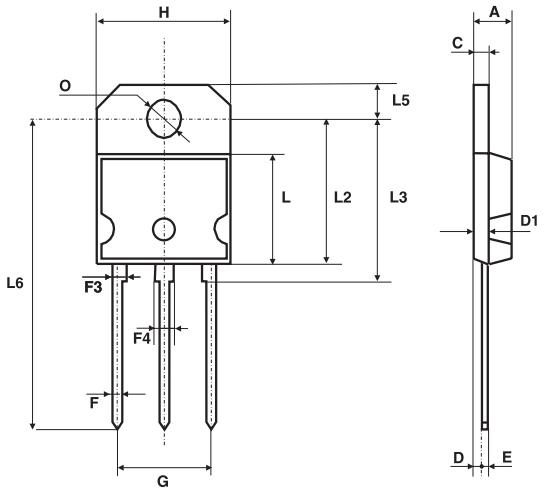


REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.85		5.15	0.191		0.203
D	2.20		2.60	0.086		0.102
E	0.40		0.80	0.015		0.031
F	1.00		1.40	0.039		0.055
F1		3.00			0.118	
F2		2.00			0.078	
F3	2.00		2.40	0.078		0.094
F4	3.00		3.40	0.118		0.133
G		10.90			0.429	
H	15.45		15.75	0.608		0.620
L	19.85		20.15	0.781		0.793
L1	3.70		4.30	0.145		0.169
L2		18.50			0.728	
L3	14.20		14.80	0.559		0.582
L4		34.60			1.362	
L5		5.50			0.216	
M	2.00		3.00	0.078		0.118
V		5°			5°	
V2		60°			60°	
Dia.	3.55		3.65	0.139		0.143

- Cooling method : by conduction (C).
- Recommended torque value : 0.8 m.N
- Maximum torque value : 1 m.N

PACKAGE DATA

SOT93 Plastic



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.70		4.90	1.185		0.193
C	1.90		2.10	0.075		0.083
D		2.50			0.098	
D1		2.00			0.078	
E	0.50		0.78	0.020		0.031
F	1.10		1.30	0.043		0.051
F3		1.75			0.069	
F4		2.10			0.083	
G	10.80		11.10	0.425		0.437
H	14.70		15.20	0.279		0.598
L			12.20			0.480
L2			16.20			0.638
L3		18.0			0.709	
L5	3.95		4.15	0.156		0.163
L6		31.00			1.220	
O	4.00		4.10	0.157		0.161

- Cooling method : by conduction (C).
- Recommended torque value : 0.8 m.N
- Maximum torque value : 1 m.N

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA3006CW	STTA3006CW	TO247	4.36g	30	Tube
STTA3006CP	STTA3006CP	SOT93	3.97g	30	Tube

- Epoxy meets UL94,V0