

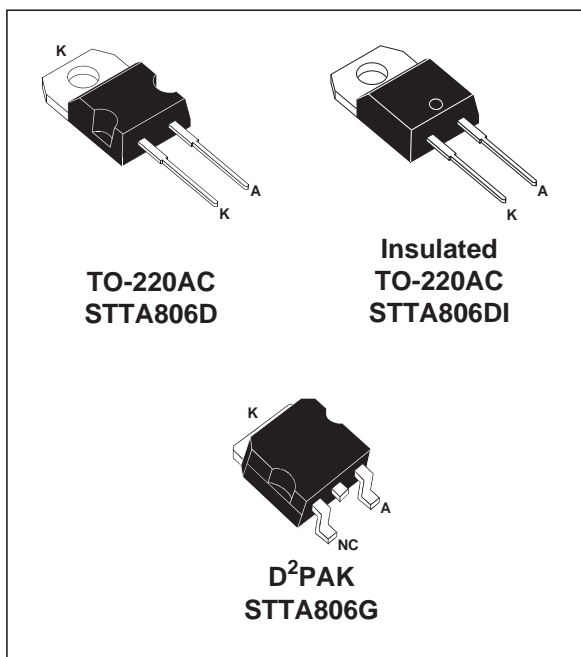
## TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCTS CHARACTERISTICS

|                |      |
|----------------|------|
| $I_{F(AV)}$    | 8A   |
| $V_{RRM}$      | 600V |
| $t_{rr}$ (typ) | 25ns |
| $V_F$ (max)    | 1.5V |

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



### 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-220AC, insulated TO-220AC or in D²PAK, these 600V devices are particularly intended for use on 240V domestic mains.

### ABSOLUTE RATINGS (limiting values)

| 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                    | TO-220AC / D²PAK          | 30   | A |
|              |  | TO-220AC ins.             | 20   | A |
| $I_{FRM}$    | Repetitive peak forward current        | $t_p=5ms$ $F=5kHz$ square | 110  | A |
| $I_{FSM}$    | Surge non repetitive forward current   | $t_p=10$ ms sinusoidal    | 90   | 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

## STTA806D/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. |  | 2.2<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. | $T_c = 118^\circ C$<br>$T_c = 102^\circ C$ | 14.5       | W    |
| $P_{max}$     | Total power dissipation<br>$P_{max} = P_1 + P_3$<br>( $P_3 = 10\% P_1$ ) | TO-220AC / D <sup>2</sup> PAK<br>TO-220AC ins. | $T_c = 115^\circ C$<br>$T_c = 97^\circ C$  | 16         | W    |

### STATIC ELECTRICAL CHARACTERISTICS

| Symbol     | Parameter               | Test conditions            |   | Min | Typ | Max         | Unit          |
|------------|-------------------------|----------------------------|---|-----|-----|-------------|---------------|
| $V_F^*$    | Forward voltage drop    | $I_F = 8A$                 | $T_j = 25^\circ C$<br>$T_j = 125^\circ C$ |     |     | 1.75<br>1.5 | V<br>V        |
| $I_R^{**}$ | Reverse leakage current | $V_R = 0.8 \times V_{RRM}$ | $T_j = 25^\circ C$<br>$T_j = 125^\circ C$ |     | 1.5 | 100<br>4    | $\mu A$<br>mA |
| $V_{to}$   | Threshold voltage       | $I_p < 3 \cdot I_{AV}$     | $T_j = 125^\circ C$                       |     |     | 1.15        | V             |
| $r_d$      | Dynamic resistance      |                            |   |     |     | 43          | m $\Omega$    |

Test pulse : \*  $t_p = 380 \mu s$ ,  $\delta < 2\%$   
 \*\*  $t_p = 5 ms$ ,  $\delta < 2\%$

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            | $T_j = 25^\circ C$<br>$I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$<br>$I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$ |     | 25   | 52  | ns   |
| $I_{RM}$ | Maximum reverse recovery current | $T_j = 125^\circ C$ $V_R = 400V$ $I_F = 8A$<br>$di_F/dt = -64 A/\mu s$<br>$di_F/dt = -500 A/\mu s$                |     | 14   | 5.5 | A    |
| S factor | Softness factor                  | $T_j = 125^\circ C$ $V_R = 400V$ $I_F = 8A$<br>$di_F/dt = -500 A/\mu s$   |     | 0.47 |     | -    |

#### 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, $1.1 \times V_{Fmax}$ |     |     | 500 | ns   |
| $V_{Fp}$ | Peak forward voltage  | $T_j = 25^\circ C$<br>$I_F = 8A$ , $di_F/dt = 64 A/\mu s$  |     |     | 10  | V    |

Fig. 1: Conduction losses versus average current.

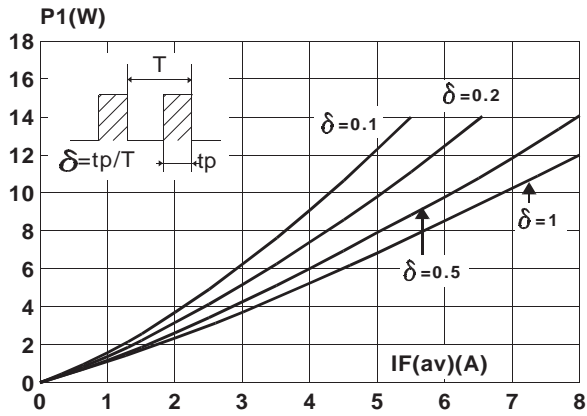


Fig. 2: Forward voltage drop versus forward current.

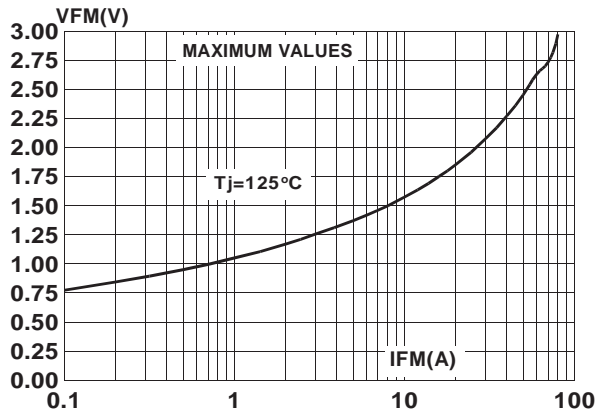


Fig. 3: Relative variation of thermal transient impedance junction to case versus pulse duration.

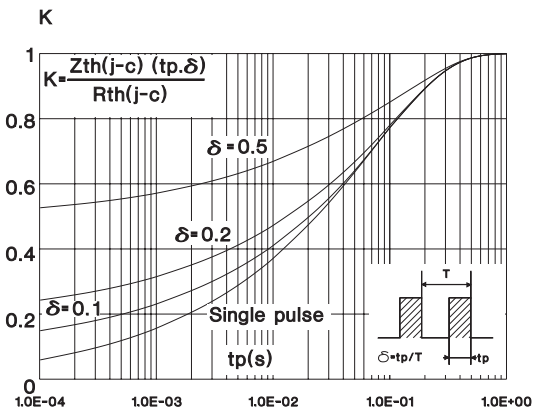


Fig. 4: Peak reverse recovery current versus dIF/dt.

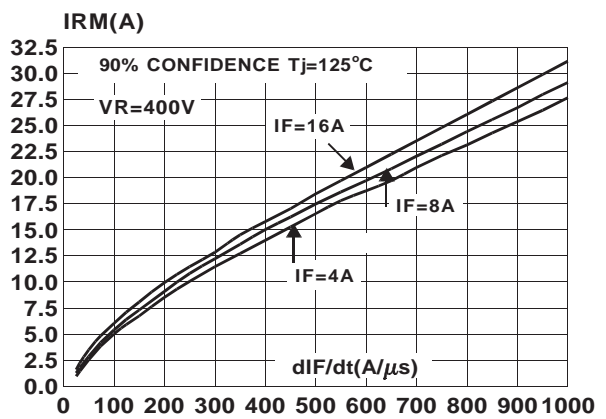


Fig. 5: Reverse recovery time versus dIF/dt.

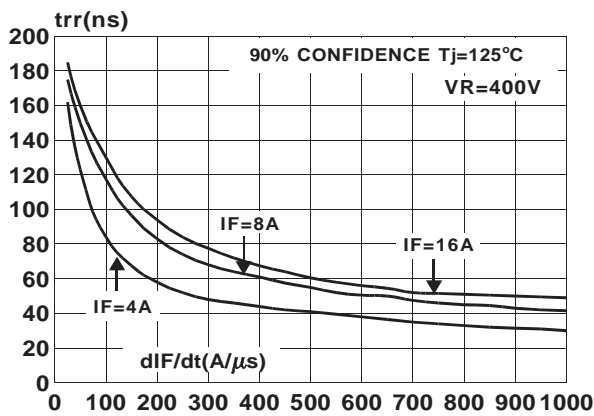


Fig. 6: Softness factor (tb/ta) versus dIF/dt.

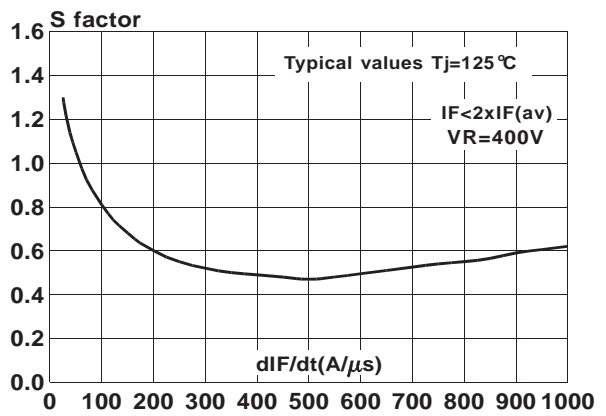


Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference  $T_j=125^\circ\text{C}$ ).

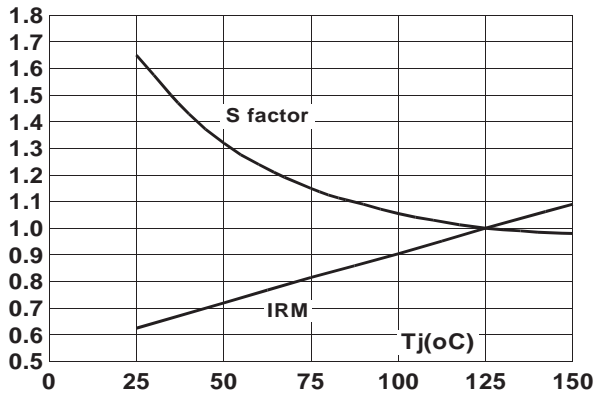


Fig. 8: Transient peak forward voltage versus  $dI_F/dt$ .

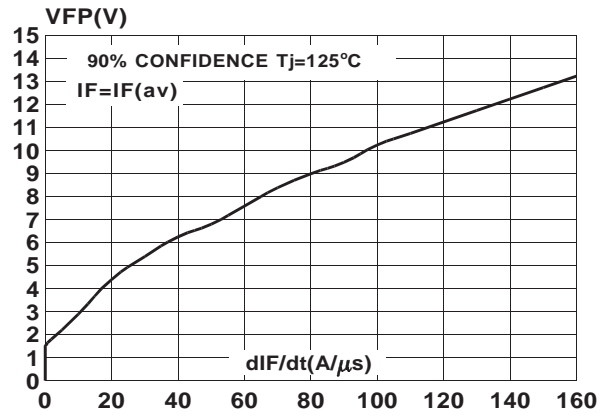
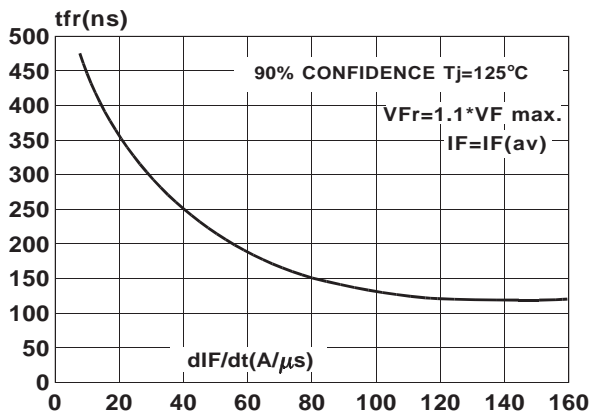


Fig. 9: Forward recovery time versus  $dI_F/dt$ .



## 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:

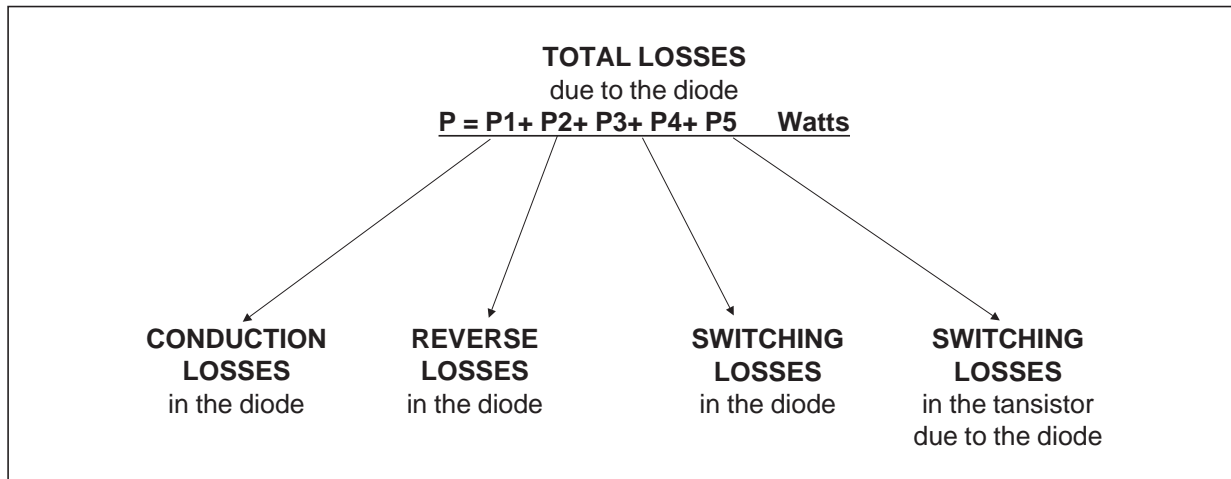
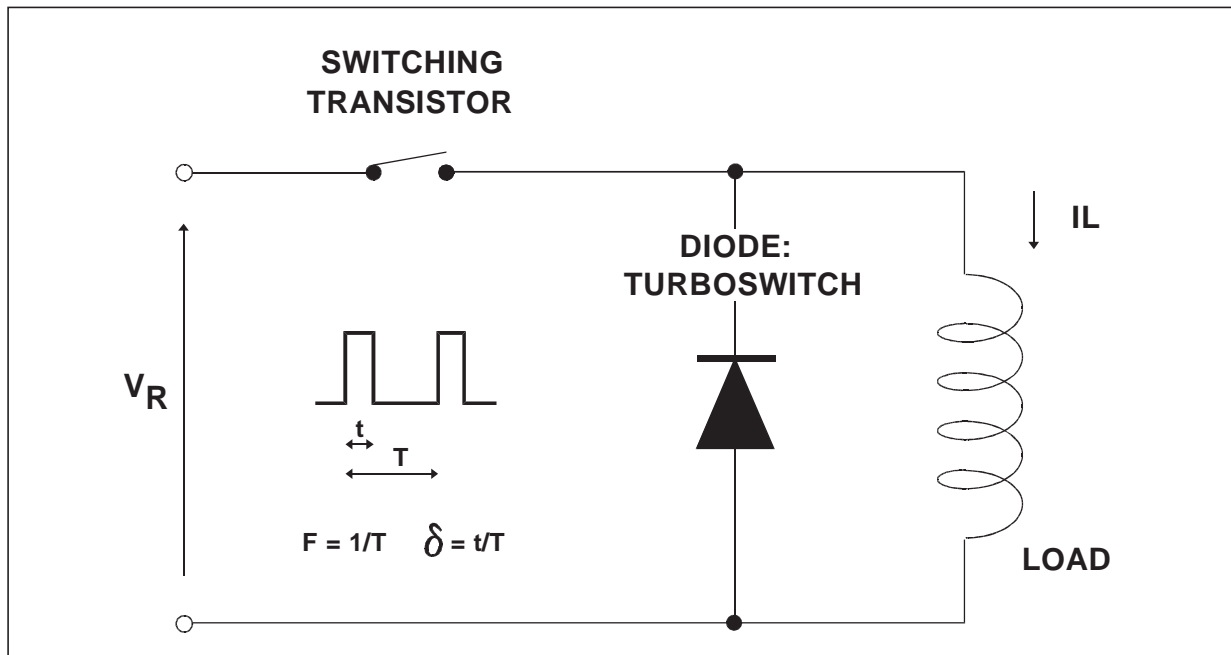
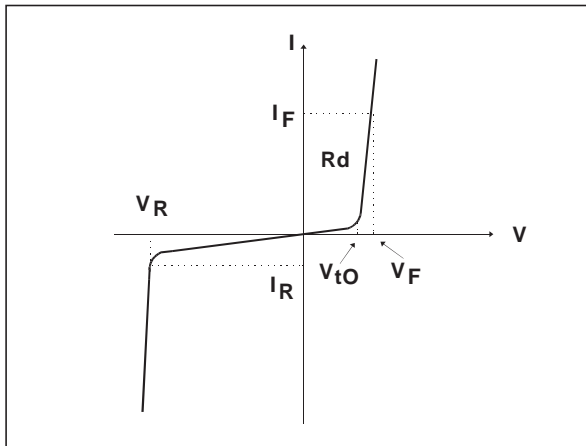


Fig. A : "FREEWHEEL" MODE.



APPLICATION DATA (Cont'd)

Fig. B: STATIC CHARACTERISTICS



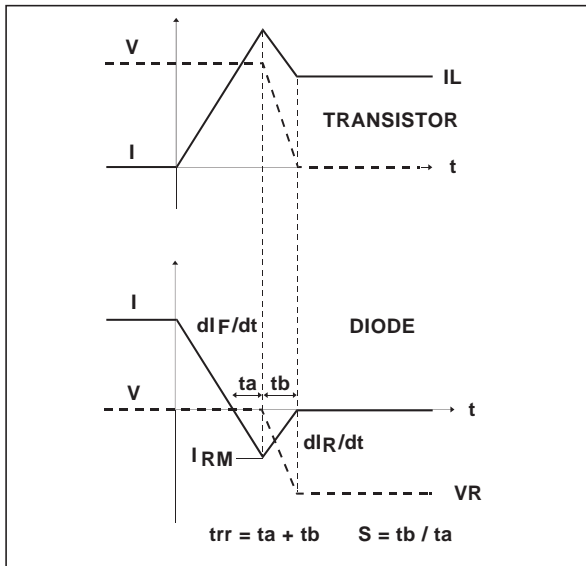
Conduction losses :

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

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)

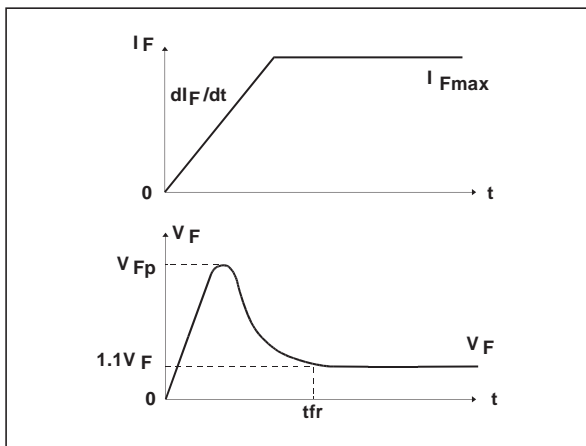
$$P5 = \frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dl_F / dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dl_F / dt}$$

Turn-off losses (in the diode) :

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

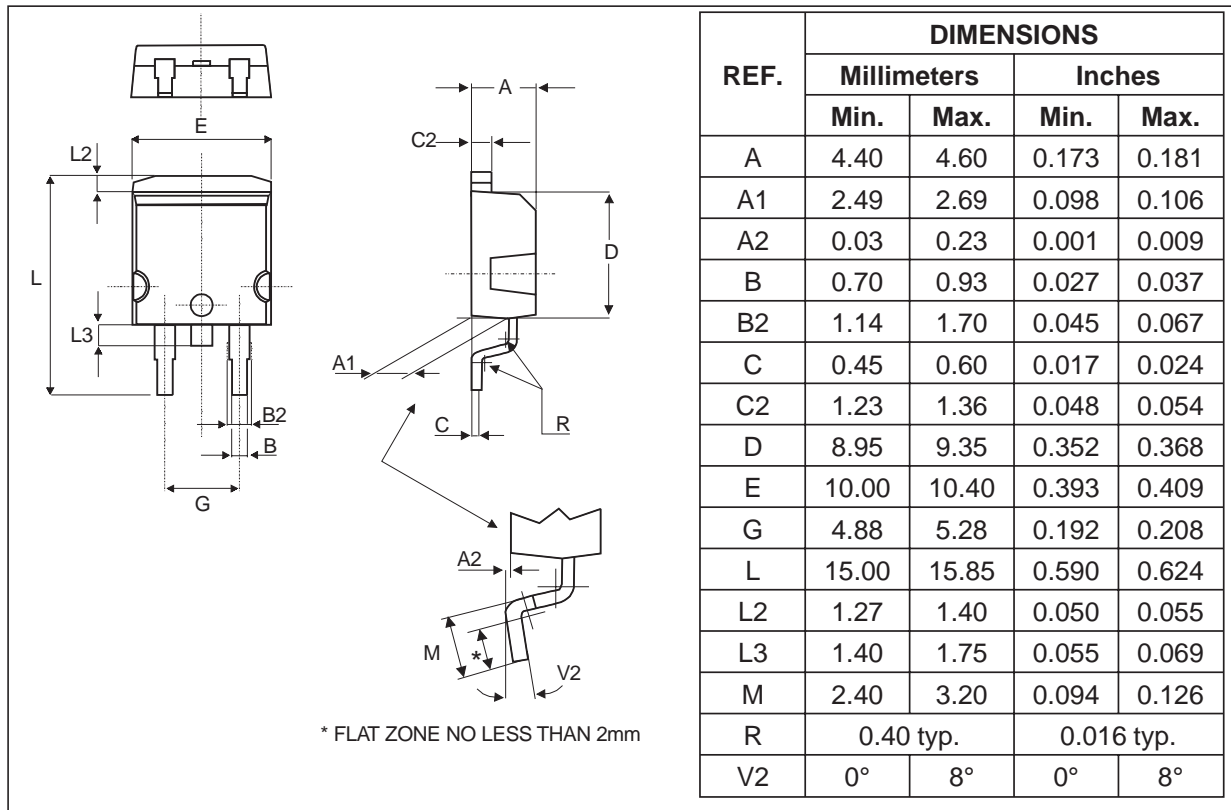
P3 and P5 are suitable for power MOSFET and IGBT

Fig. D: TURN-ON CHARACTERISTICS

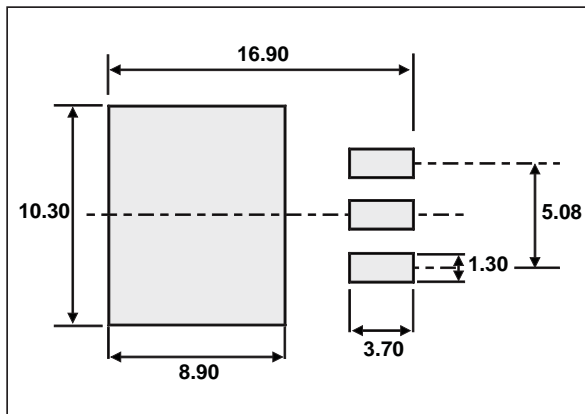


Turn-on losses :

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

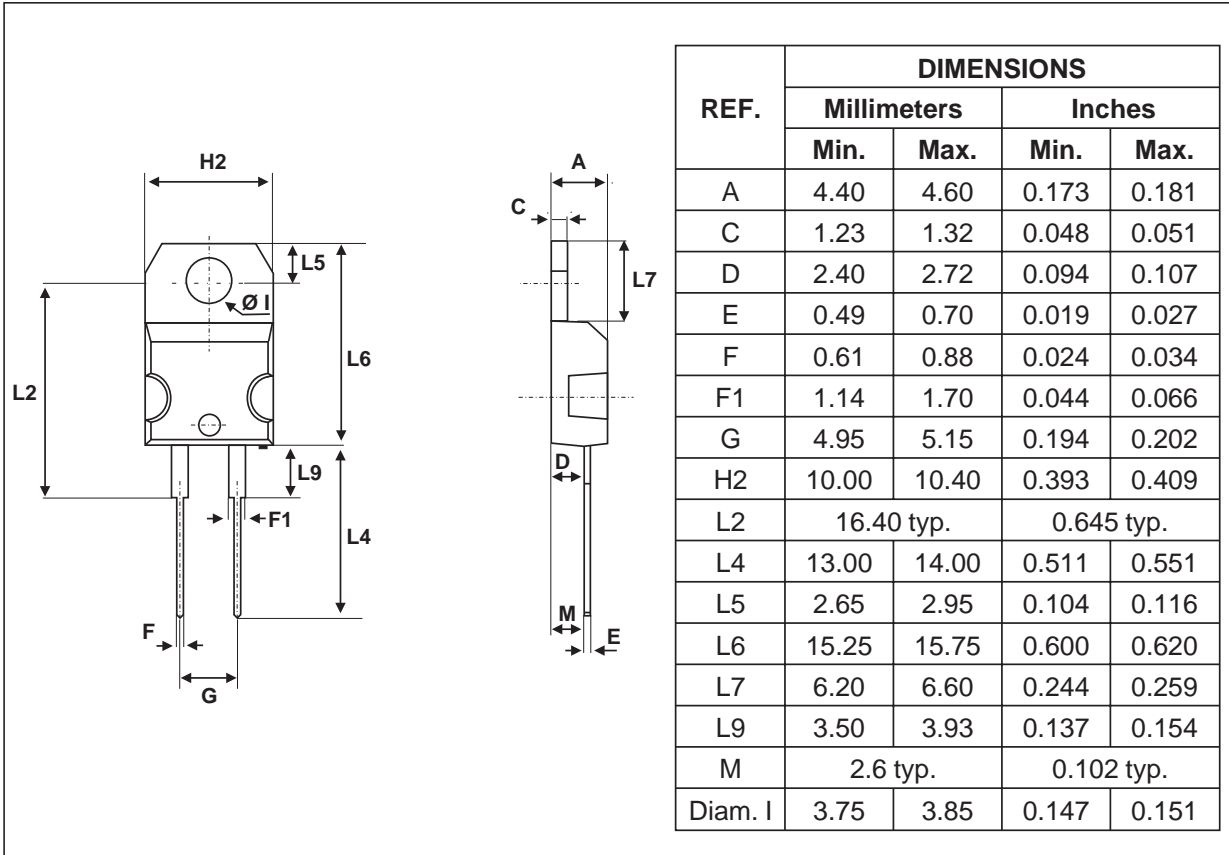
**PACKAGE DATA**  
**D<sup>2</sup>PAK**

**FOOTPRINT DIMENSIONS** (in millimeters)

■ Cooling method : by conduction (C)



**STTA806D/DI/G**

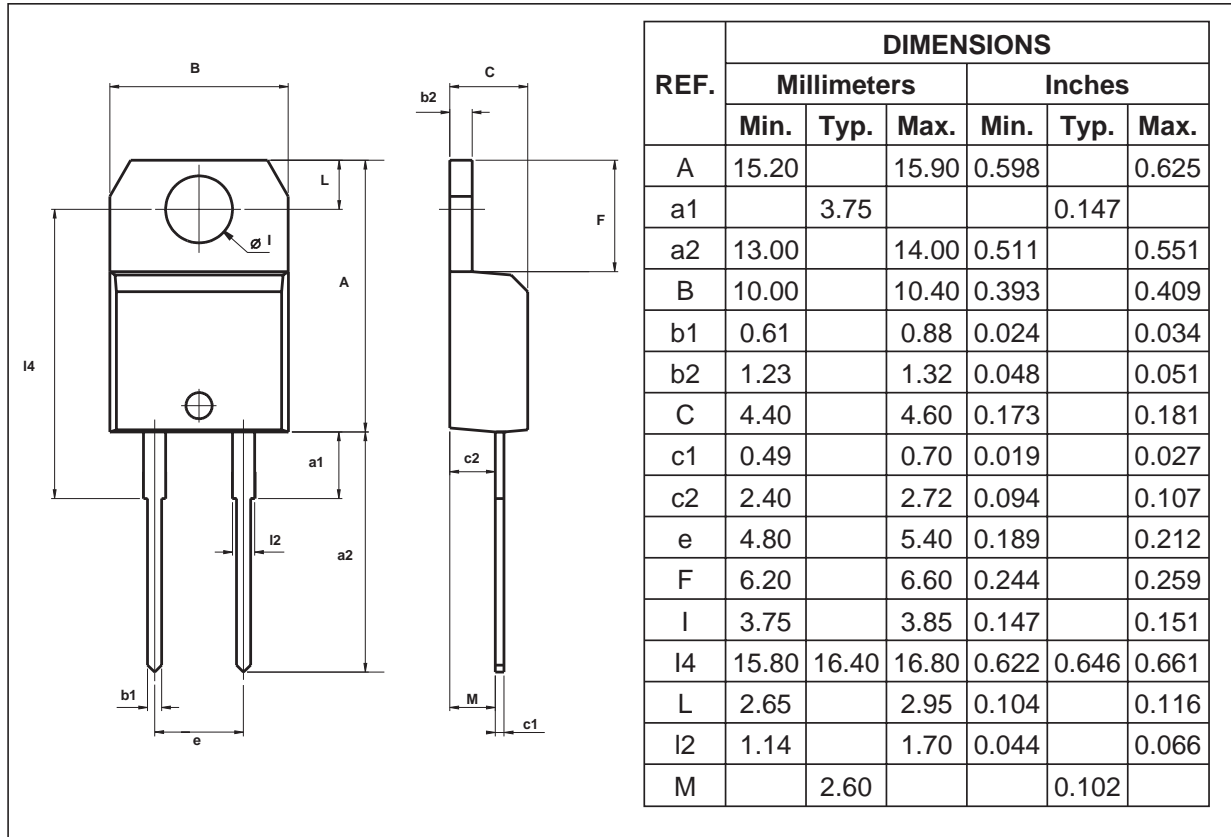
**PACKAGE DATA**  
TO-220AC (JEDEC OUTLINE)



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



**PACKAGE DATA**  
INSULATED TO-220AC



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

| Ordering type | Marking   | Package            | Weight | Base qty | Delivery mode |
|---------------|-----------|--------------------|--------|----------|---------------|
| STTA806D      | STTA806D  | TO-220AC           | 1.86g  | 50       | Tube          |
| STTA806DI     | STTA806DI | TO-220AC Ins.      | 1.86g  | 250      | Bulk          |
| STTA806G      | STTA806G  | D <sup>2</sup> PAK | 1.48g  | 50       | Tube          |
| STTA806G-TR   | STTA806G  | D <sup>2</sup> PAK | 1.48g  | 500      | Tape & reel   |

- Epoxy meets UL94,V0

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