



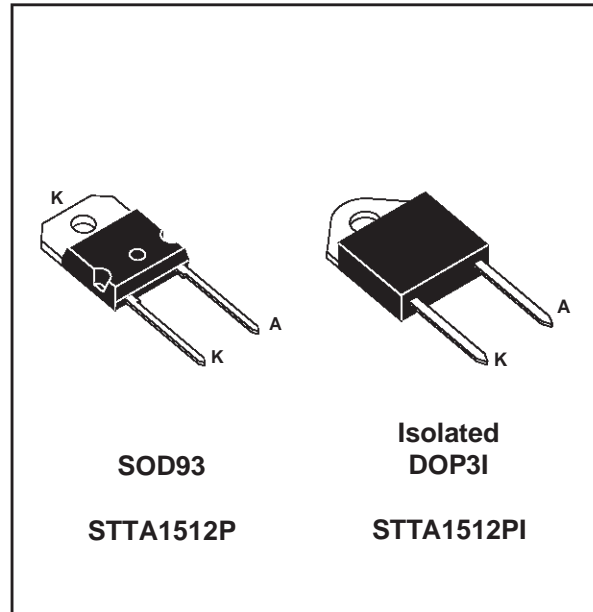
## TURBOSWITCH™ ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	15A
$V_{RRM}$	1200V
$t_{rr}$ (typ)	55ns
$V_F$ (max)	1.9V

### FEATURES AND BENEFITS

- ULTRA-FAST, SOFT RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATION.
- HIGH REVERSE VOLTAGE CAPABILITY
- INSULATED PACKAGE: DOP3I  
Electrical insulation :  $2500V_{RMS}$   
Capacitance : 12pF



### 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. They are also suitable for secondary of SMPS as high voltage rectifier diodes.

### ABSOLUTE RATINGS (limiting values)

Symbol	Parameter		Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		50	A
$I_{FRM}$	Repetitive peak forward current	$t_p = 5 \mu s$ $F = 5kHz$ square	220	A
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10ms$ sinusoidal	150	A
$T_{stg}$	Storage temperature range		- 65 to + 150	°C
$T_j$	Maximum operating junction temperature		150	°C

## THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	SOD93 DOP3I	1.6 2.1	°C/W
$P_1$	Conduction power dissipation $I_{F(AV)} = 15A$ $\delta = 0.5$	SOD93 DOP3I	$T_c = 95^\circ C$ $T_c = 78^\circ C$	W
$P_{max}$	Total power dissipation $P_{max} = P_1 + P_3$ ( $P_3 = 10\% P_1$ )	SOD93 DOP3I	$T_c = 89$ $T_c = 70^\circ C$	W

## STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_F^*$	Forward voltage drop	$I_F = 15A$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.3	2.1 1.9	V V
$I_R^{**}$	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.3	100 6.0	$\mu A$ mA
$V_{to}$	Threshold voltage	$I_p < 3 \cdot I_{F(AV)}$ $T_j = 125^\circ C$			1.48	V
$R_d$	Dynamic resistance	$T_j = 125^\circ C$			25	m $\Omega$

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

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

To evaluate the maximum conduction losses use the following equation :

$$P = V_{to} \times I_{F(AV)} + R_d \times I_{F(RMS)}^2$$

## DYNAMIC ELECTRICAL CHARACTERISTICS

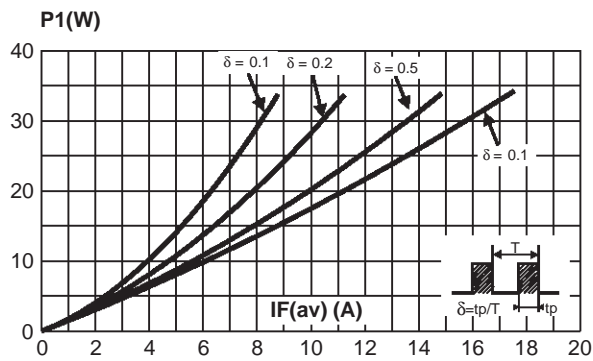
## TURN-OFF SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$		55	105	ns
$I_{RM}$	Maximum reverse recovery current	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 15A$ $di_F/dt = -120 A/\mu s$ $di_F/dt = -500 A/\mu s$		33	20	A
$S_{factor}$	Softness factor	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 15A$ $di_F/dt = -500 A/\mu s$		1.2		/

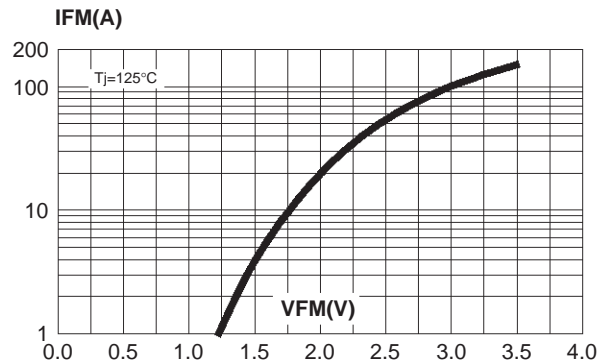
## TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{fr}$	Forward recovery time	$T_j = 25^\circ C$ $I_F = 15 A$ , $di_F/dt = 120 A/\mu s$ measured at $1.1 \times V_{Fmax}$			900	ns
$V_{Fp}$	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 15A$ , $di_F/dt = 120 A/\mu s$ $I_F = 40A$ , $di_F/dt = 500 A/\mu s$		40	30	V

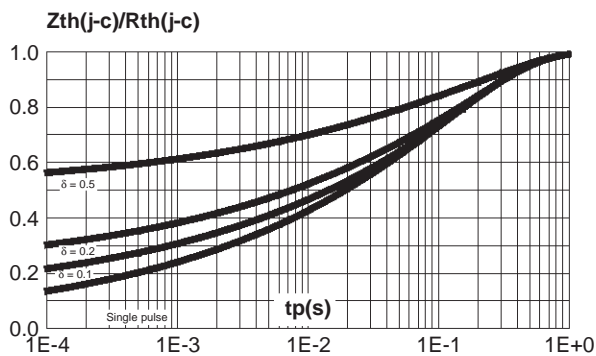
**Fig. 1:** Conduction losses versus average current.



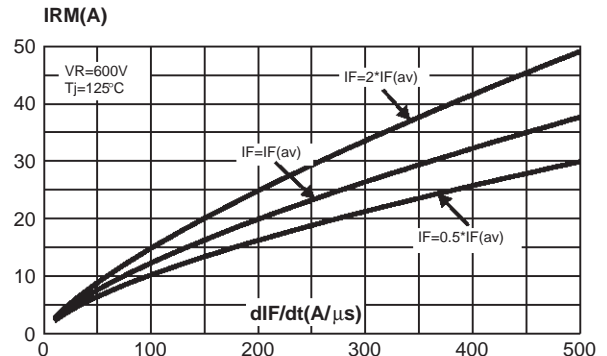
**Fig. 2:** Forward voltage drop versus forward current (maximum values).



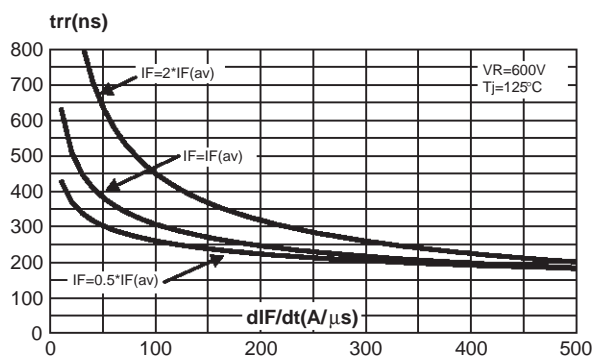
**Fig. 3:** Relative variation of thermal impedance junction to case versus pulse duration.



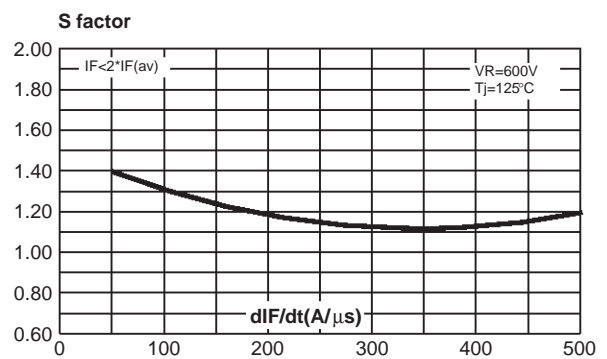
**Fig. 4:** Peak reverse recovery current versus  $di_F/dt$  (90% confidence).



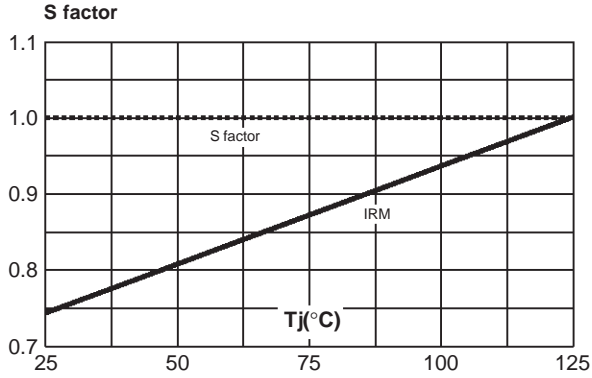
**Fig. 5:** Reverse recovery time versus  $di_F/dt$  (90% confidence).



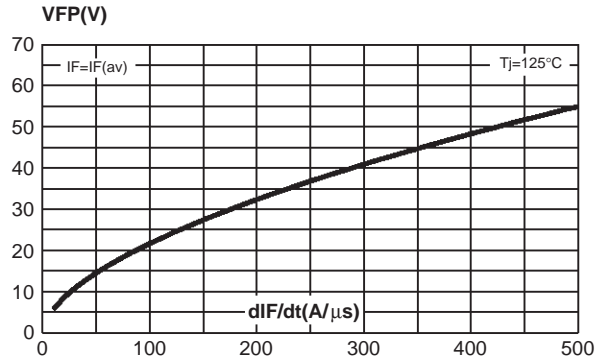
**Fig. 6:** Softness factor (tb/ta) versus  $di_F/dt$  (typical values).



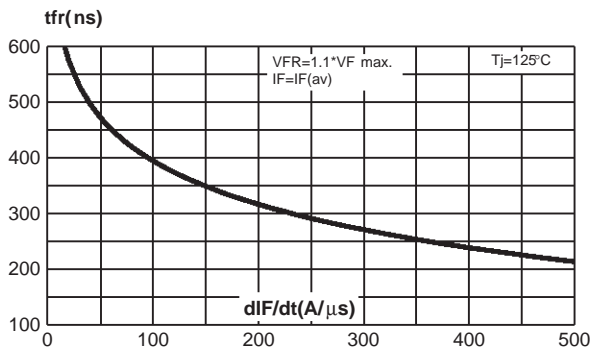
**Fig. 7:** Relative variation of dynamic parameters versus junction temperature.



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



**Fig. 9:** Forward recovery time versus  $dI_F/dt$  (90% confidence).



## 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 A to D), the way of calculating the power losses is given below :

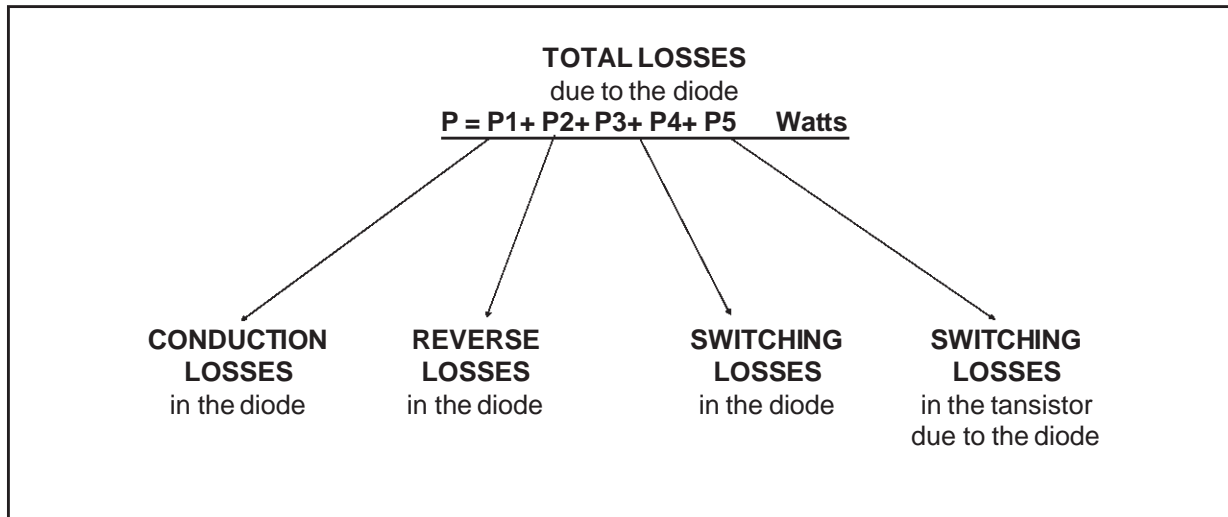


Fig. A : "FREEWHEEL" MODE.

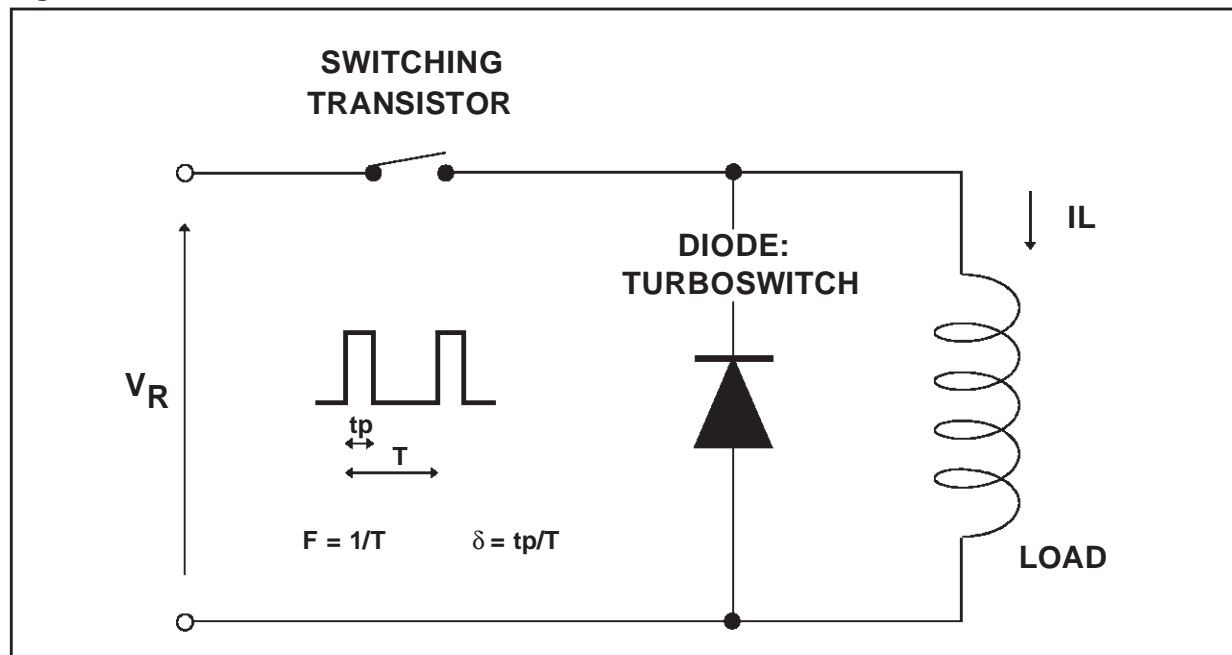


Fig. B : SNUBBER DIODE.

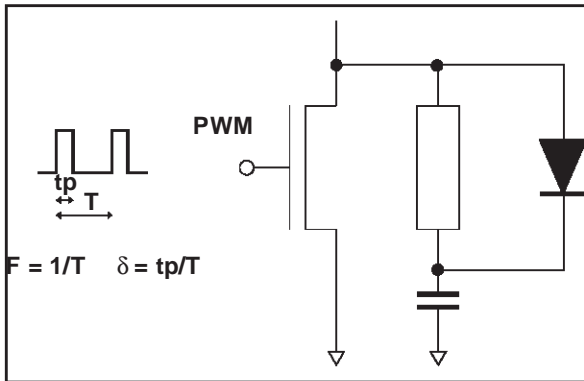


Fig. C : DEMAGNETIZING DIODE.

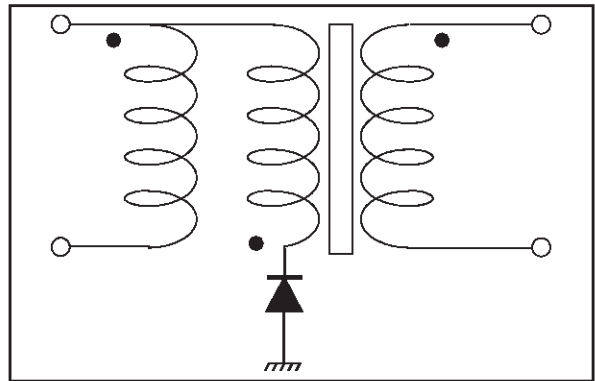
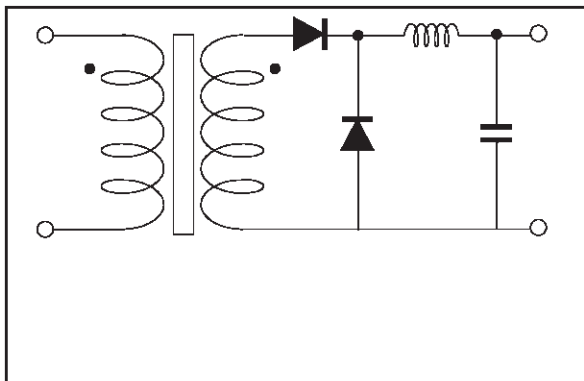
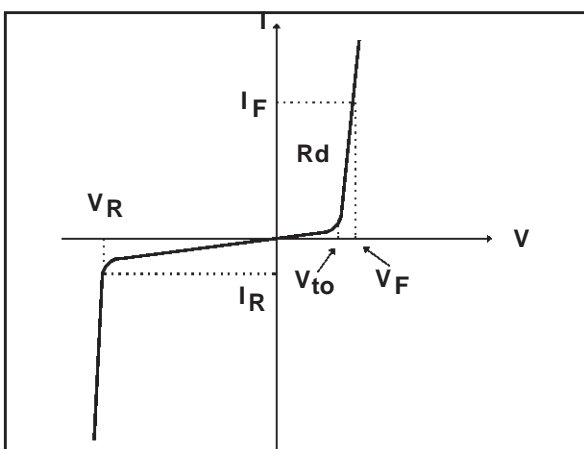


Fig. D : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. E: STATIC CHARACTERISTICS



**Conduction losses :**

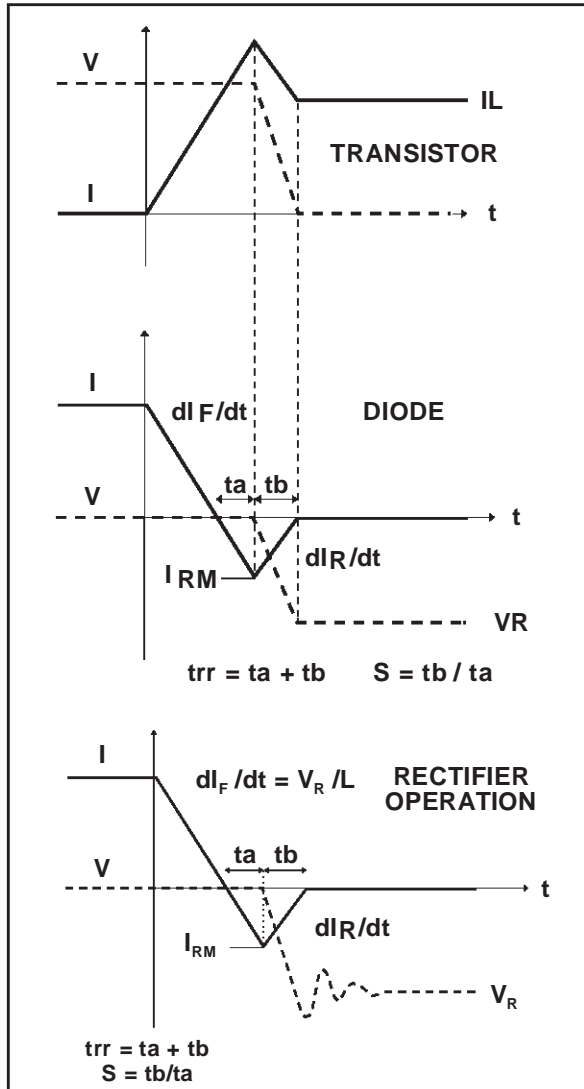
$$P1 = V_{to} \cdot I_F(AV) + R_d \cdot I_F^2(RMS)$$

**Reverse losses :**

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

APPLICATION DATA (Cont'd)

Fig. F: 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):**

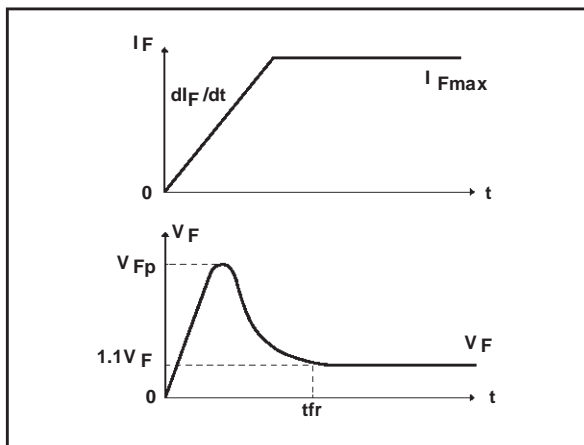
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

**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

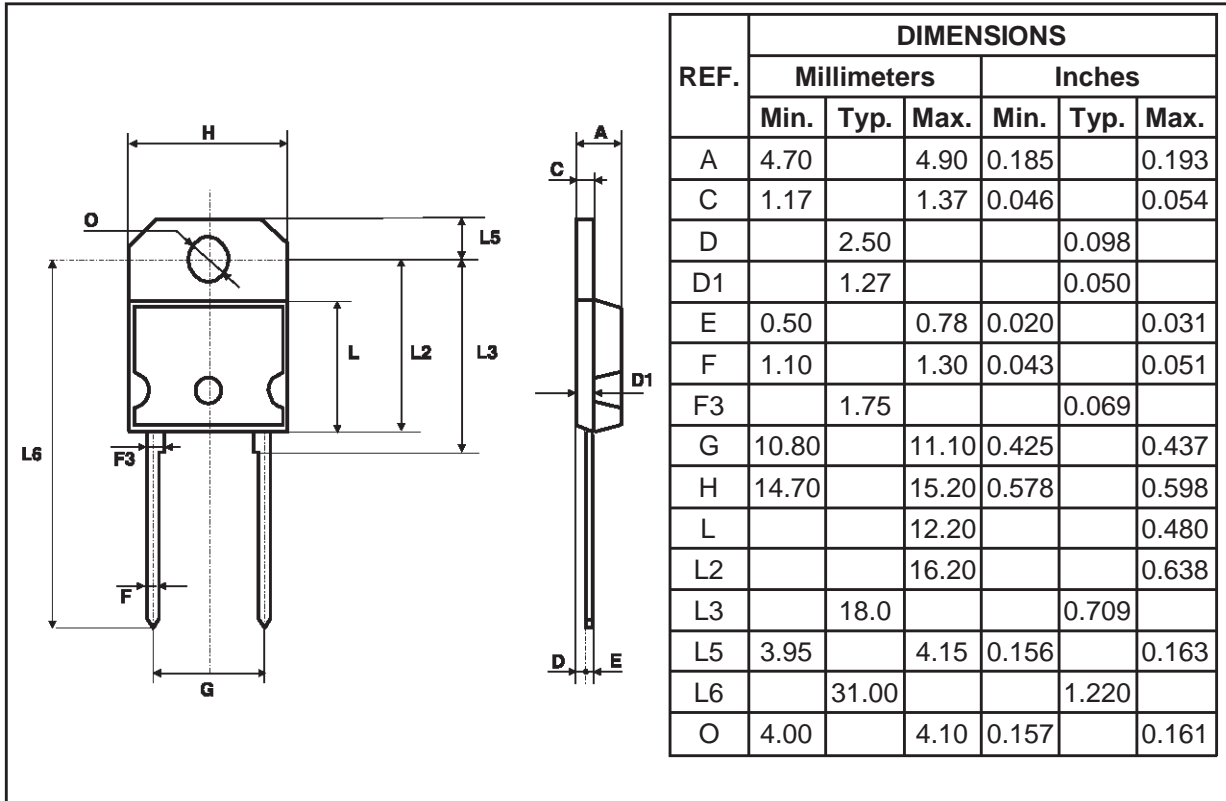
Fig. G: TURN-ON CHARACTERISTICS



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

STTA1512P/PI

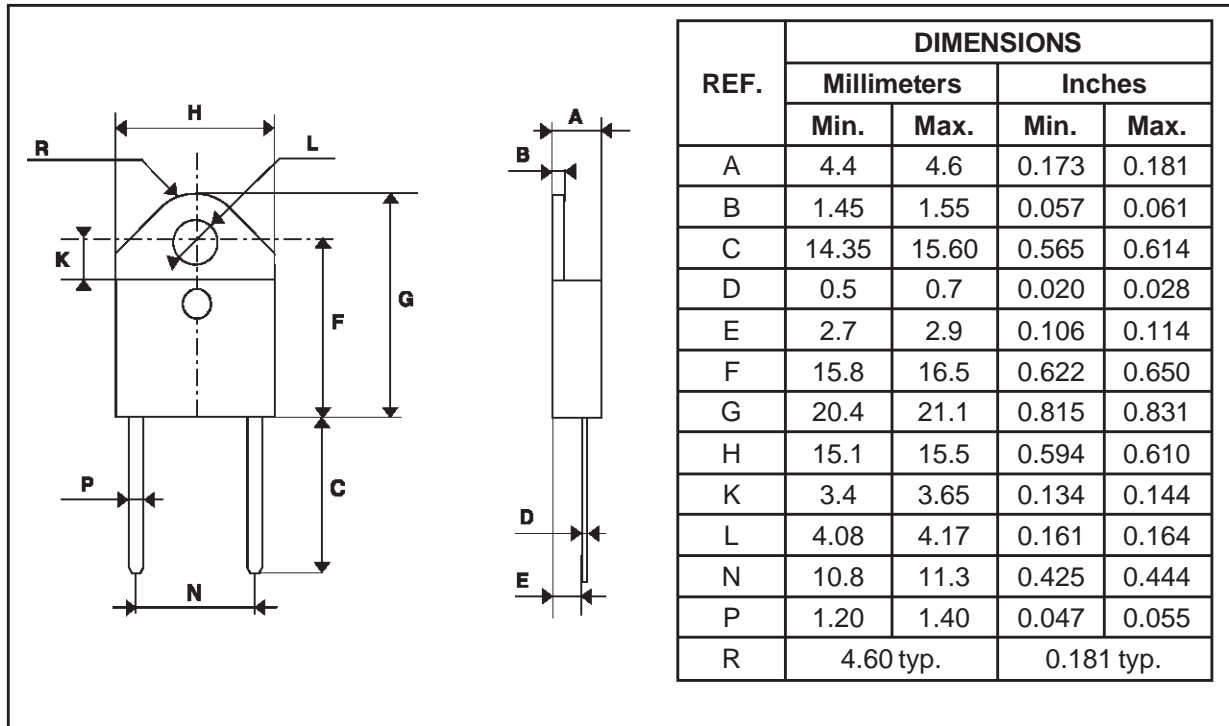
PACKAGE MECHANICAL DATA  
SOD93





**PACKAGE MECHANICAL DATA**

DOP3I (insulated)



Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA1512P	STTA1512P	SOD93	3.79g	30	Tube
STTA1512PI	STTA1512PI	DOP3I	4.52g	30	Tube

- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N.m.
- Maximum torque value: 1.0 N.m.
- Epoxy meets UL94,V0

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