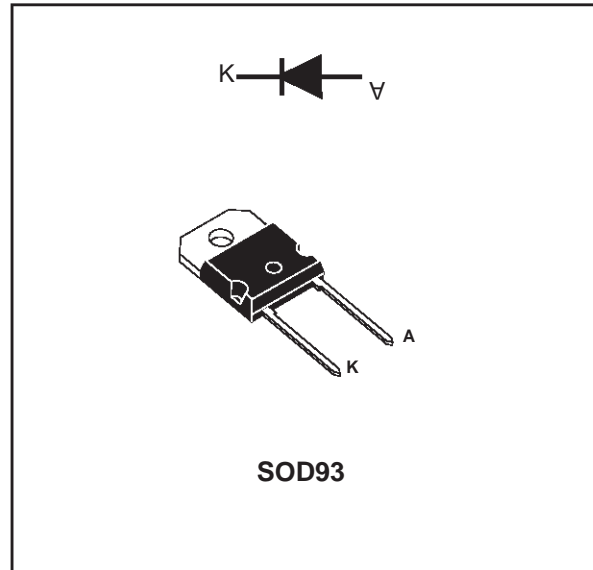


**TURBOSWITCH™ "A". ULTRA-FAST HIGH VOLTAGE DIODE**
**MAIN PRODUCT CHARACTERISTICS**

$I_{F(AV)}$	<b>25A</b>
$V_{RRM}$	<b>1200V</b>
$t_{rr}$ (typ)	<b>60ns</b>
$V_F$ (max)	<b>1.9V</b>

**FEATURES AND BENEFITS**

- 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.

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.

**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	50	A
$I_{FRM}$	Repetitive peak forward current ( $t_p = 5 \mu s$ , $F = 5kHz$ )	300	A
$T_j$	Maximum operating junction temperature	150	°C
$T_{stg}$	Storage temperature	-65 to 150	°C

TURBOSWITCH is a trademark of STMicroelectronics.

## STTA2512P

### THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance		1.2	°C/W
$P_1$	Conduction power dissipation (see fig. 6)	$I_{F(AV)} = 25A$ $\delta = 0.5$ $T_c = 82^\circ C$	57	W
$P_{max}$	Total power dissipation $P_{max} = P_1 + P_3$ ( $P_3 = 10\% P_1$ )	$T_c = 75^\circ C$	62.5	W

### STATIC ELECTRICAL CHARACTERISTICS (see Fig. 6)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_F$ *	Forward voltage drop	$I_F = 25A$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.3	2.1 1.9	V V
$I_R$ **	Reverse leakage current	$V_R = 0.8$ $\times V_{RRM}$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		2.0	150 8.0	$\mu A$ mA
$V_{to}$	Threshold voltage	$T_j = 125^\circ C$			1.52	V
$R_d$	Dynamic resistance				15	m $\Omega$

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

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

### DYNAMIC ELECTRICAL CHARACTERISTICS

#### TURN-OFF SWITCHING (see Fig. 7)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$		60	110	ns
$I_{RM}$	Maximum reverse recovery current	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 25A$ $di_F/dt = -200 A/\mu s$ $di_F/dt = -500 A/\mu s$		45	35	A
S factor	Softness factor	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 25A$ $di_F/dt = -500 A/\mu s$		1.2		/

#### TURN-ON SWITCHING (see Fig. 8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$t_{fr}$	Forward recovery time	$T_j = 25^\circ C$ $I_F = 25A$ , $di_F/dt = 200 A/\mu s$ measured at $1.1 \times V_{Fmax}$			900	ns
$V_{Fp}$	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 25A$ , $di_F/dt = 200 A/\mu s$ $I_F = 40A$ , $di_F/dt = 500 A/\mu s$		35	30	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 :

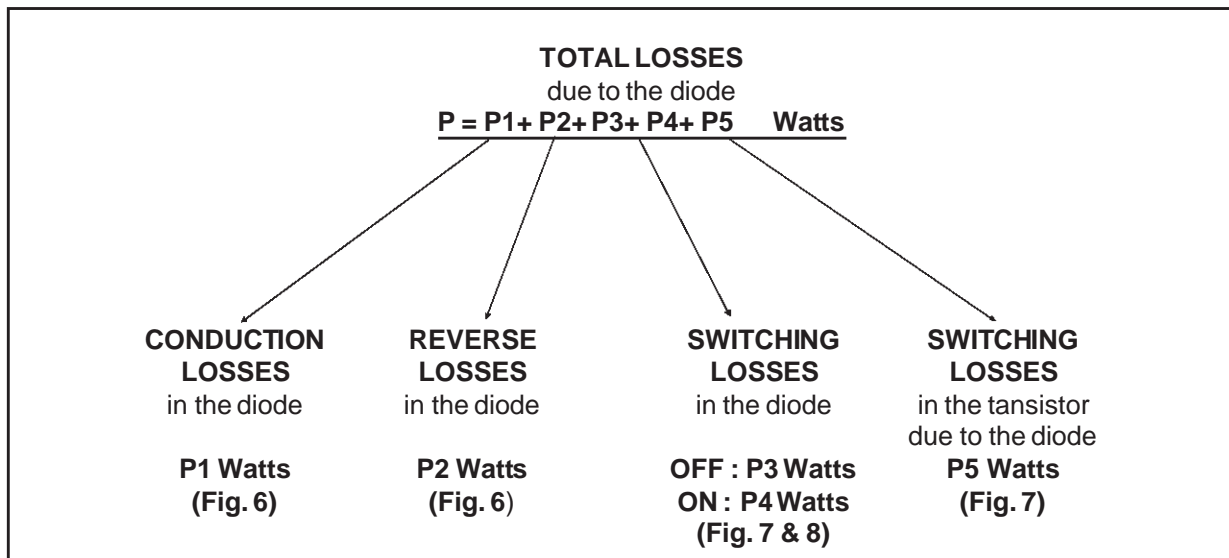


Fig. 1 : "FREEWHEEL" MODE.

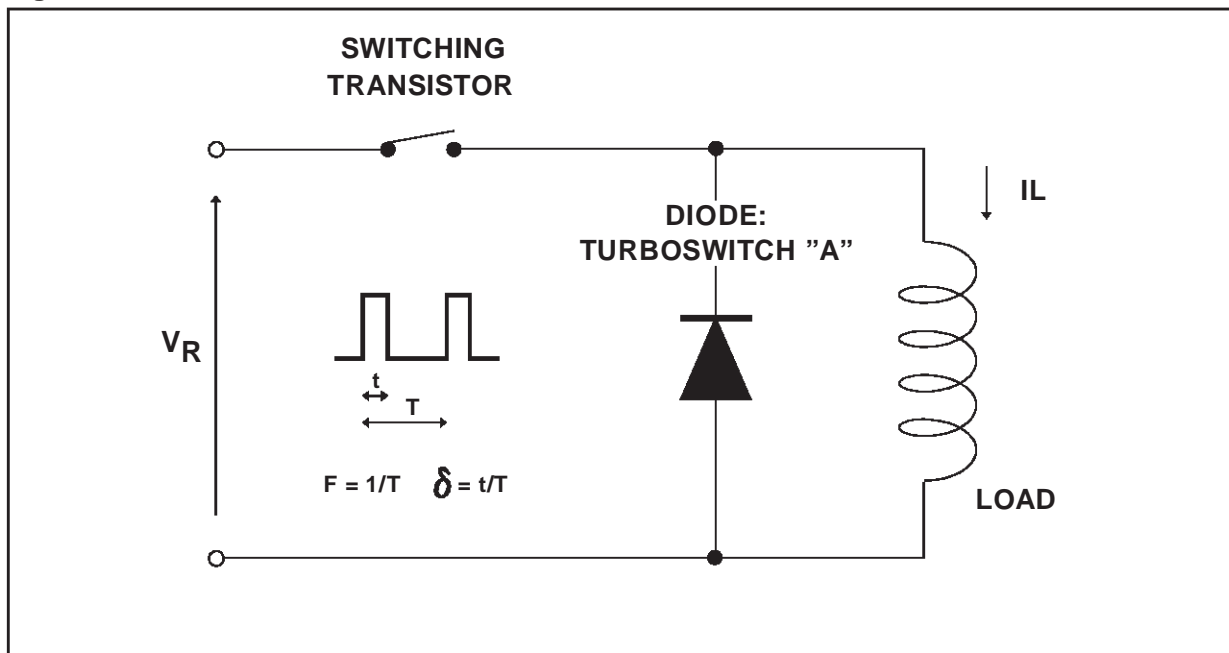


Fig. 2 : SNUBBER DIODE.

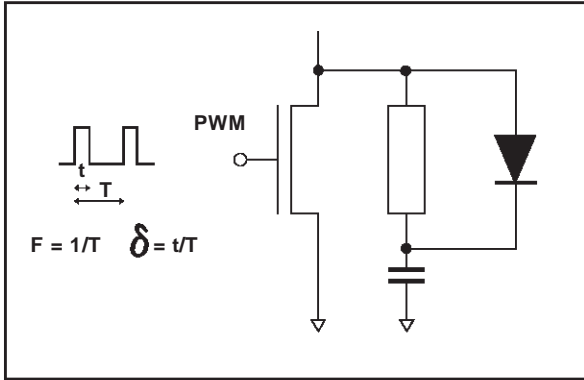


Fig. 3 : CLAMPING DIODE.

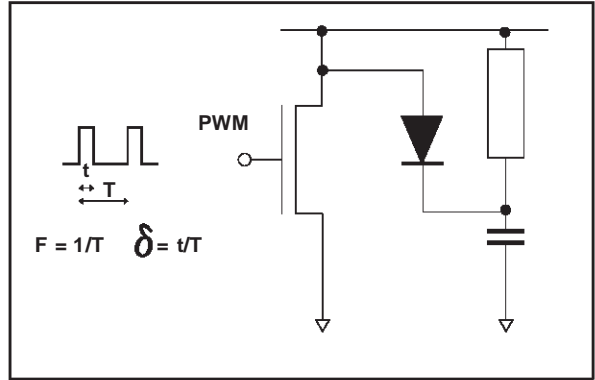


Fig. 4 : DEMAGNETIZING DIODE.

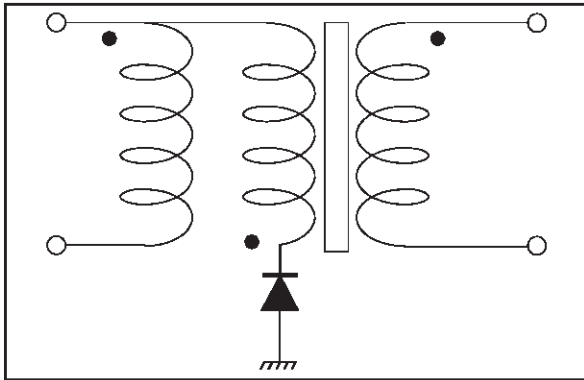
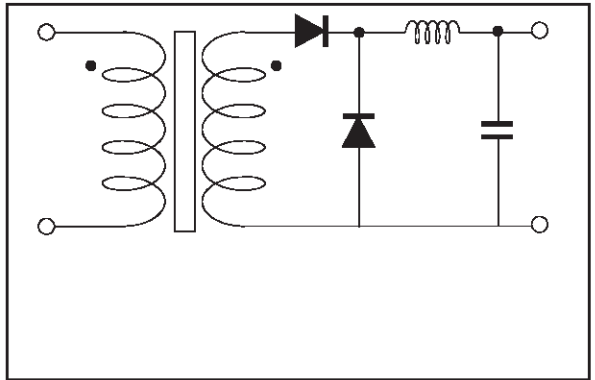
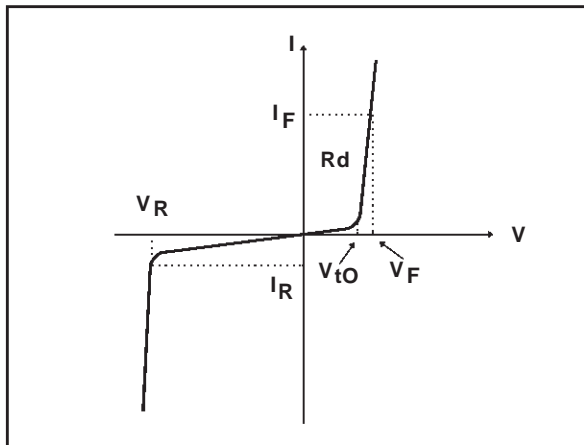


Fig. 5 : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. 6: STATIC CHARACTERISTICS



**Conduction losses :**

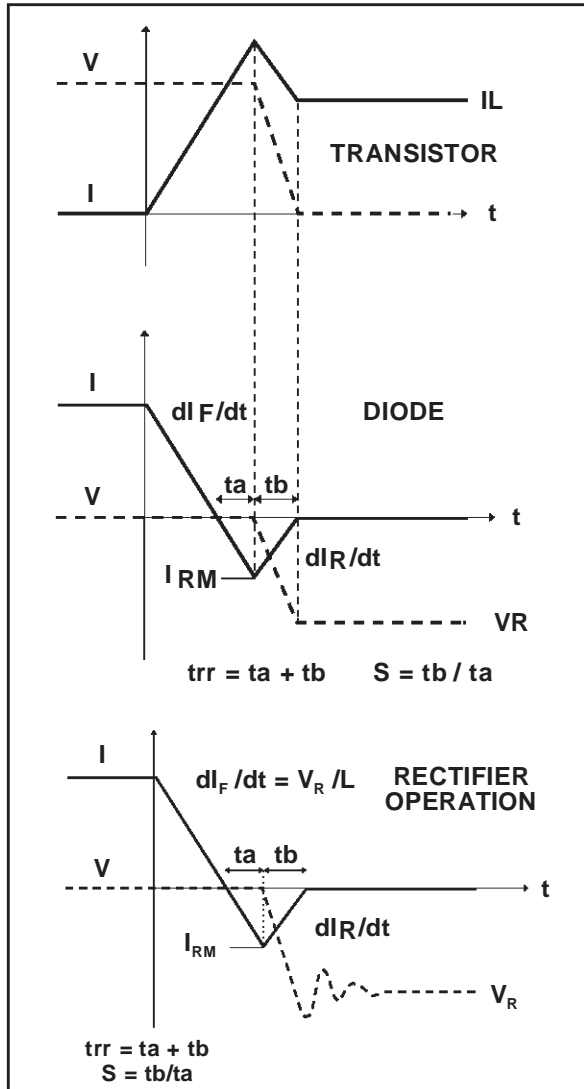
$$P1 = V_{t0} \cdot I_F(AV) + R_d \cdot I_F^2(RMS)$$

**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):**

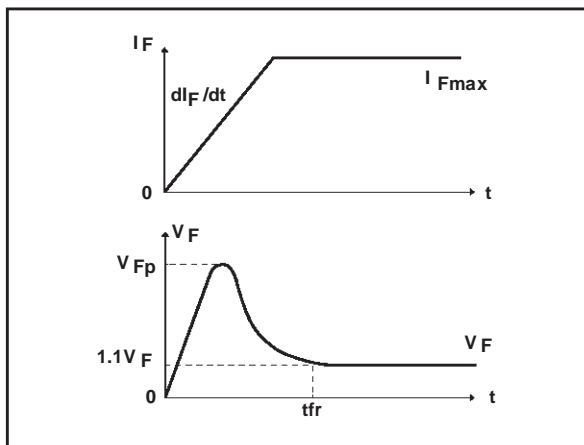
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

**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.

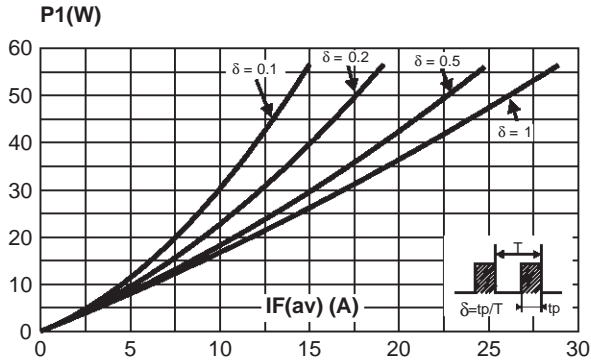


Fig. 11: Switching ON losses versus  $dIF/dt$ .

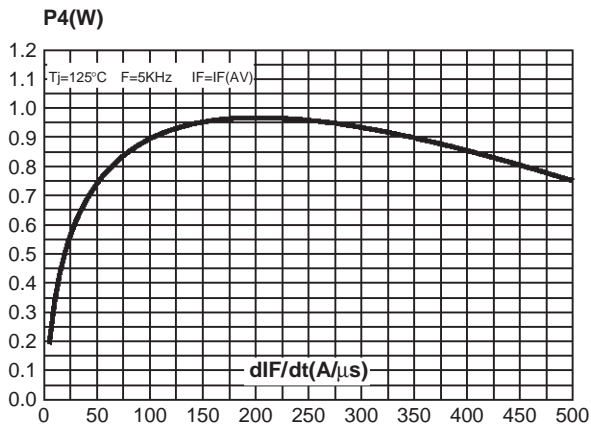


Fig. 13: Forward voltage drop versus forward current (maximum values).

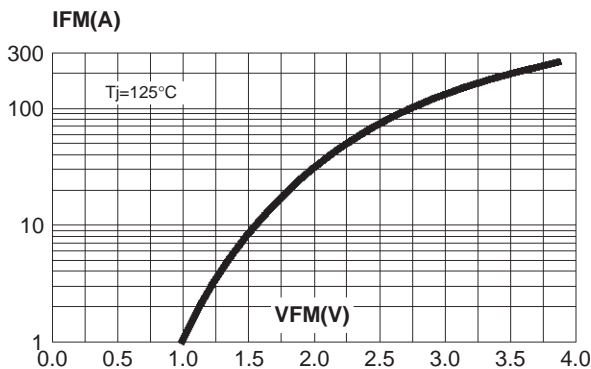


Fig. 10: Switching OFF losses versus  $dIF/dt$ .

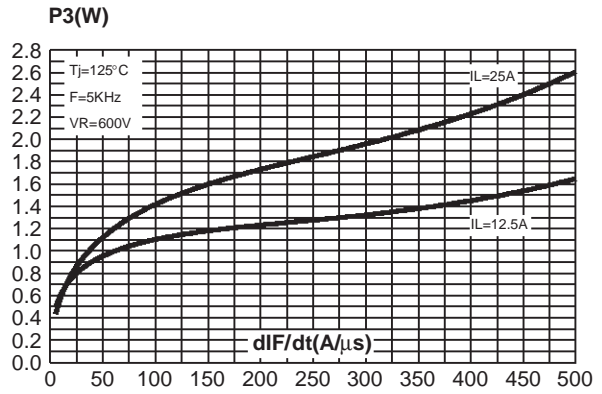


Fig. 12: Switching losses in transistor due to the diode.

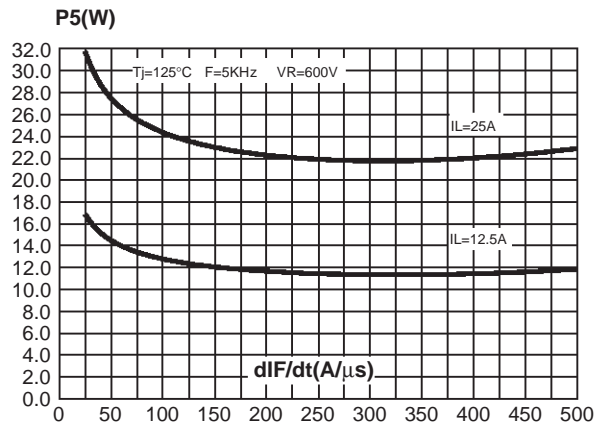
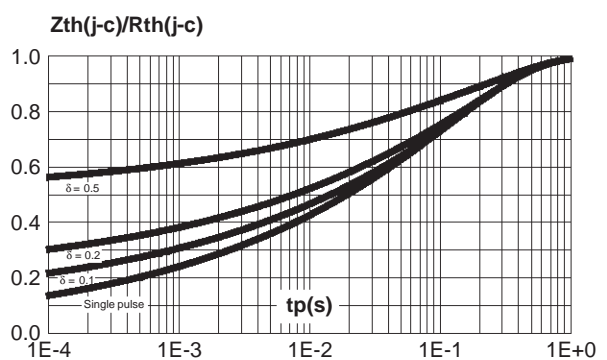
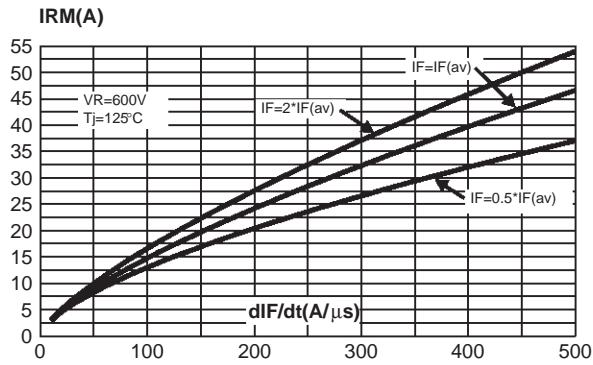


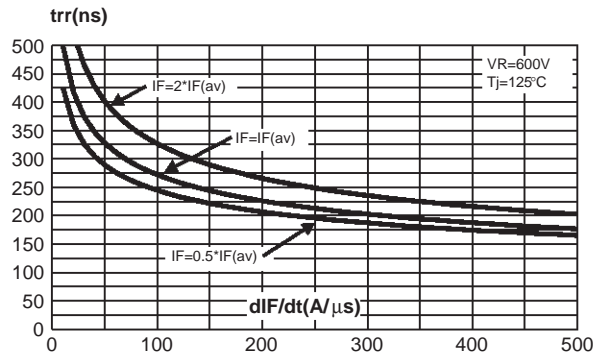
Fig. 14: Relative variation of thermal impedance junction to case versus pulse duration.



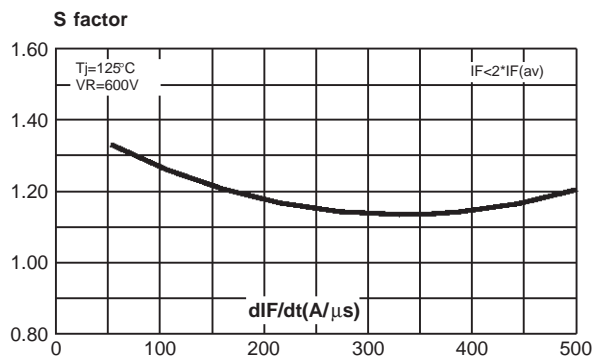
**Fig. 15:** Peak reverse recovery current versus  $dI_F/dt$  (90% confidence).



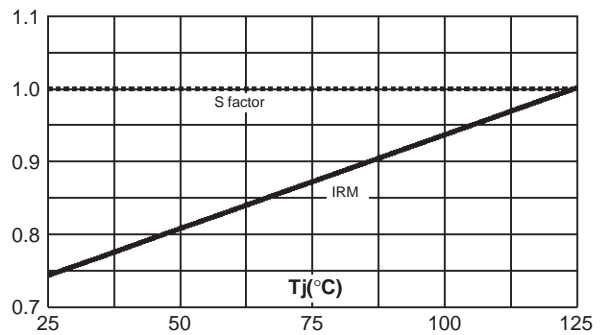
**Fig. 16:** Reverse recovery time versus  $dI_F/dt$  (90% confidence).



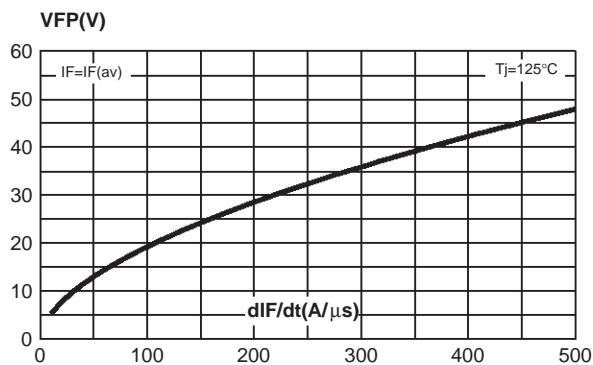
**Fig. 17:** Softness factor (tb/ta) versus  $dI_F/dt$  (typical values).



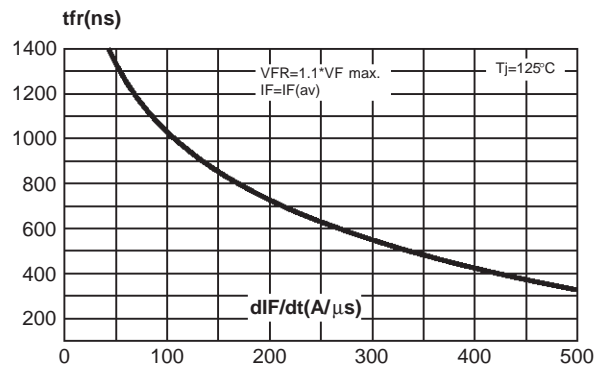
**Fig. 18:** Relative variation of dynamic parameters versus junction temperature (reference  $T_J = 125^\circ C$ ).



**Fig. 19:** Transient peak forward voltage versus  $dI_F/dt$  (90% confidence).

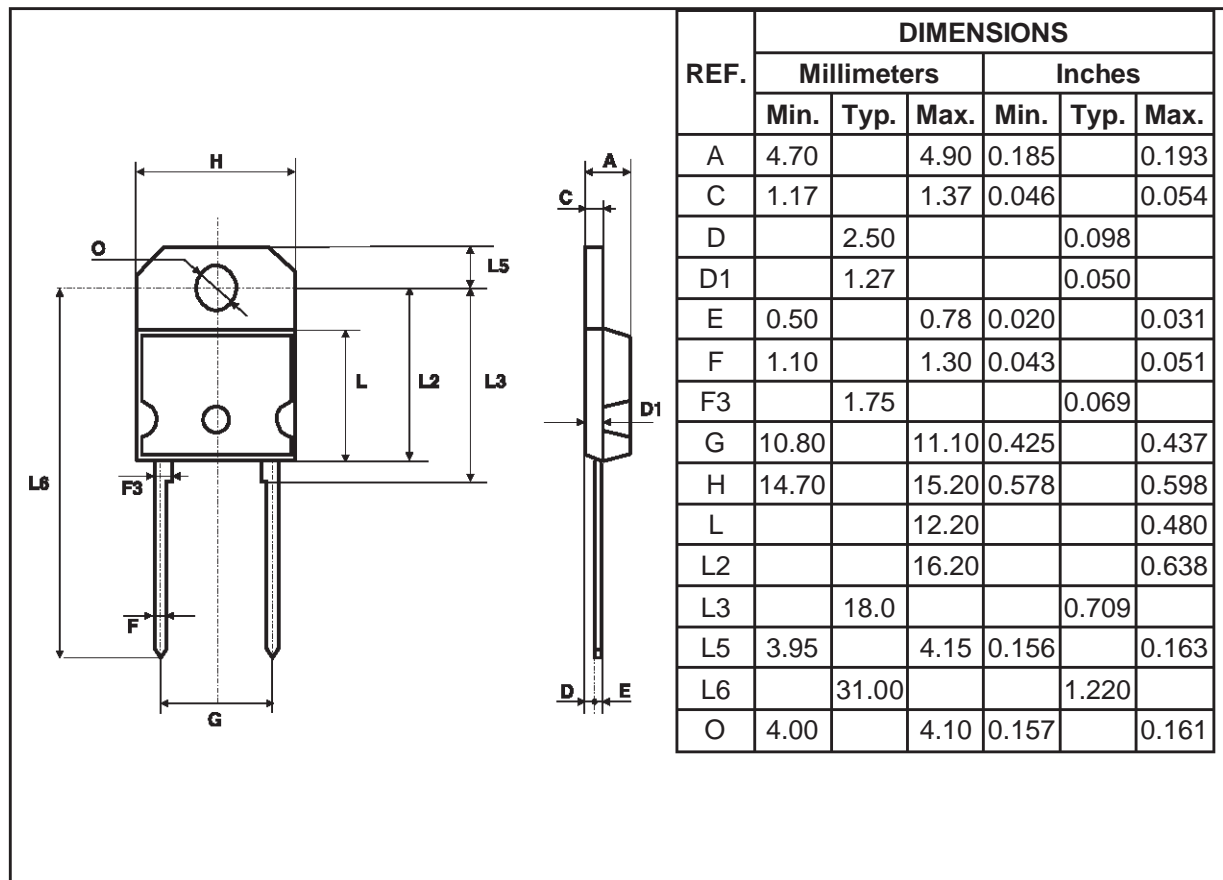


**Fig. 20:** Forward recovery time versus  $dI_F/dt$  (90% confidence).



# STTA2512P

## PACKAGE MECHANICAL DATA SOD93



- **Marking:** Type number
- **Cooling method:** C
- **Weight:** 5.2 g
- **Recommended torque value:** 0.8 m.N
- **Maximum torque value:** 1.0 m.N

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