

## TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCT CHARACTERISTICS

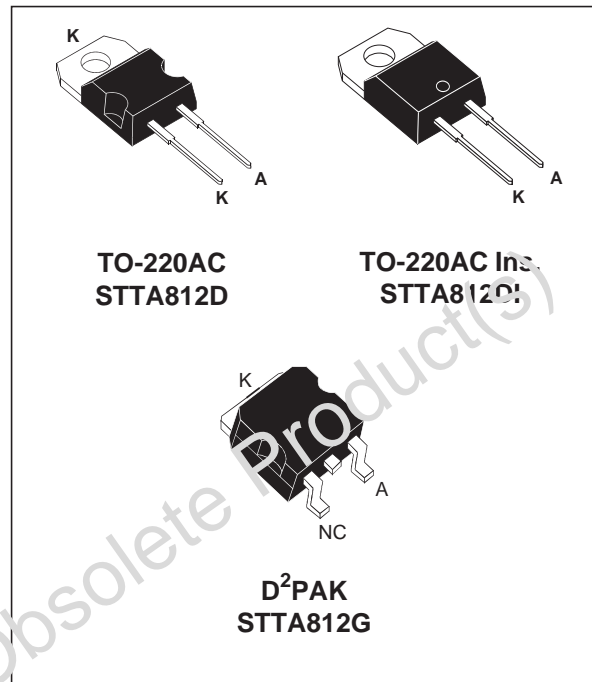
|               |       |
|---------------|-------|
| $I_{F(AV)}$   | 8A    |
| $V_{RRM}$     | 1200V |
| $t_{rr}(typ)$ | 50ns  |
| $V_F(max)$    | 2.0V  |

### 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 : TO-220AC Ins.  
Electrical insulation : 2500V<sub>RMS</sub>  
Capacitance : 7pF.

### 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)

| Sym. bcl     | 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                    | TO-220AC/ D <sup>2</sup> PAK    | 30 A  |
|              |  | TO-220AC Ins.                   | 20 A  |
| $I_{FRM}$    | Repetitive peak forward current        | $t_p = 5 \mu s$ F = 5kHz square | 110 A |
| $I_{FSM}$    | Surge non repetitive forward current   | $t_p = 10ms$ sinusoidal         | 70 A  |
| $T_{stg}$    | Storage temperature range              | - 65 to + 150                   | °C    |
| $T_j$        | Maximum operating junction temperature | 150                             | °C    |

## STTA812D/DI/G

### THERMAL AND POWER DATA

| Symbol        | Parameter  | Conditions                                   | Value                                     | Unit |
|---------------|--|--|---|------|
| $R_{th(j-c)}$ | Junction to case thermal resistance  | TO-220AC/D <sup>2</sup> PAK<br>TO-220AC Ins. | 2.3<br>3.3                                | °C/W |
| $P_1$         | Conduction power dissipation<br>$I_{F(AV)} = 8A$ $\delta = 0.5$            | TO-220AC/D <sup>2</sup> PAK<br>TO-220AC Ins. | $T_c = 105^\circ C$<br>$T_c = 85^\circ C$ | W    |
| $P_{max}$     | Total power dissipation<br>$P_{max} = P_1 + P_3$ ( $P_3 = 10\%$<br>$P_1$ ) | TO-220AC/D <sup>2</sup> PAK<br>TO-220AC Ins. | $T_c = 100^\circ C$<br>$T_c = 79^\circ C$ | W    |

### STATIC ELECTRICAL CHARACTERISTICS

| Symbol   | Parameter               | Test conditions   | Min | Typ  | Max        | Unit          |
|----------|-------------------------|---|-----|------|------------|---------------|
| $V_F$ *  | Forward voltage drop    | $I_F = 8A$<br>$T_j = 25^\circ C$<br>$T_j = 125^\circ C$                 |     | 1.35 | 2.2<br>2.0 | V<br>V        |
| $I_R$ ** | Reverse leakage current | $V_R = 0.8 \times V_{RRM}$<br>$T_j = 25^\circ C$<br>$T_j = 125^\circ C$ |     | 0.6  | 100<br>4   | $\mu A$<br>mA |
| $V_{to}$ | Threshold voltage       | $I_p < 3 \cdot I_{AV}$<br>$T_j = 125^\circ C$                           |     |      | 1.57       | V             |
| $r_d$    | Dynamic parameter       |   |     |      | 54         | 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 :  
 $P = V_{to} \times I_{F(AV)} + r_d \times I_F^2(RMS)$

### DYNAMIC ELECTRICAL CHARACTERISTICS

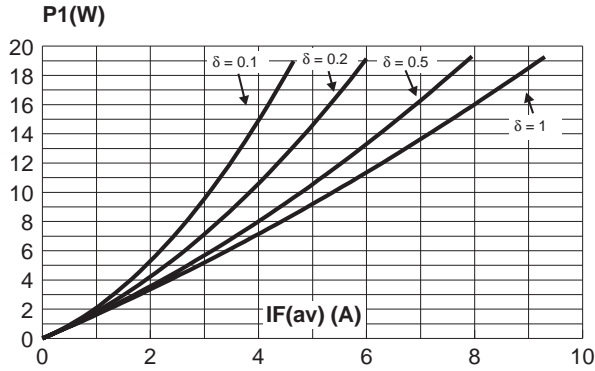
#### TURN-OFF SWITCHING

| Symbol   | Parameter                        | Test conditions   | Min | Typ | Max | Unit |
|----------|----------------------------------|---|-----|-----|-----|------|
| $t_{rr}$ | Reverse recovery time            | $T_j = 25^\circ C$<br>$I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$<br>$I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$ |     | 50  | 100 | ns   |
| $I_{RM}$ | Maximum reverse recovery current | $T_j = 125^\circ C$ $V_R = 600V$ $I_F = 8A$<br>$di_F/dt = -64 A/\mu s$<br>$di_F/dt = -500 A/\mu s$                |     | 25  | 12  | A    |
| S factor | Softness factor                  | $T_j = 125^\circ C$ $V_R = 600V$ $I_F = 8A$<br>$di_F/dt = -500 A/\mu s$   |     | 1.2 |     | -    |

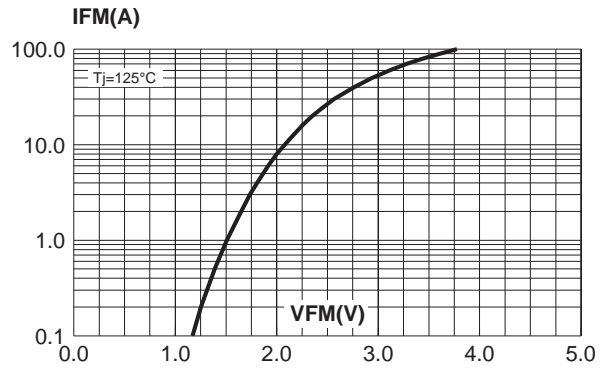
#### TURN-ON SWITCHING

| Symbol   | Parameter             | Test conditions  | Min | Typ | Max | Unit |
|----------|-----------------------|--|-----|-----|-----|------|
| $t_{fr}$ | Forward recovery time | $T_j = 25^\circ C$<br>$I_F = 8 A$ , $di_F/dt = 64 A/\mu s$<br>measured at $1.1 \times V_{Fmax}$    |     |     | 900 | ns   |
| $V_{FP}$ | Peak forward voltage  | $T_j = 25^\circ C$<br>$I_F = 8A$ , $di_F/dt = 64 A/\mu s$<br>$I_F = 40A$ , $di_F/dt = 500 A/\mu s$ |     | 45  | 35  | V    |

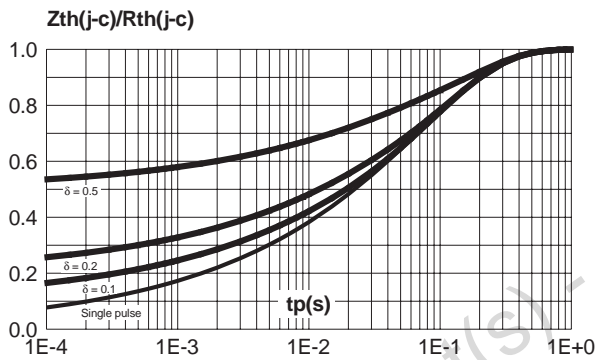
**Fig. 1:** Conduction losses versus average current.



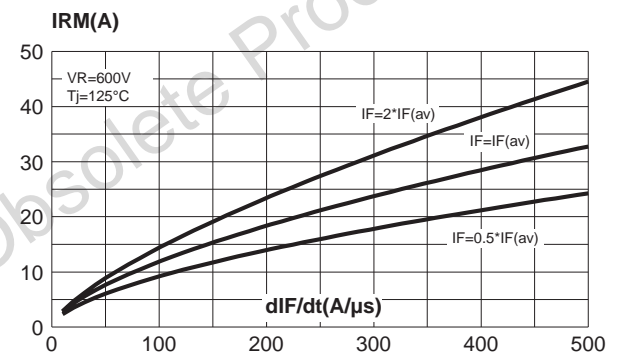
**Fig. 2:** Forward voltage drop versus forward current (maximum values).



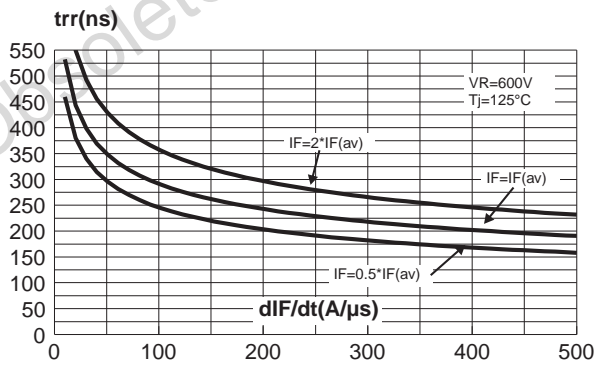
**Fig. 3:** Relative variation of thermal impedance junction to case versus pulse duration.



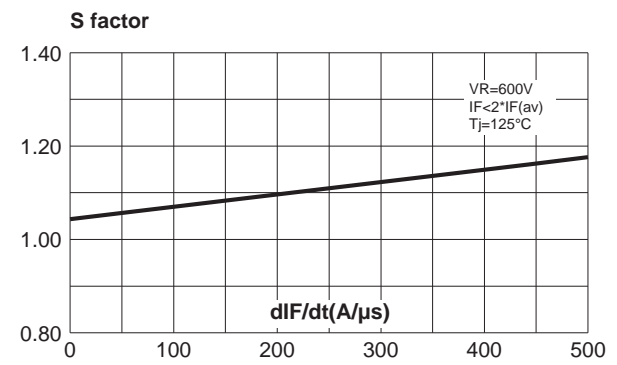
**Fig. 4:** Peak reverse recovery current versus  $dI_F/dt$  (90% confidence).



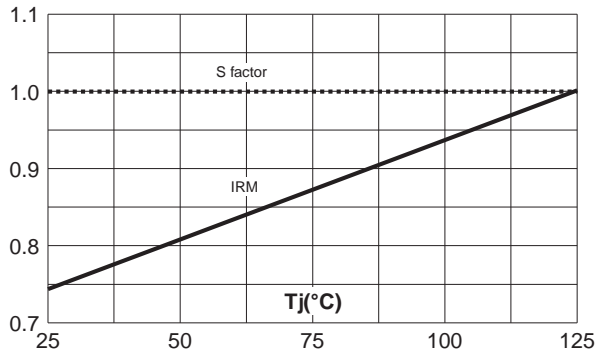
**Fig. 5:** Reverse recovery time versus  $dI_F/dt$  (90% confidence).



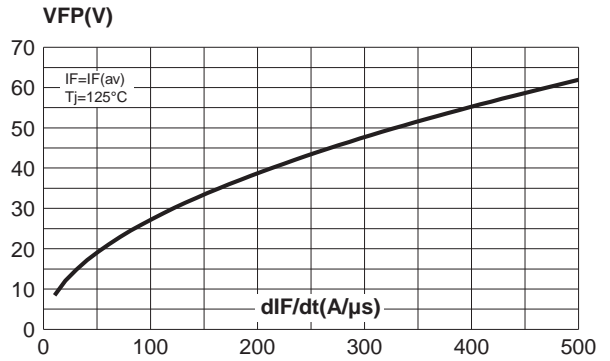
**Fig. 6:** Softness factor (tb/ta) versus  $dI_F/dt$  (typical values).



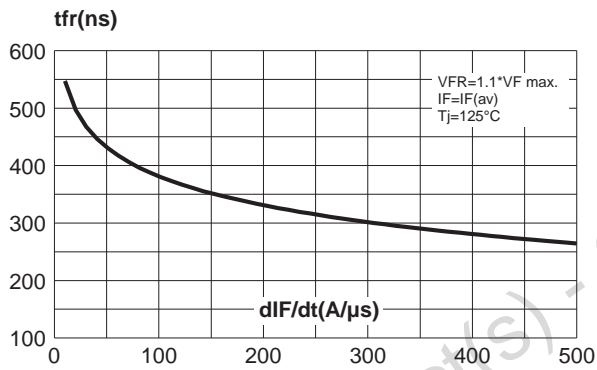
**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (reference  $T_j=125^\circ\text{C}$ ).



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



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



Obsolete Product(s)

## 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 :

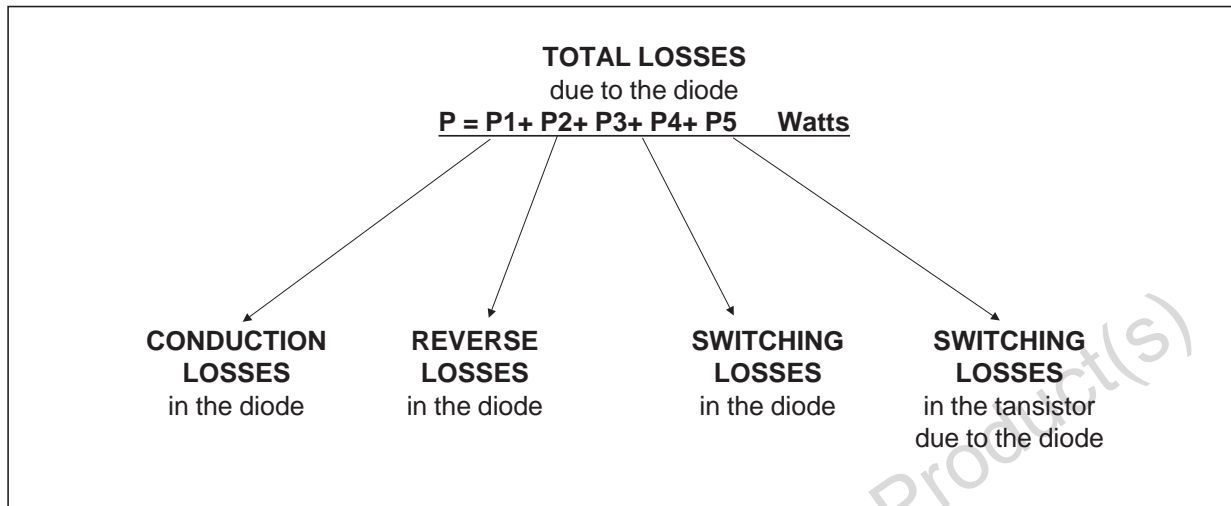


Fig. A: "FREEWHEEL" MODE.

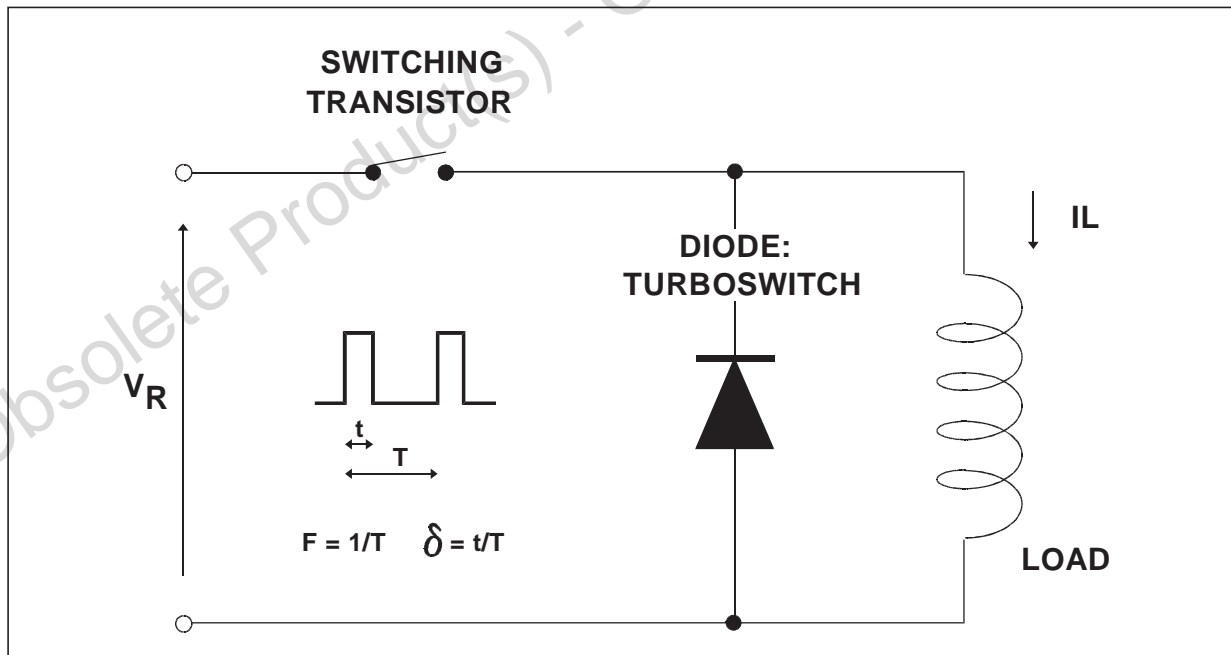


Fig. B: SNUBBER DIODE.

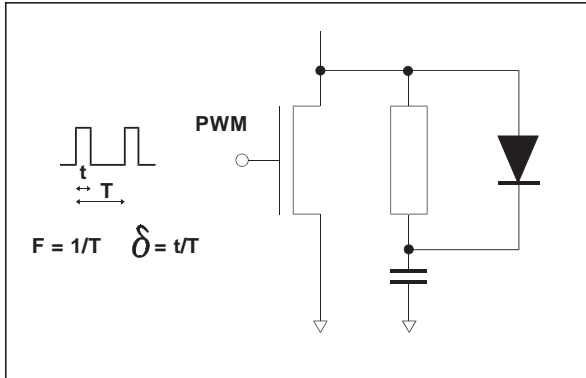


Fig. C: DEMAGNETIZING DIODE.

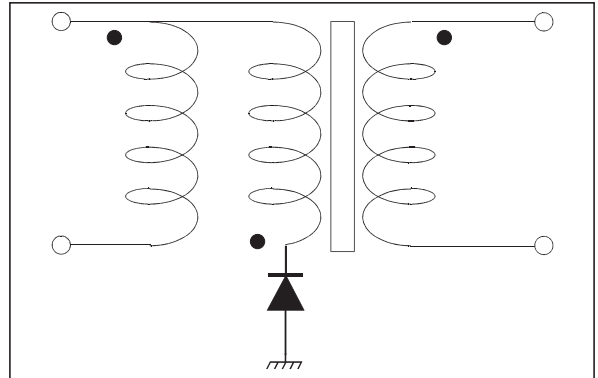
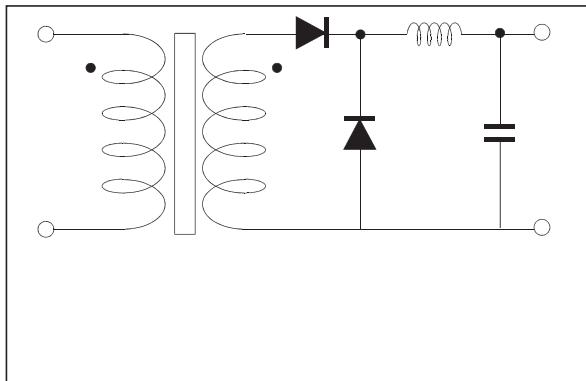
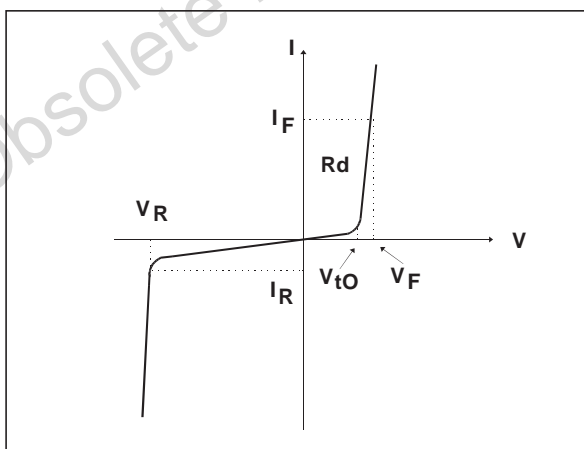


Fig. D: RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. E: STATIC CHARACTERISTICS



Conduction losses :

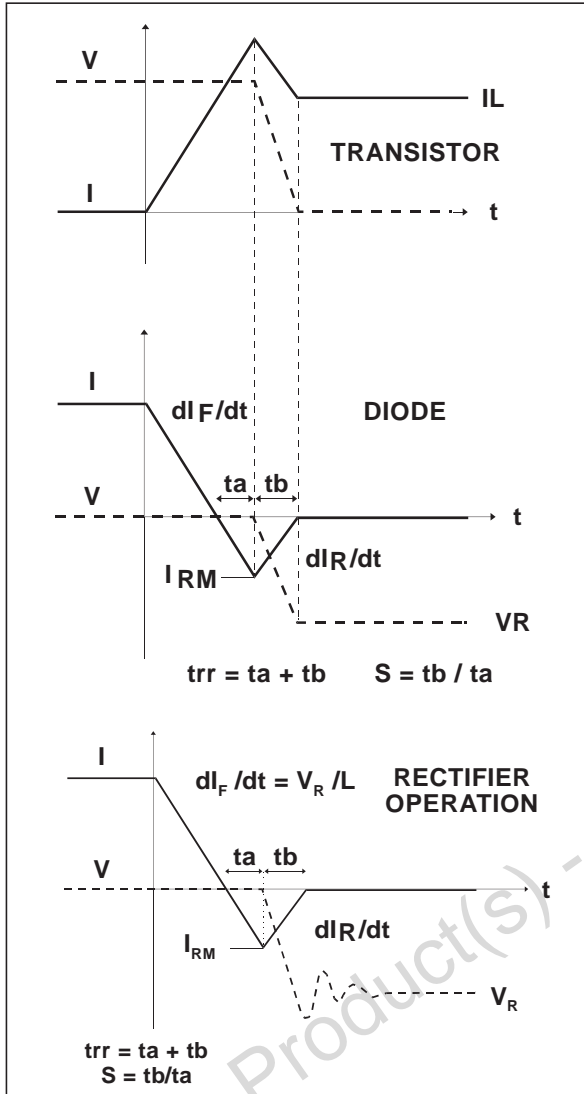
$$P1 = V_{t0} \cdot I_{F(AV)} + R_d \cdot I_{F(RMS)}^2$$

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)

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

Turn-off losses (in the diode) :

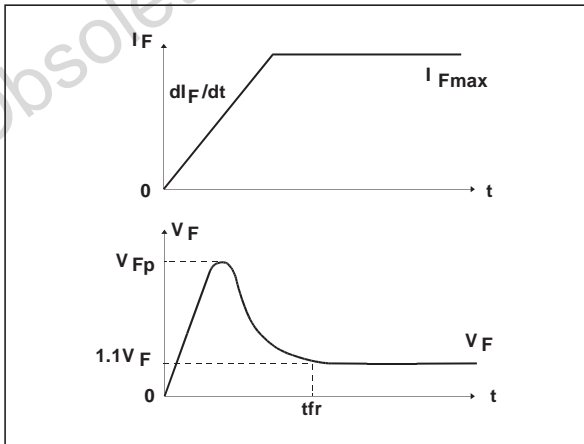
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dl_F/dt}$$

Turn-off losses :  
(with non negligible serial inductance)

$$P3' = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dl_F/dt} + \frac{L \times I_{RM}^2 \times F}{2}$$

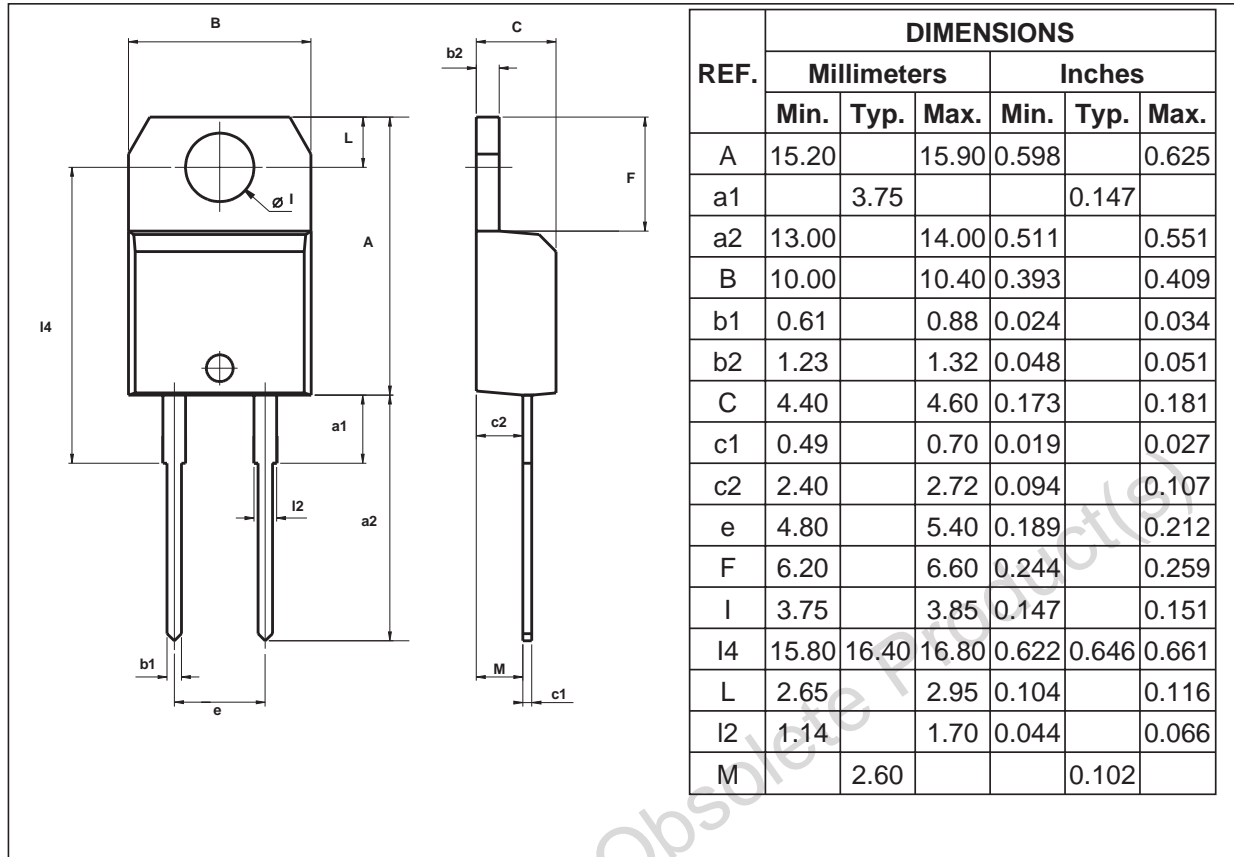
P3,P3' and P5 are suitable for power MOSFET and IGBT

Fig. G: TURN-ON CHARACTERISTICS



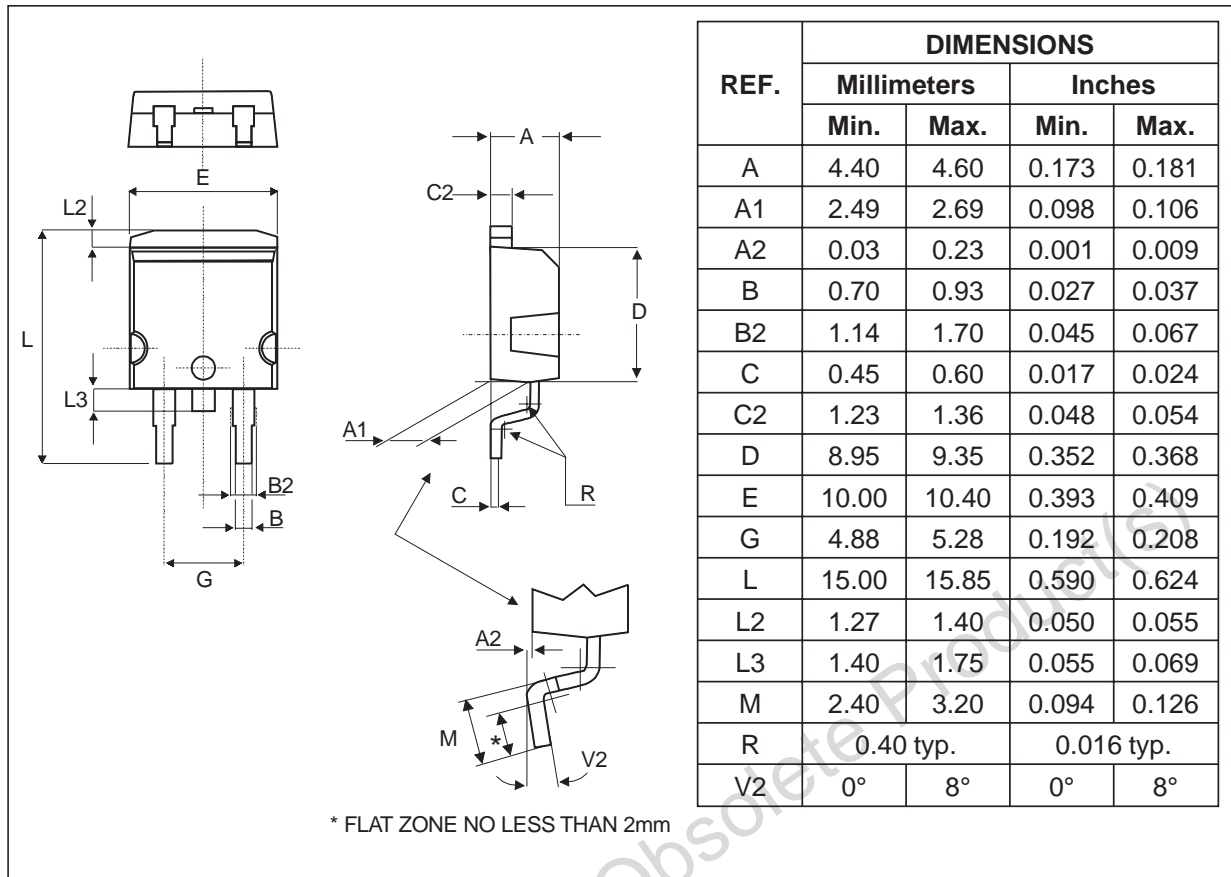
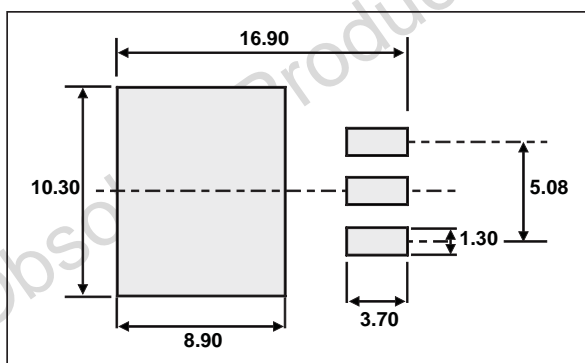
Turn-on losses :  
 $P4 = 0.4 (V_{FP} - V_F) \cdot I_{Fmax} \cdot t_{fr} \cdot F$

**PACKAGE DATA**  
TO-220AC Ins.



- Cooling method: by conduction (C)
- Recommended torque value: 0.8 m.N
- Maximum torque value: 1.0 m.N

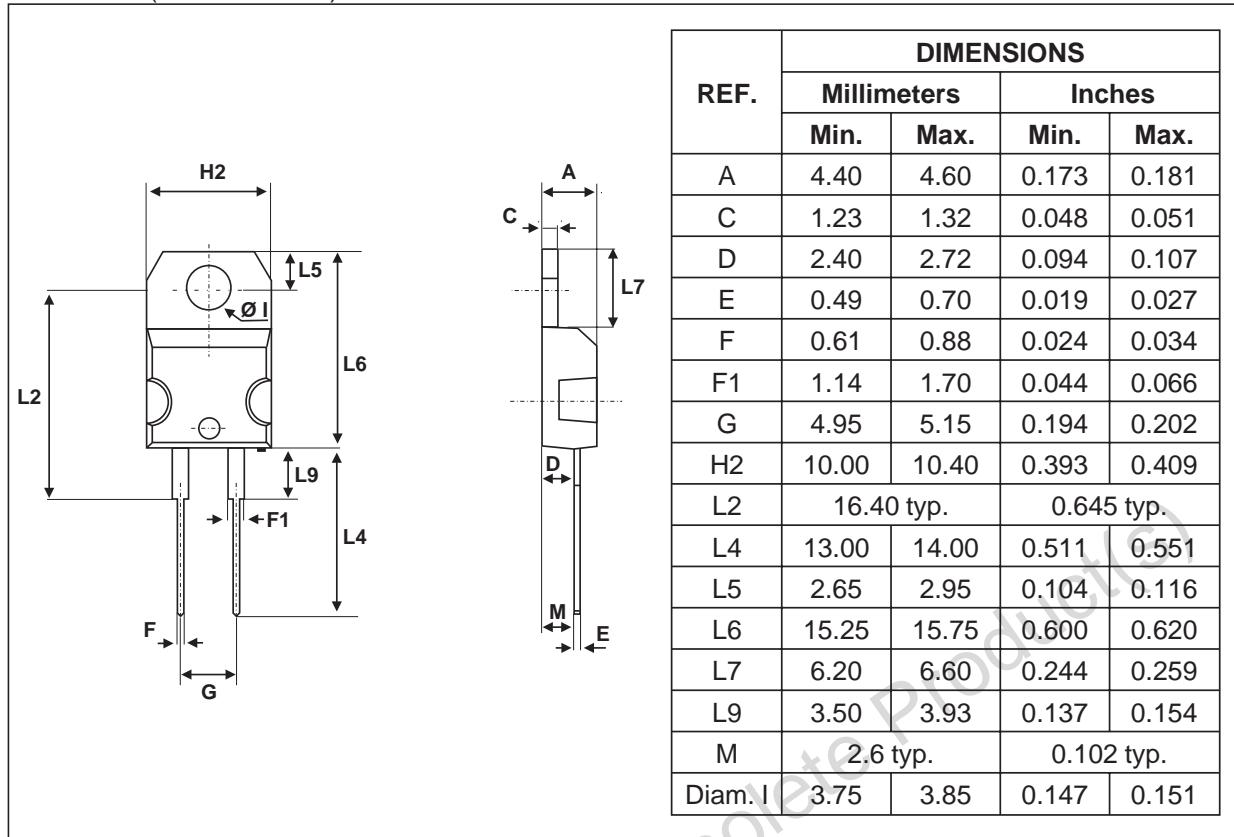


**PACKAGE DATA**  
**D<sup>2</sup>PAK**

**FOOTPRINT DIMENSIONS (in millimeters)**


# STTA812D/DI/G

## PACKAGE DATA

TO-220AC (JEDEC outline)



- Cooling method: by conduction (C)
- Recommended torque value: 0.55 m.N
- Maximum torque value: 0.7 m.N

| Ordering type | Marking   | Package            | Weight | Base qty | Delivery mode |
|---------------|-----------|--------------------|--------|----------|---------------|
| STTA812D      | STTA812D  | TO-220AC           | 1.86g  | 50       | Tube          |
| STTA812DI     | STTA812DI | TO-220AC Ins.      | 1.86g  | 250      | Bulk          |
| STTA812G      | STTA812G  | D <sup>2</sup> PAK | 1.48g  | 50       | Tube          |
| STTA812G-TR   | STTA812G  | D <sup>2</sup> PAK | 1.48g  | 500      | Tape & reel   |

- Epoxy meets UL94,V0

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  
 © 2002 STMicroelectronics - Printed in Italy - All rights reserved.  
 STMicroelectronics GROUP OF COMPANIES  
 Australia - Brazil - Canada - China - Finland - France - Germany  
 Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore  
 Spain - Sweden - Switzerland - United Kingdom - United States.

<http://www.st.com>

