

## TURBOSWITCH™ "B". ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCTS CHARACTERISTICS

|                |      |
|----------------|------|
| $I_{F(AV)}$    | 12A  |
| $V_{RRM}$      | 600V |
| $t_{rr}$ (typ) | 50ns |
| $V_F$ (max)    | 1.3V |

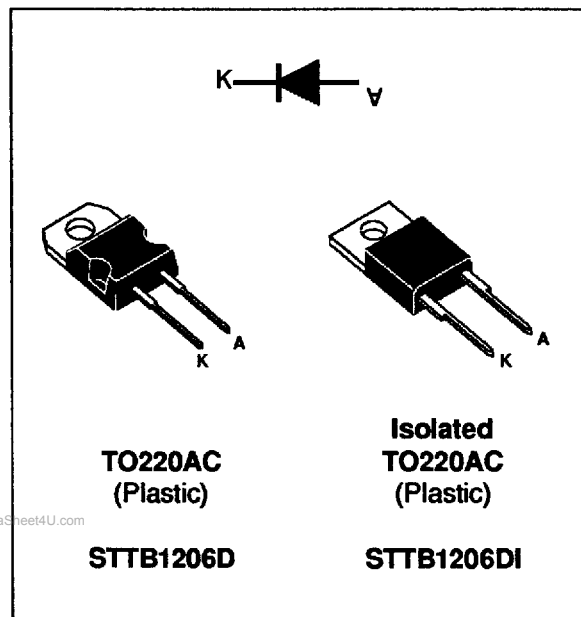
### FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: Snubbing or clamping, demagnetization and rectification.
- ULTRA-FAST, SOFT AND NOISE-FREE RECOVERY.
- VERY LOW OVERALL POWER LOSSES AND PARTICULARLY LOW FORWARD VOLTAGE.
- DESIGNED FOR HIGH PULSED CURRENT OPERATIONS.
- CECC APPROVED.

### DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.

TURBOSWITCH, B family, drastically cuts losses in all high voltage operations which require extremely fast, soft and noise-free power diodes. They are particularly suitable in the primary circuit



of an SMPS as snubber, clamping or demagnetizing diodes, and also in most power converters as high performance rectifier diodes. Packaged in TO220AC and in isolated TO220AC, these 600V devices are particularly intended for use on 240V domestic mains.

### ABSOLUTE MAXIMUM RATINGS

| 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                                                  | STTB1206D<br>STTB1206DI | 30<br>20   | A    |
| $I_{FRM}$    | Repetitive peak forward current<br>( $t_p = 5 \mu s$ , $f = 1 kHz$ ) | STTB1206D<br>STTB1206DI | 420<br>280 | A    |
| $T_j$        | Max operating junction temperature                                   |                         | -65 to 150 | °C   |
| $T_{stg}$    | Storage temperature                                                  |                         | -65 to 150 | °C   |

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**STTB1206D(I)****THERMAL AND POWER DATA**

| Symbol        | Parameter                                                             | Conditions                                                                                         | Value      | Unit |
|---------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------|------|
| $R_{th(j-c)}$ | Junction to case thermal resistance                                   | STTB1206D<br>STTB1206DI                                                                            | 1.9<br>3.0 | °C/W |
| $P_1$         | Conduction power dissipation<br>(see fig. 5)                          | $I_{F(AV)} = 12A$ $\delta = 0.5$<br>STTB1206D $T_C = 114^\circ C$<br>STTB1206DI $T_C = 93^\circ C$ | 19         | W    |
| $P_{max}$     | Total power dissipation<br>$P_{max} = P_1 + P_3$ ( $P_3 = 10\% P_1$ ) | STTB1206D $T_C = 104^\circ C$<br>STTB1206DI $T_C = 78^\circ C$                                     | 24         | W    |

**STATIC ELECTRICAL CHARACTERISTICS (see Fig.5)**

| Symbol   | Parameter               | Test Conditions                 |                                           | Min | Typ | Max        | Unit          |
|----------|-------------------------|---------------------------------|-------------------------------------------|-----|-----|------------|---------------|
| $V_F$ *  | Forward voltage drop    | $I_F = 12A$                     | $T_j = 25^\circ C$<br>$T_j = 125^\circ C$ |     |     | 1.4<br>1.3 | V<br>V        |
| $I_R$ ** | Reverse leakage current | $V_R = 0.8$<br>$\times V_{RRM}$ | $T_j = 25^\circ C$<br>$T_j = 125^\circ C$ |     |     | 100<br>2   | $\mu A$<br>mA |

Test pulses widths : \*  $t_p = 380 \mu s$ , duty cycle < 2%\*\*  $t_p = 5 ms$ , duty cycle < 2%**DYNAMIC ELECTRICAL CHARACTERISTICS**

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**TURN-OFF SWITCHING (see Fig.6)**

| 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 | $T_j = 125^\circ C$ $V_R = 400V$ $I_F = 12A$<br>$di_F/dt = -96 A/\mu s$<br>$di_F/dt = -500 A/\mu s$               |     | 30  | 18  | A    |
| S factor | Softness factor                  | $T_j = 125^\circ C$ $V_R = 400V$ $I_F = 12A$<br>$di_F/dt = -500 A/\mu s$                                          |     | 0.9 |     | /    |

**TURN-ON SWITCHING (see Fig.7)**

| Symbol   | Parameter             | Test Conditions                                                                                     | Min | Typ | Max | Unit |
|----------|-----------------------|-----------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{fr}$ | Forward recovery time | $T_j = 25^\circ C$<br>$I_F = 12 A$ , $di_F/dt = 96 A/\mu s$<br>measured at, $1.1 \times V_{Fmax}$   |     |     | 500 | ns   |
| $V_{Fp}$ | Peak forward voltage  | $T_j = 25^\circ C$<br>$I_F = 12A$ , $di_F/dt = 96 A/\mu s$<br>$I_F = 60A$ , $di_F/dt = 500 A/\mu s$ |     | 10  | 8   | V    |

## APPLICATION DATA

The TURBOSWITCH "B" is especially designed to provide the lowest overall power losses in any application such as snubbing, clamping, demagne-

tization and rectification. In such applications (fig. 1 to fig. 4), the way of calculating the power losses is given below :

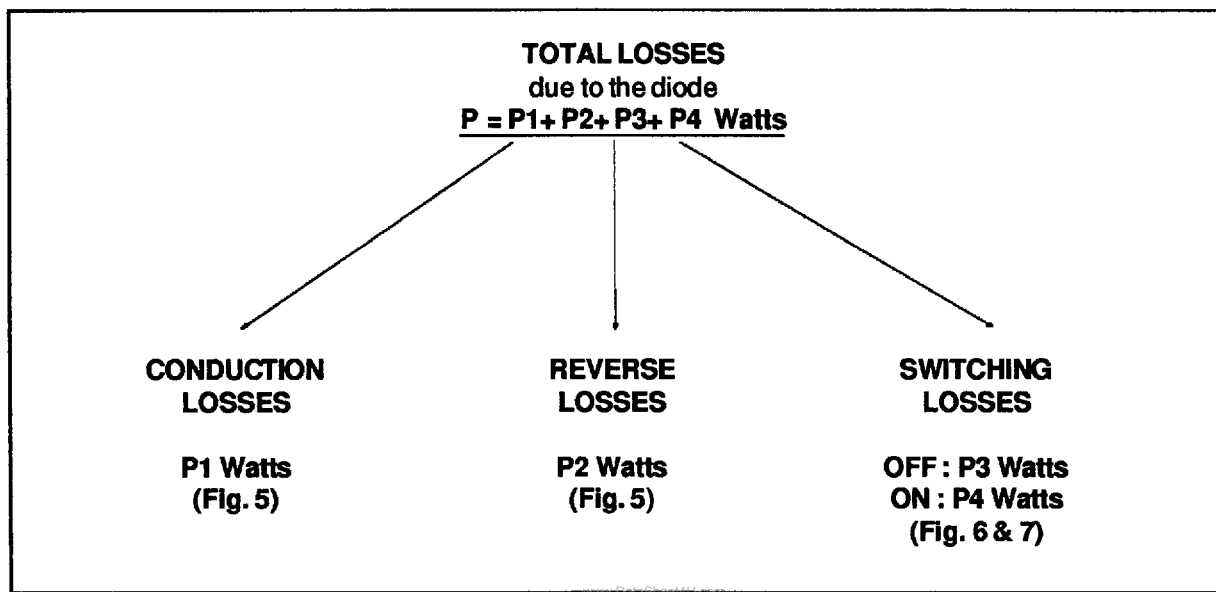


Fig. 1 : SNUBBER DIODE.

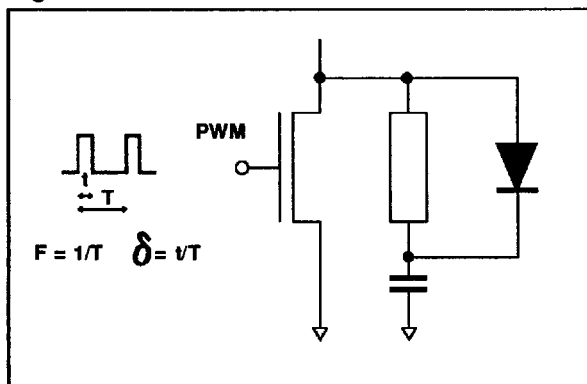


Fig. 2 : CLAMPING DIODE.

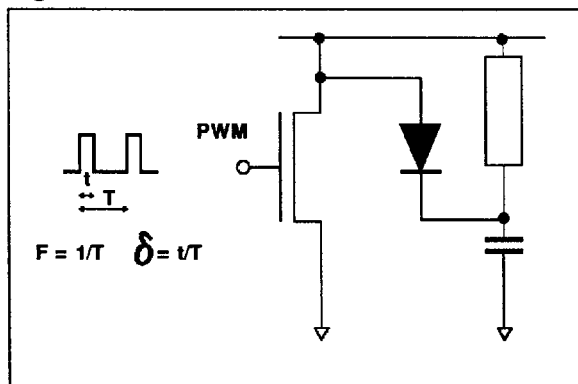


Fig. 3 : DEMAGNETIZING DIODE.

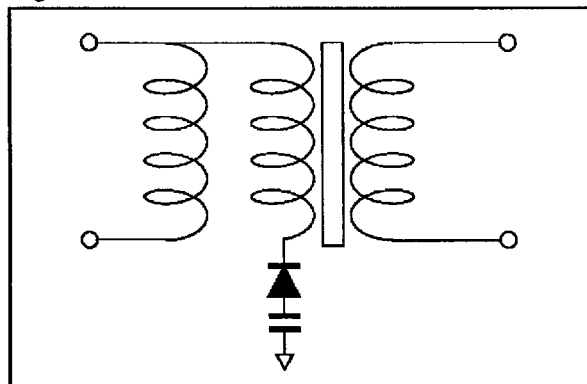
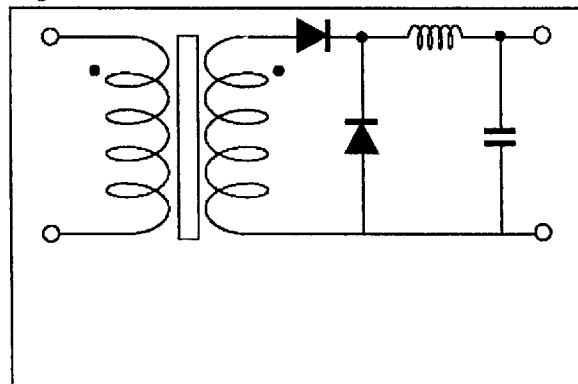
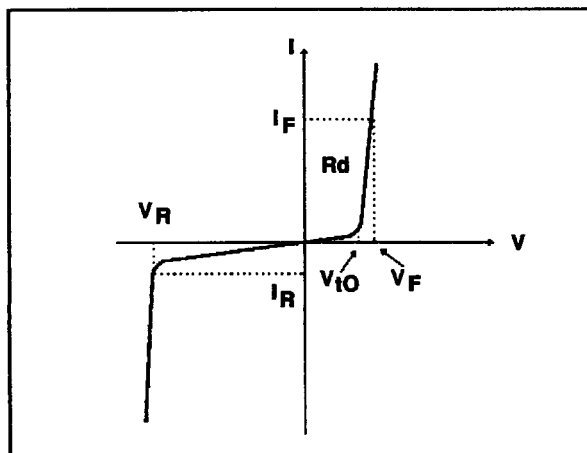


Fig. 4 : RECTIFIER DIODE.



## APPLICATION DATA (Cont'd)

Fig. 5: STATIC CHARACTERISTICS



Conduction losses :

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

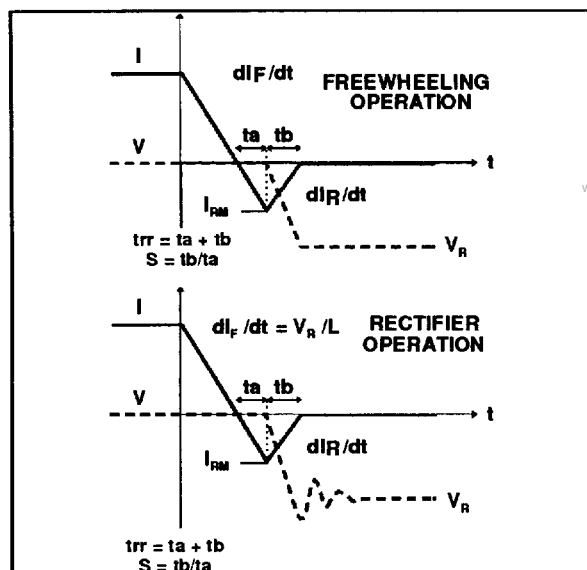
with

$$\begin{aligned} V_{t0} &= 1.00 \text{ V} \\ R_d &= 0.025 \text{ Ohm} \\ &\text{(Max values at 125°C)} \end{aligned}$$

Reverse losses :

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

Fig. 6: TURN-OFF CHARACTERISTICS



Turn-off losses :

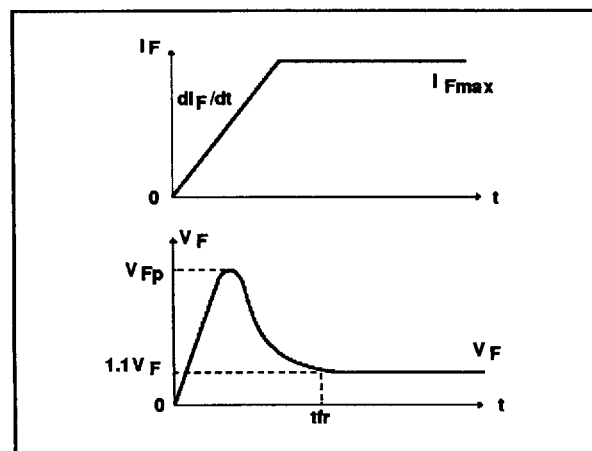
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

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 and P3' are suitable for power MOSFET and IGBT

Fig. 7: TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig 8 : Conduction losses versus average current

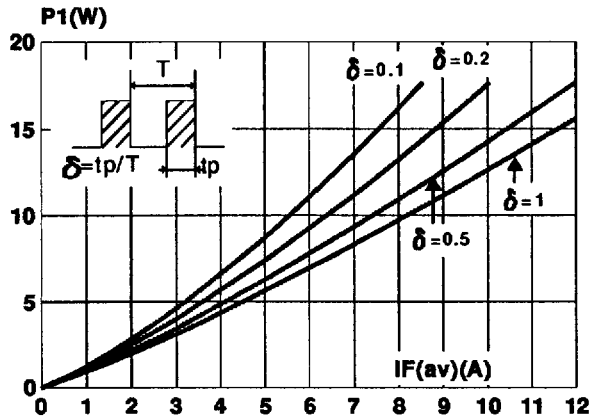
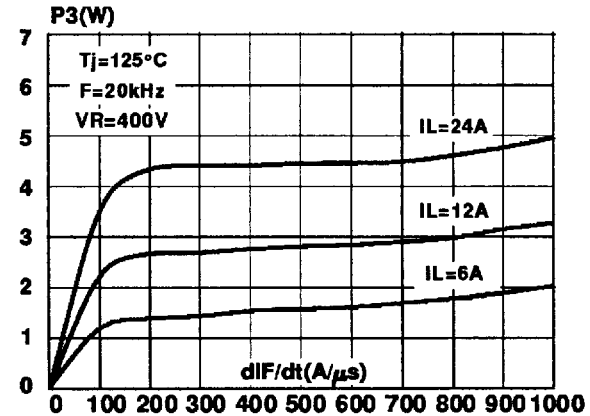
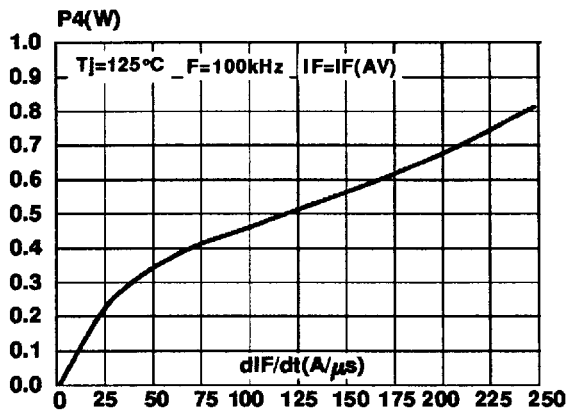
Fig 9 : Switching OFF losses versus  $dIF/dt$ Fig 10 : Switching ON losses versus  $dIF/dt$ 

Fig 11 : Forward voltage drop versus forward current

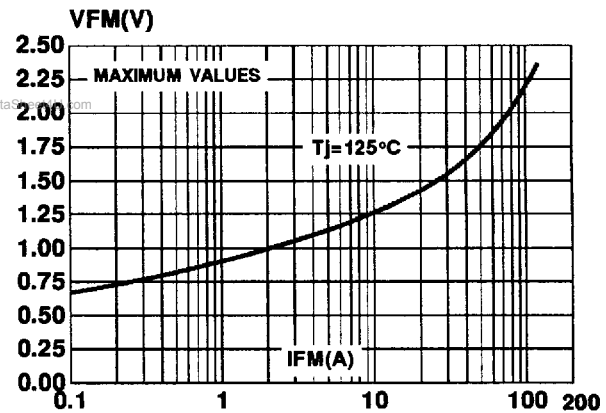


Fig 12 : Relative variation of thermal transient impedance junction to case versus pulse duration

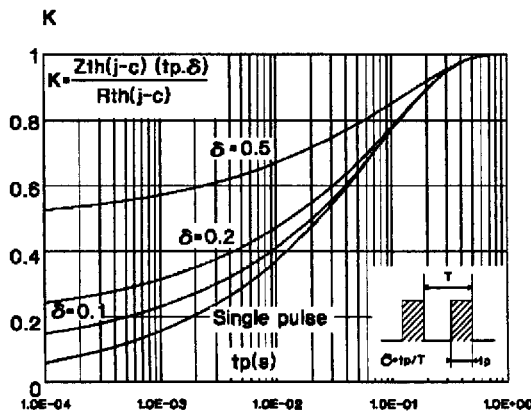
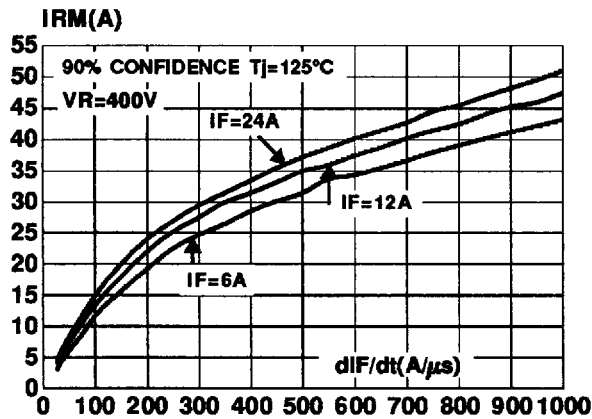
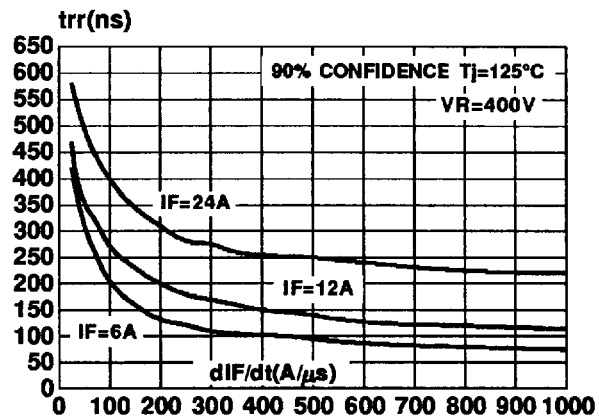
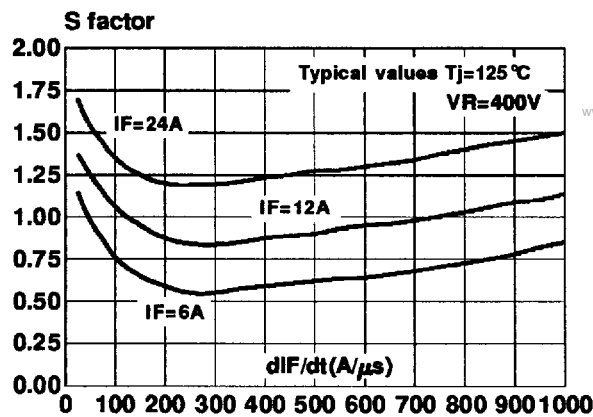
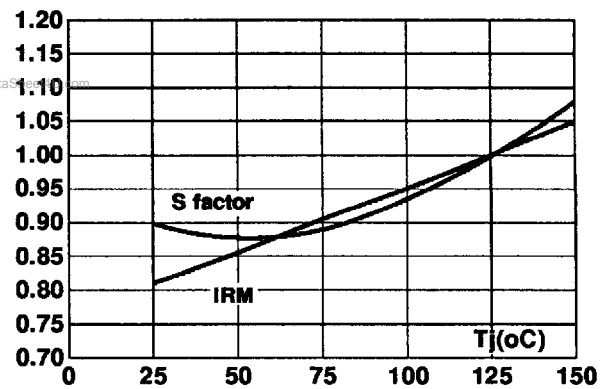
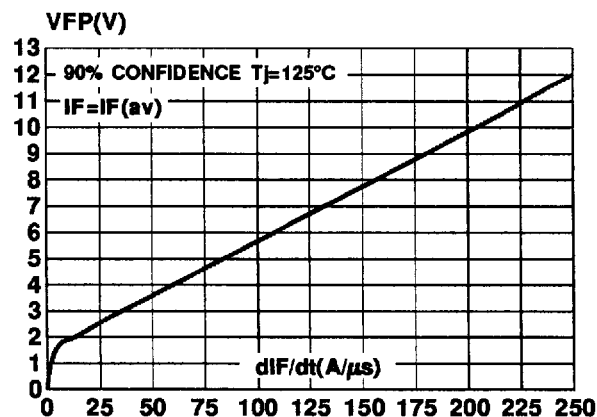
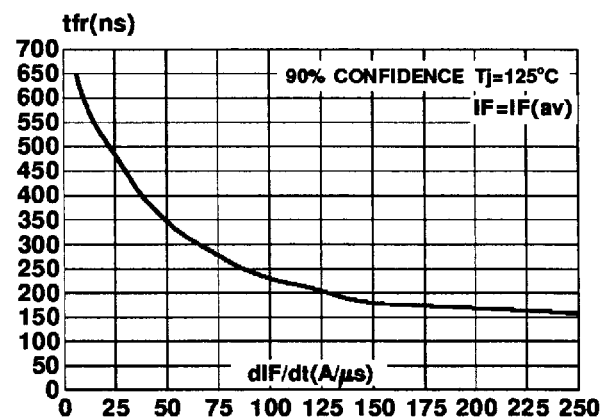
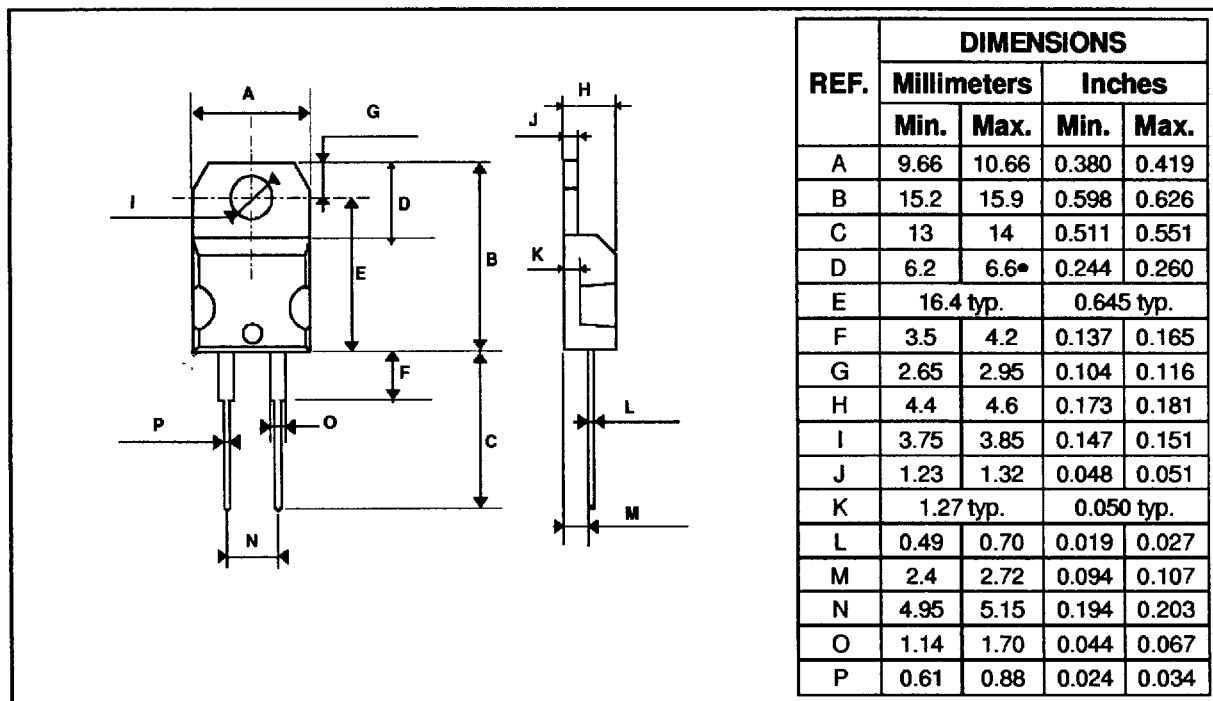


Fig 13 : Peak reverse recovery current versus  $di_F/dt$ Fig 14 : Reverse recovery time versus  $di_F/dt$ Fig 15 : Softness factor ( $tb/ta$ ) versus  $di_F/dt$ Fig 16 : Relative variation of dynamic parameters versus junction temperature (Reference  $T_j = 125^\circ\text{C}$ )Fig 17 : Transient peak forward voltage versus  $di_F/dt$ Fig 18 : Forward recovery time versus  $di_F/dt$ 

**PACKAGE DATA**  
**TO220AC (JEDEC outline)**


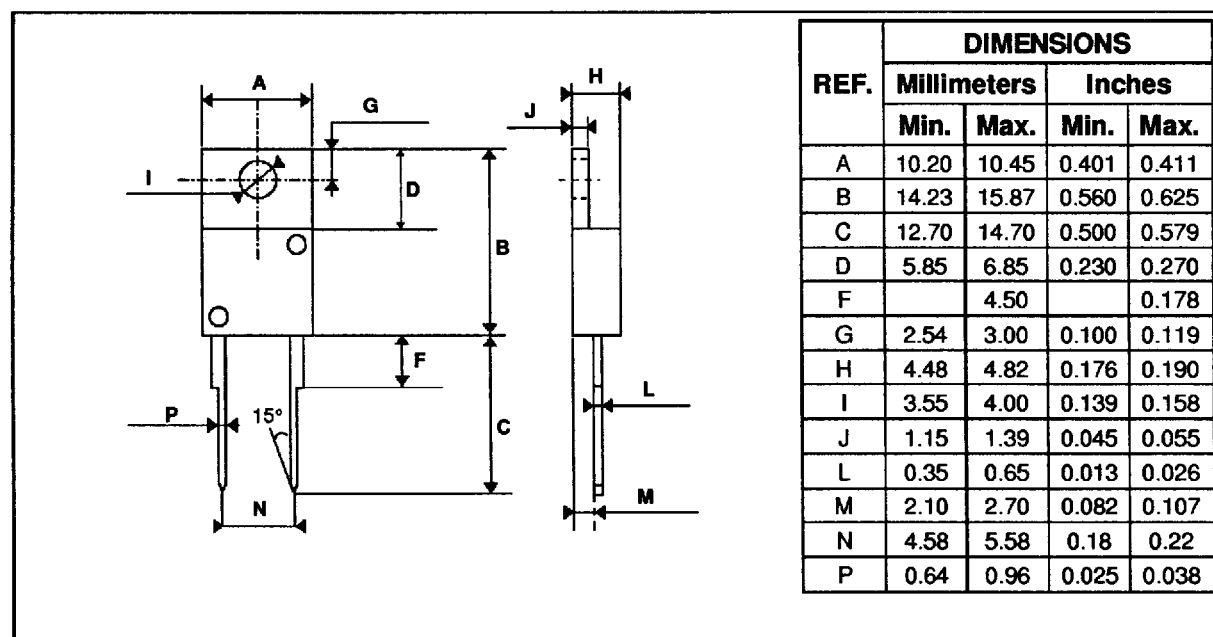
Cooling method : C.

Marking : Type number.

Weight : 1.9 g.

Torque value : 0.55 m.N typ (0.70 m.N max).

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**PACKAGE DATA**  
**ISOLATED TO220AC (JEDEC outline)**


Cooling method : C.

Marking : Type number.

Weight : 2.2 g.

Torque value : 0.8 m.N typ (1.0 m.N max).

Electrical isolation : 2500V DC

Capacitance : 7pF