



STTA512D/F/B

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

MAIN PRODUCTS CHARACTERISTICS

$I_{F(AV)}$	5A
V_{RRM}	1200V
t_{rr} (typ)	45ns
V_F (max)	2.0V

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 IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATIONS.
- CECC APPROVED.

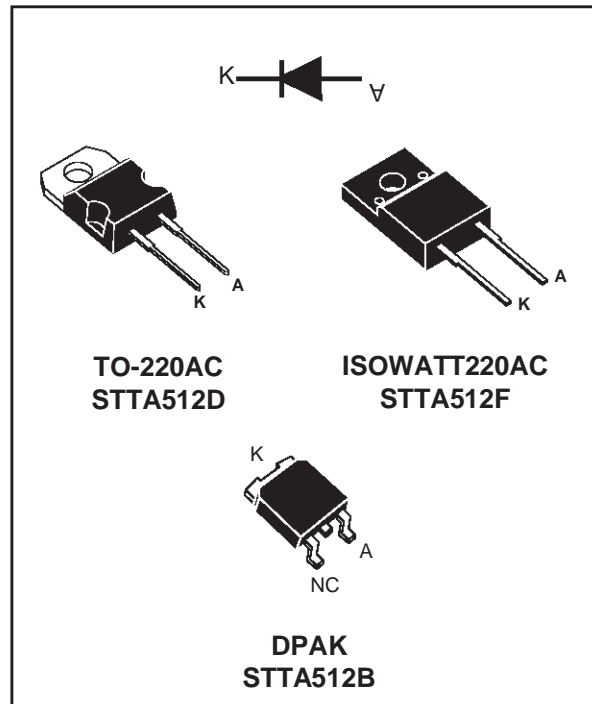
DESCRIPTION

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 also highly decrease power losses in any associated switching IGBT or MOSFET in all "Freewheel Mode" operations.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1200	V
V_{RSM}	Non repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		20	A
I_{FRM}	Repetitive peak forward current	$t_p = 5 \mu s$ $F = 5 kHz$	75	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10 ms$ Sine	45	A
T_j	Maximum operating junction temperature		150	°C
T_{stg}	Storage temperature		-65 to 150	°C

TURBOSWITCH is a trademark of STMicroelectronics.



They are particularly suitable in Motor Control circuitries, or in the primary of SMPS as snubber, clamping or demagnetizing diodes, and also at the secondary of SMPS as high voltage rectifier diodes.

STTA512D/F/B

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	STTA512D/B STTA512F	4.0 5.5	°C/W
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)} = 5A$ $\delta = 0.5$ STTA512D/B $T_c = 102^\circ C$ STTA512F $T_c = 84^\circ C$	12	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3$ ($P_3 = 10\% P_1$)	STTA512D/B $T_c = 98^\circ C$ STTA512F $T_c = 78^\circ C$	13	W

STATIC ELECTRICAL CHARACTERISTICS (see figure 6)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_F *	Forward voltage drop	$I_F = 5A$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.35	2.2 2.0	V V
I_R **	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		0.3	100 2.0	μA mA
V_{to}	Threshold voltage	$T_j = 125^\circ C$			1.57	V
R_d	Dynamic resistance				0.086	m Ω

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

** $t_p = 5 ms$, $\delta < 2\%$

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see figure 7)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$		45	95	ns
I_{RM}	Maximum reverse recovery current	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 5A$ $di_F/dt = -40 A/\mu s$ $di_F/dt = -500 A/\mu s$		20	7.5	A
S factor	Softness factor	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 5A$ $di_F/dt = -500 A/\mu s$		1.2		/

TURN-ON SWITCHING (see figure 8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	$T_j = 25^\circ C$ $I_F = 5A$, $di_F/dt = 40 A/\mu s$ measured at $1.1 \times V_{Fmax}$			900	ns
V_{Fp}	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 5A$, $di_F/dt = 40 A/\mu s$ $I_F = 40A$, $di_F/dt = 500 A/\mu s$		50	35	V

APPLICATION DATA

The 1200V TURBOSWITCH series has been designed to provide the lowest overall power losses in all high frequency or high pulsed current operations. In such applications (Fig 1 to 5), the way of calculating the power losses is given below :

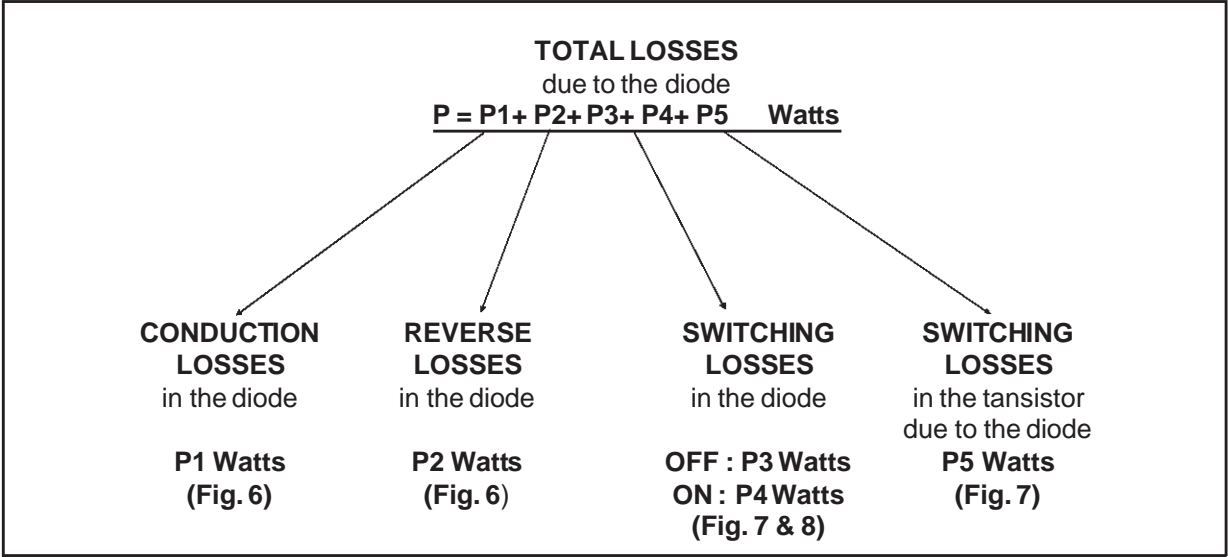


Fig. 1 : "FREEWHEEL" MODE.

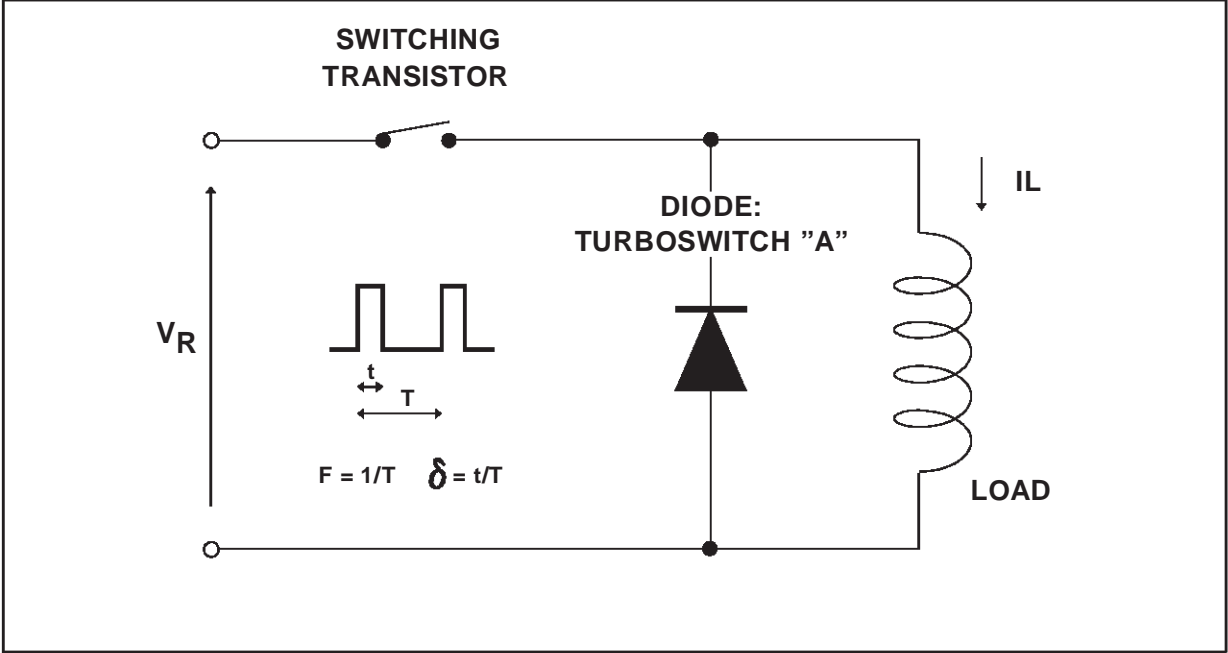


Fig. 2 : SNUBBER DIODE.

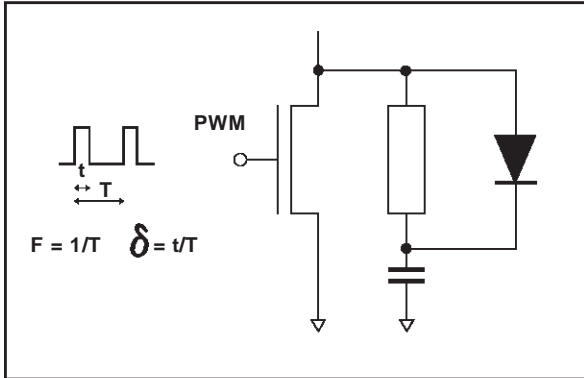


Fig. 3 : CLAMPING DIODE.

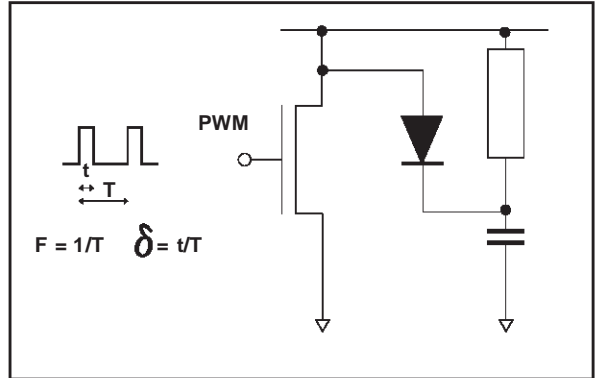


Fig. 4 : DEMAGNETIZING DIODE.

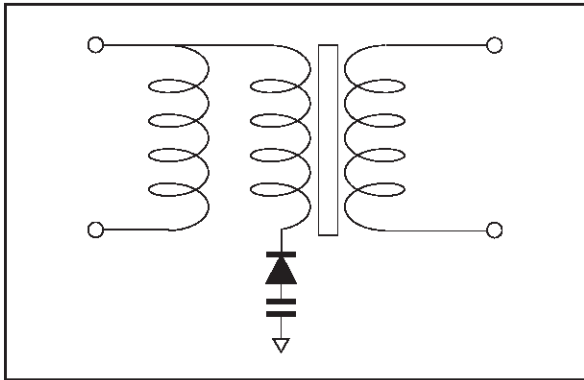
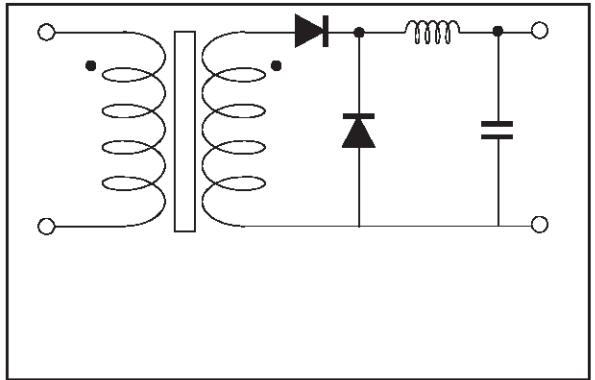
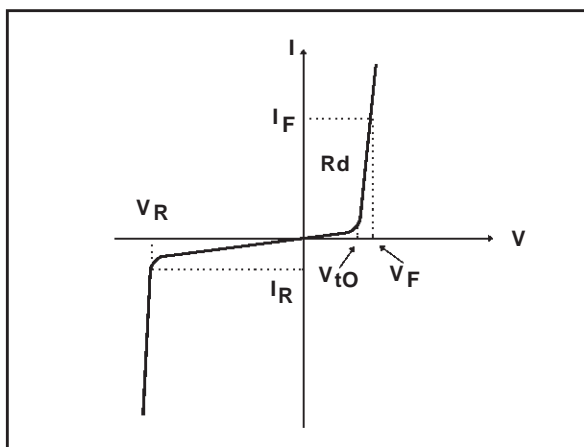


Fig. 5 : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. 6: STATIC CHARACTERISTICS



Conduction losses :

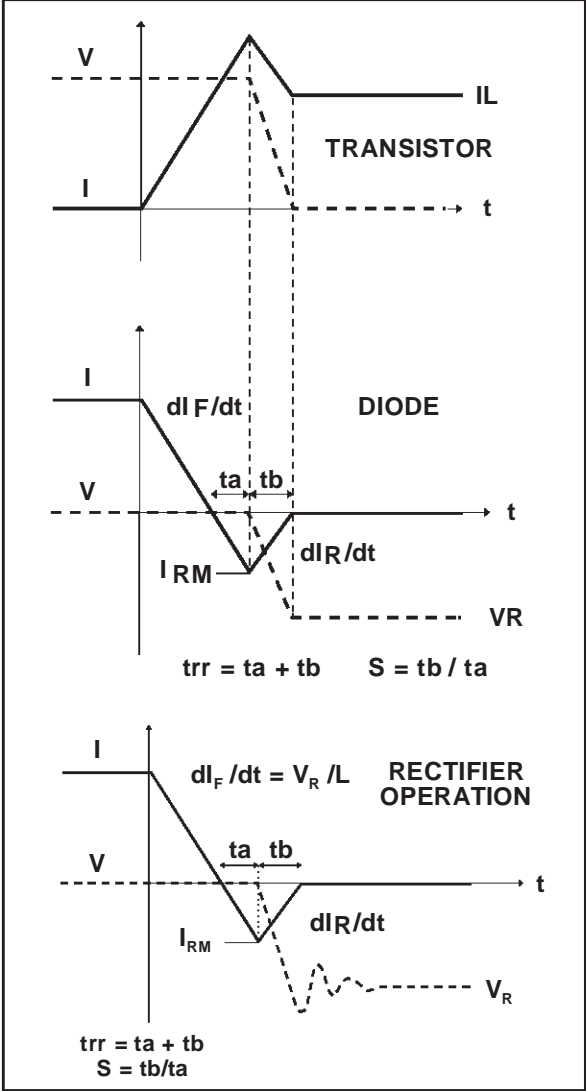
$$P1 = V_{t0} \cdot I_F(AV) + R_d \cdot I_F^2(RMS)$$

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. 7: 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):

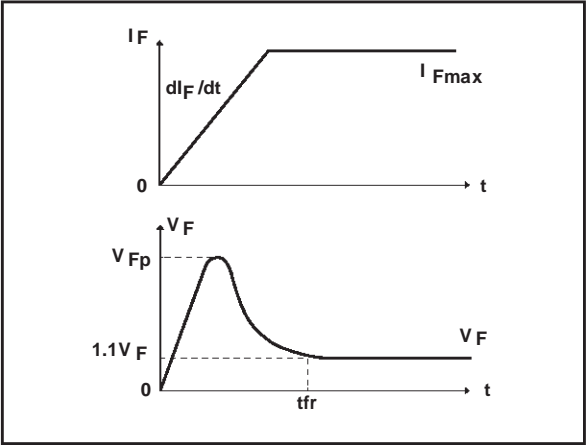
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

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

Fig. 8: TURN-ON CHARACTERISTICS



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



Fig. 9: Conduction losses versus average current.

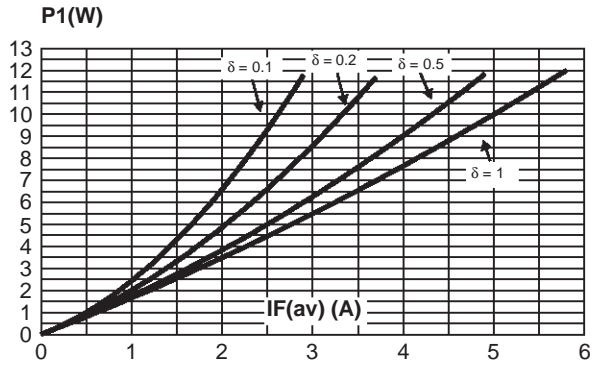


Fig. 10: Switching OFF losses versus dI_F/dt .

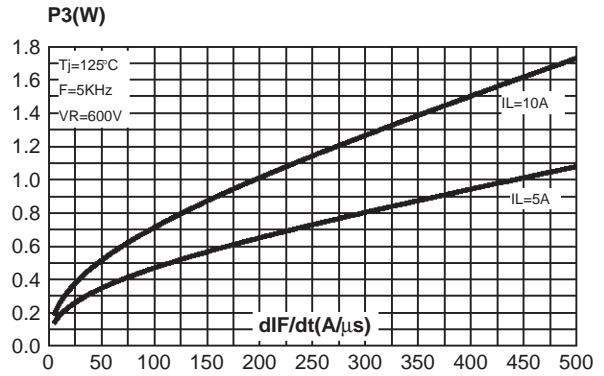


Fig. 11: Switching ON losses versus dI_F/dt

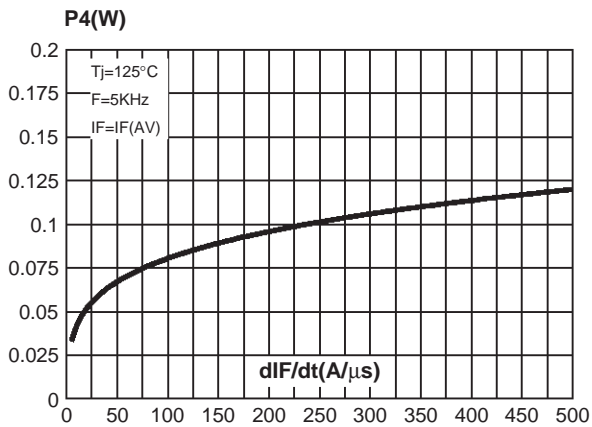


Fig. 12: Switching losses in transistor due to the diode.

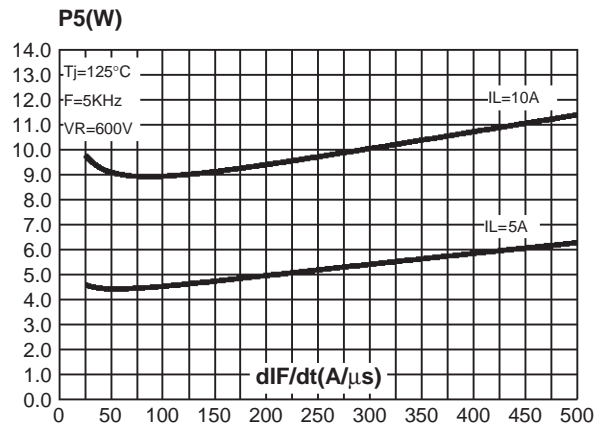


Fig. 13: Forward voltage drop versus forward current (maximum values).

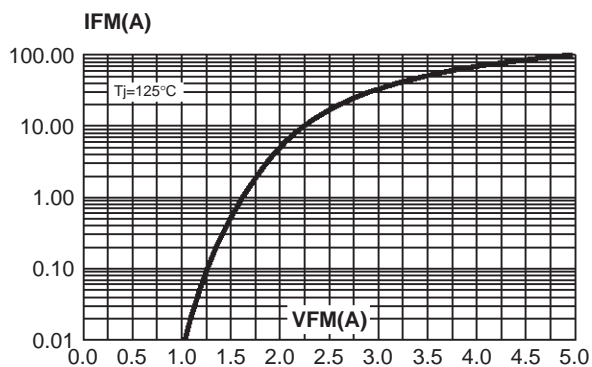


Fig. 14: Peak reverse recovery current versus dI_F/dt (90% confidence).

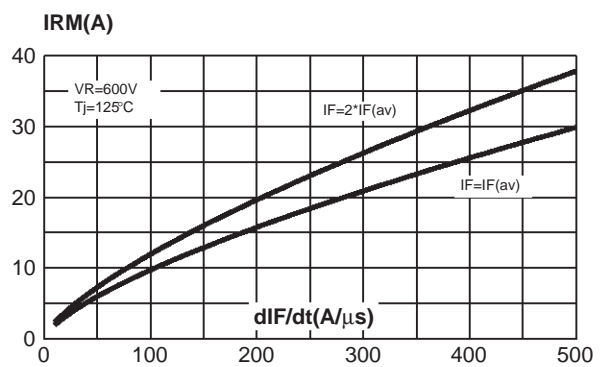


Fig. 15: Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC and DPAK).

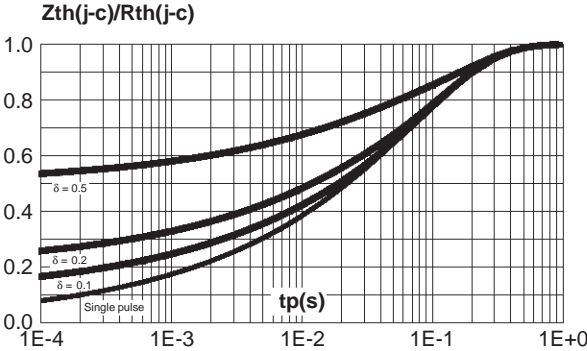


Fig. 16: Relative variation of thermal impedance junction to case versus pulse duration (ISOWATT220AC).

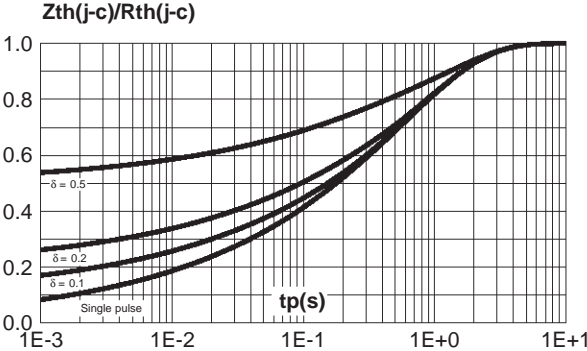


Fig. 17: Reverse recovery time versus dI_F/dt (90% confidence).

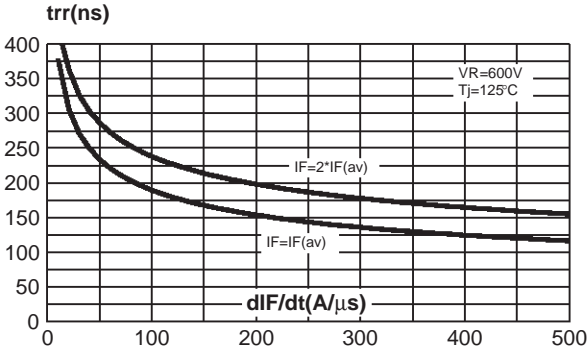


Fig. 18: Softness factor (t_b/t_a) versus dI_F/dt (typical values).

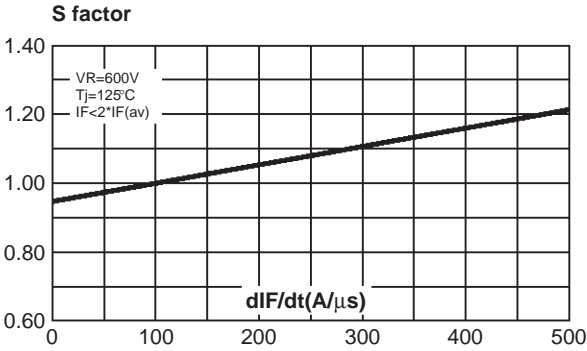


Fig. 19: Relative variation of dynamic parameters versus junction temperature (reference $T_j=125^\circ\text{C}$).

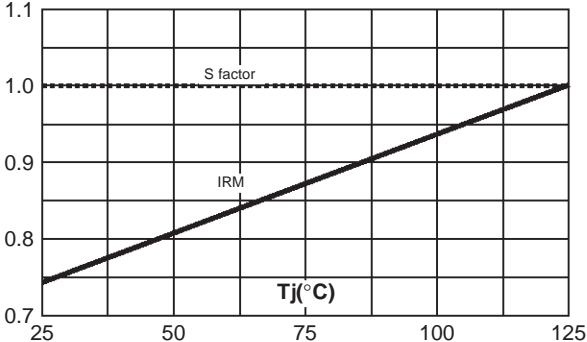
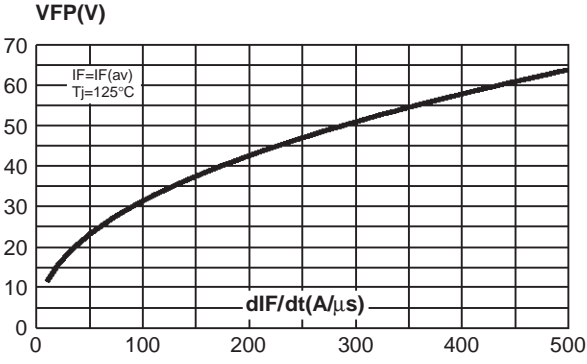
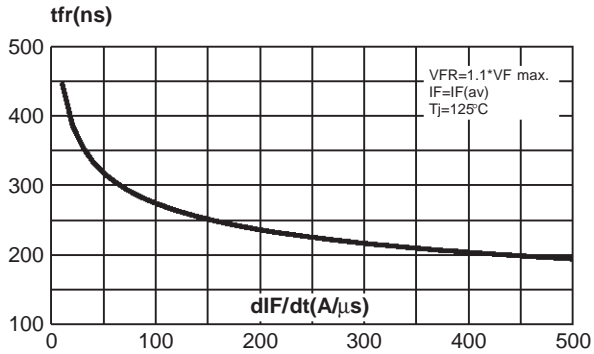


Fig. 20: Transient peak forward voltage versus dI_F/dt (90% confidence).



STTA512D/F/B

Fig. 21: Forward recovery time versus dI_F/dt (90% confidence).



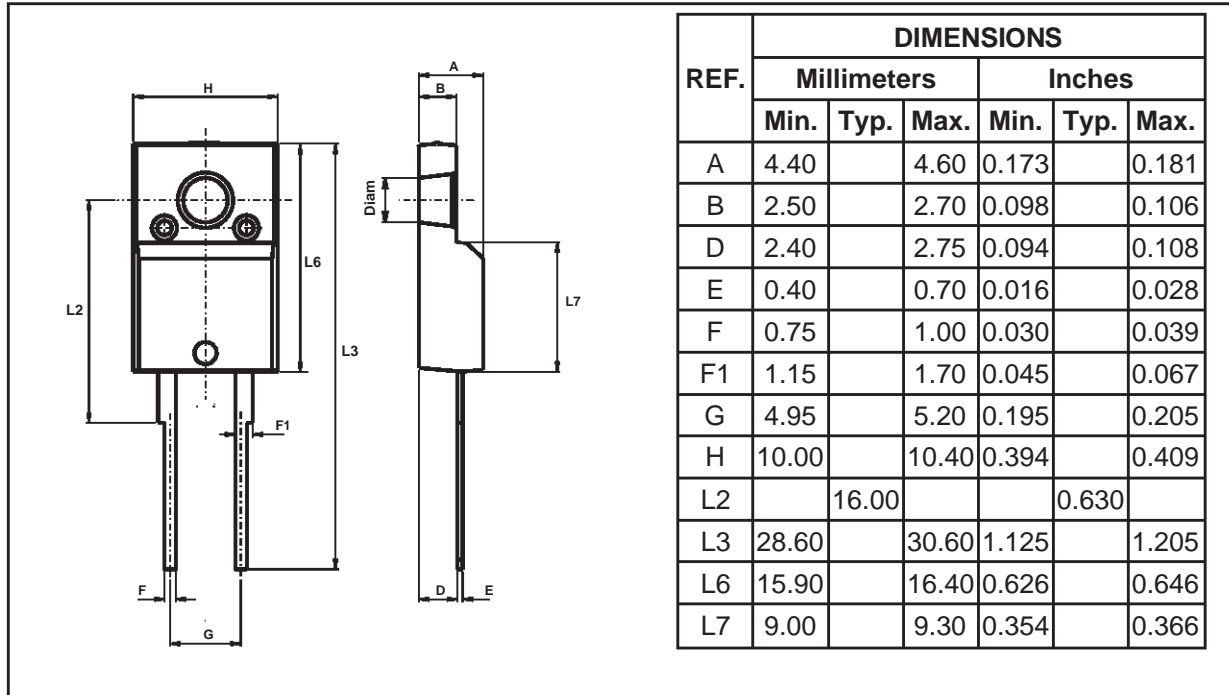
PACKAGE DATA

TO-220AC (JEDEC outline)

REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151

- **Marking:** Type number.
- Cooling method: C.
- Weight: 1.9 g.
- Torque value: 0.55 m.N typ (0.70 m.N max).

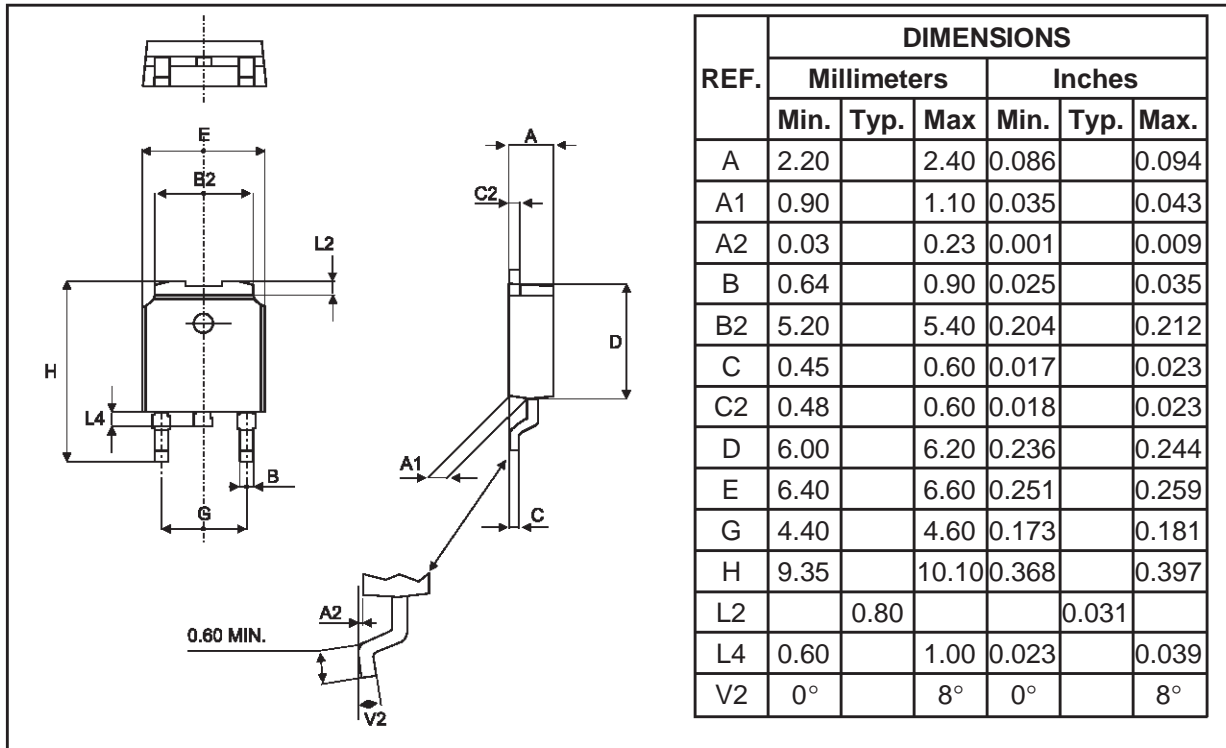
PACKAGE DATA
ISOWATT220AC



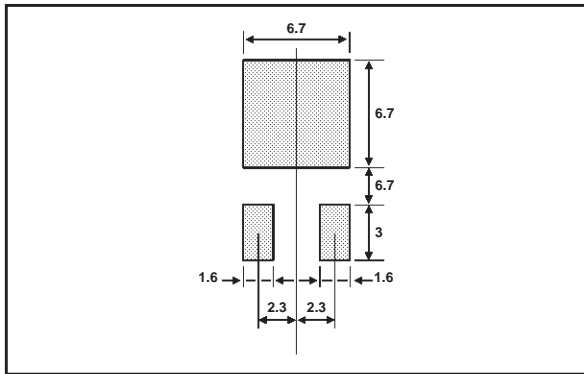
- **Marking:** Type number.
- Cooling method: C.
- Weight: 2.0 g.
- Torque value: 0.55 m.N typ (0.70 m.N max).
- Electrical isolation: 2000V DC
- Capacitance: 12 pF

STTA512D/F/B

PACKAGE DATA DPAK



FOOTPRINT DIMENSIONS (in millimeters)



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics

© 1998 STMicroelectronics - Printed in Italy - All rights reserved.

STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Italy - Japan - Korea - Malaysia - Malta - Mexico - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.

<http://www.st.com>