



STTA3006P/PI STTA6006TV1/2

TURBOSWITCH™ ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

| | |
|----------------|---------------|
| $I_{F(AV)}$ | 30A / 2 x 30A |
| V_{RRM} | 600V |
| t_{rr} (typ) | 35ns |
| 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 : ISOTOP & DOP3I
Electrical insulation : 2500V_{RMS}
Capacitance < 12 pF (DOP3I)
Capacitance < 45 pF (ISOTOP)

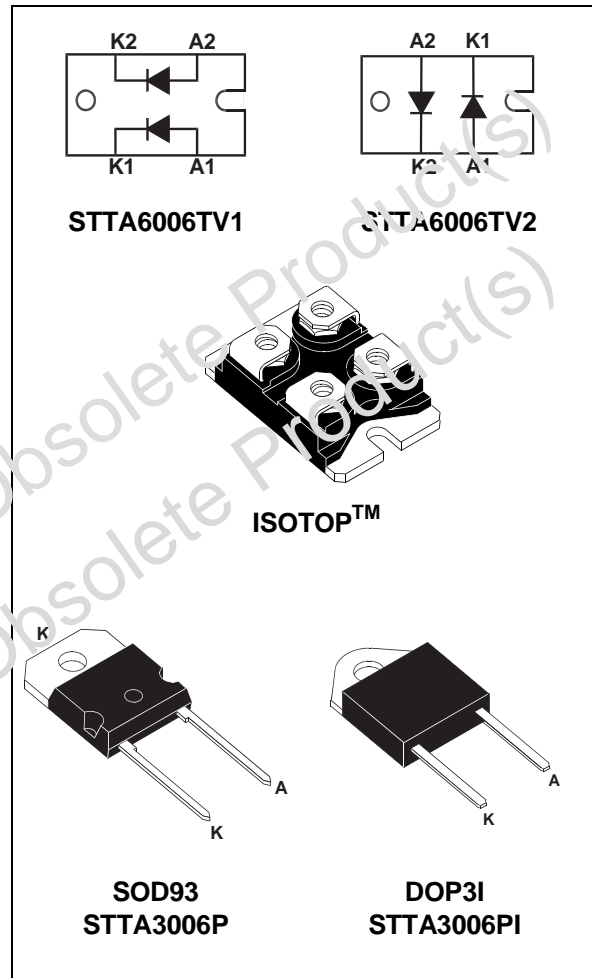
DESCRIPTION

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 ISOTOP, DOP3I or SOD93 these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE RATINGS (limiting values, per diode)

| 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 | 50 | A |
| I_{FRM} | Repetitive peak forward current | $t_p=5\mu s$ F=5kHz square | A |
| I_{FSM} | Surge non repetitive forward current | $t_p=10$ ms sinusoidal | A |
| T_j | Maximum operating junction temperature | 150 | °C |
| T_{stg} | Storage temperature range | -65 to 150 | °C |

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STTA6006TV1/2/ STTA3006P/PI

THERMAL AND POWER DATA (Per diode)

| Symbol | Parameter | Test conditions | | Value | Unit |
|----------------------|--|-----------------|-----------------------|-------|------|
| R _{th(j-c)} | Junction to case thermal resistance | ISOTOP | Per diode | 1.4 | °C/W |
| | | | Total | 0.75 | |
| | | DOP3I | | 1.8 | |
| | | SOD93 | | 1.2 | |
| R _{th(c)} | | ISOTOP | Coupling | 0.1 | °C/W |
| P ₁ | Conduction power dissipation I _{F(AV)} = 30A δ = 0.5 | ISOTOP | T _c = 74°C | 54 | W |
| | | DOP3I | T _c = 52°C | | |
| | | SOD93 | T _c = 85°C | | |
| P _{max} | Total power dissipation P _{max} = P ₁ + P ₃ (P ₃ = 10% P ₁) | ISOTOP | T _c = 66°C | 60 | W |
| | | DOP3I | T _c = 42°C | | |
| | | SOD93 | T _c = 78°C | | |

STATIC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test conditions | | Min | Typ | Max | Unit |
|------------------|-------------------------|--|------------------------|-----|------|------|------|
| V _{F*} | Forward voltage drop | I _F = 30A | T _j = 25°C | | | 1.75 | V |
| | | | T _j = 125°C | | 1.25 | 1.5 | V |
| I _{R**} | Reverse leakage current | V _R = 1.8 V V _{PRM} | T _j = 25°C | | | 150 | μA |
| | | | T _j = 125°C | | 3 | 8 | mA |
| V _{to} | Threshold voltage | I _p < 3.I _{AV} | T _j = 125°C | | | 1.15 | V |
| r _d | Dynamic resistance | | | | | 11 | mΩ |

Test pulses : * t_p = 380 μs, δ < 2%

** t_p = 5 ms, δ < 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°C I _F = 0.5 A I _R = 1A I _{rr} = 0.25A I _F = 1 A dI _F /dt = -50A/μs V _R = 30V | | 35 | 65 | ns |
| I _{RM} | Maximum reverse recovery current | T _j = 125°C V _R = 400V I _F = 30A dI _F /dt = -240 A/μs dI _F /dt = -500 A/μs | | 20 | 19 | A |
| S factor | Softness factor | T _j = 125°C V _R = 400V I _F = 30A dI _F /dt = -500 A/μs | | 0.40 | | - |

TURN-ON SWITCHING

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------|-----------------------|---|-----|-----|-----|------|
| t_{fr} | Forward recovery time | $T_j = 25^\circ\text{C}$ $I_F = 30\text{A}$, $dI_F/dt = 240\text{ A}/\mu\text{s}$ measured at, $1.1 \times V_{Fmax}$ | | | 600 | ns |
| V_{FP} | Peak forward voltage | $T_j = 25^\circ\text{C}$ $I_F = 30\text{A}$, $dI_F/dt = 240\text{ A}/\mu\text{s}$ | | | 12 | V |

Fig. 1: Conduction losses versus average current.

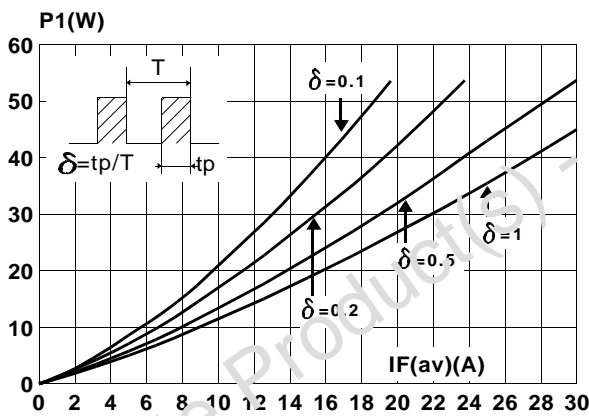


Fig. 2: Forward voltage drop versus forward current.

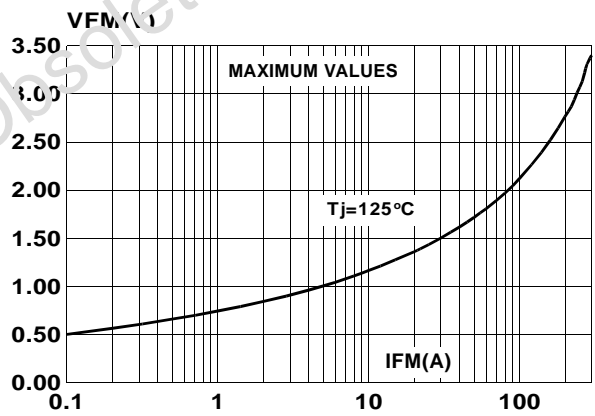


Fig. 3: Relative variation of thermal transient impedance junction to case versus pulse duration.

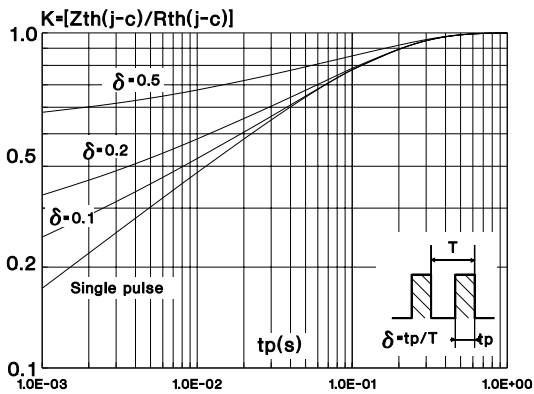


Fig. 4: Peak reverse recovery current versus dI/dt.

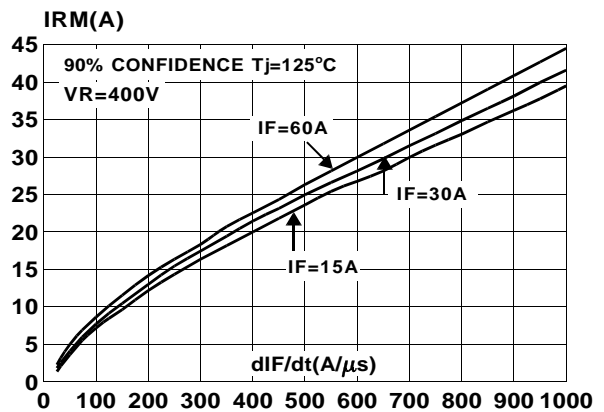


Fig. 5: Reverse recovery time versus dI_F/dt .

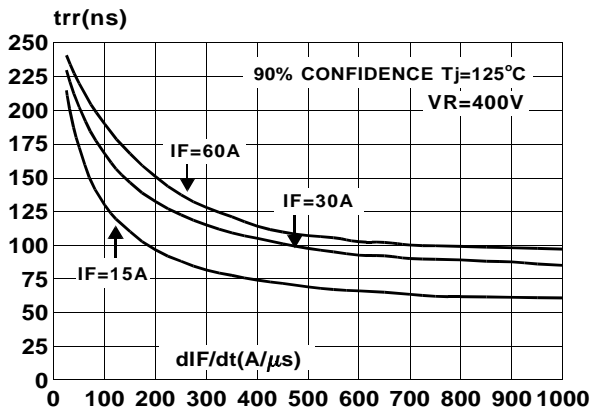


Fig. 6: Softness factor (t_b/t_a) versus dI_F/dt .

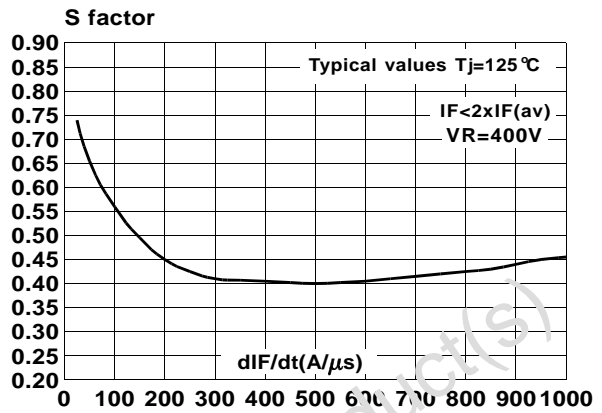


Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference $T_j=125^\circ C$).

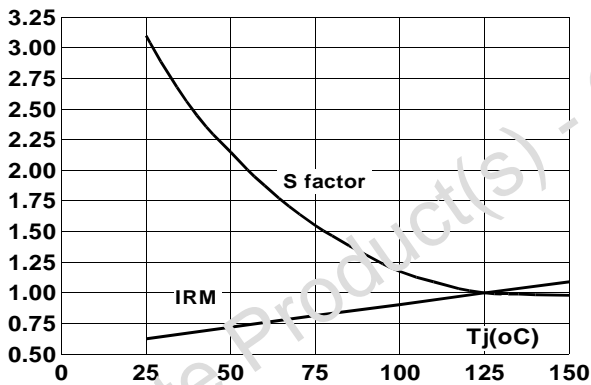


Fig. 8: Transient peak forward voltage versus dI_F/dt .

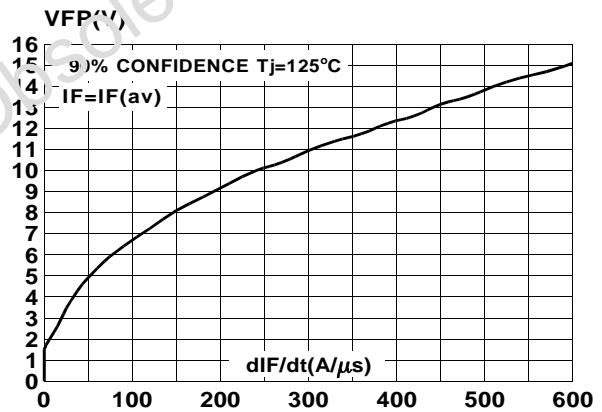
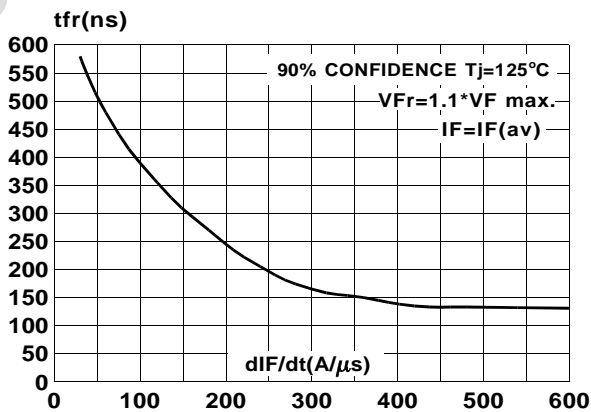


Fig. 9: Forward recovery time versus dI_F/dt .



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:

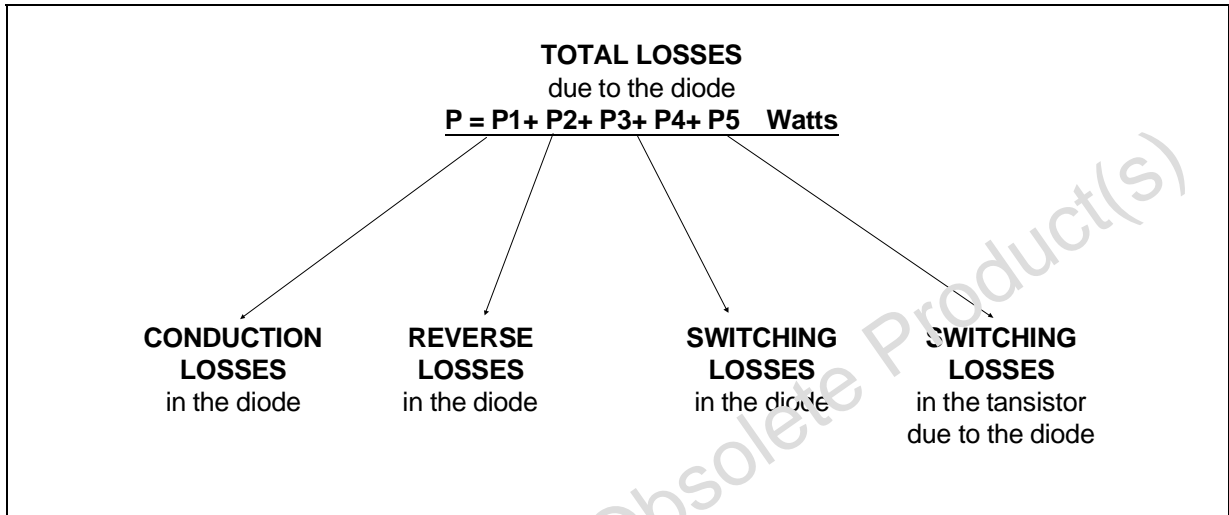
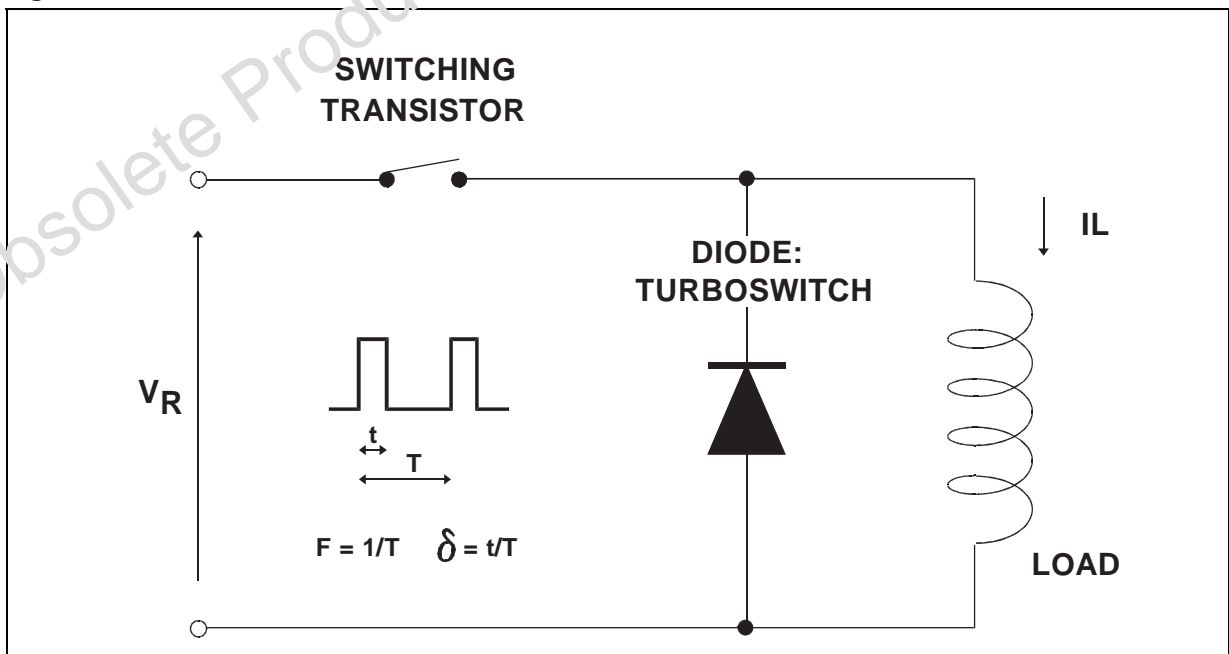
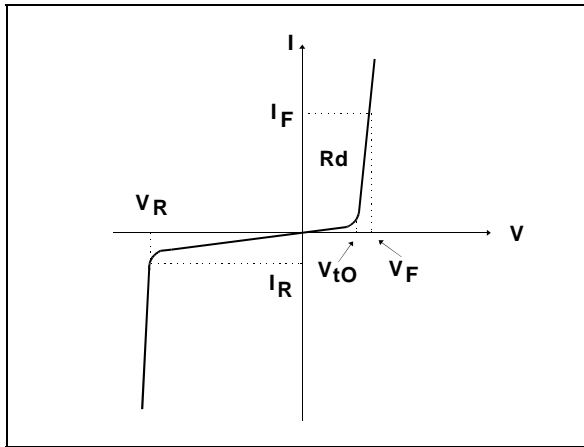


Fig. A : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

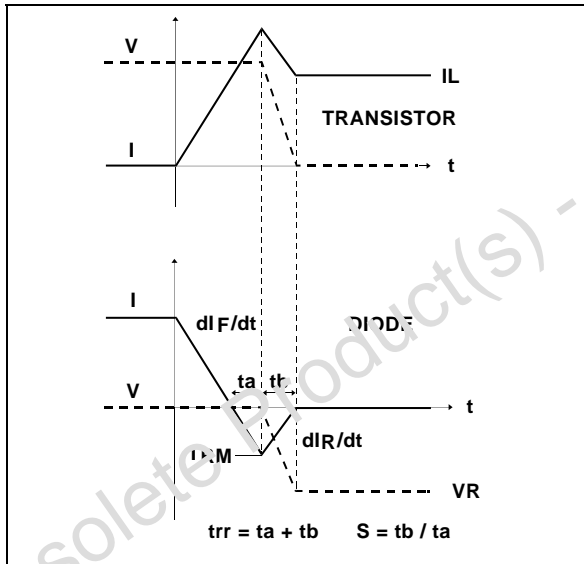
Fig. B: STATIC CHARACTERISTICS



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)

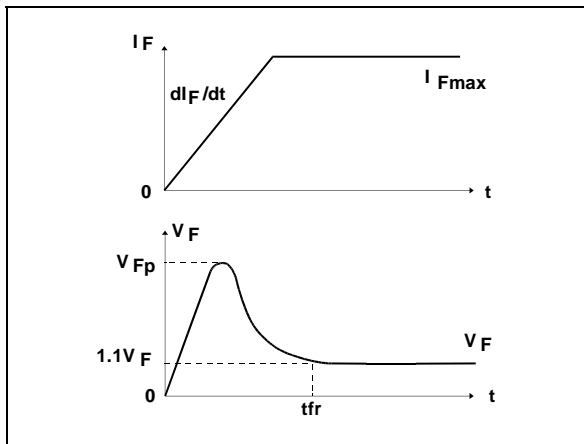
$$P5 = \frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dI_F/dt}$$

Turn-off losses (in the diode) :

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

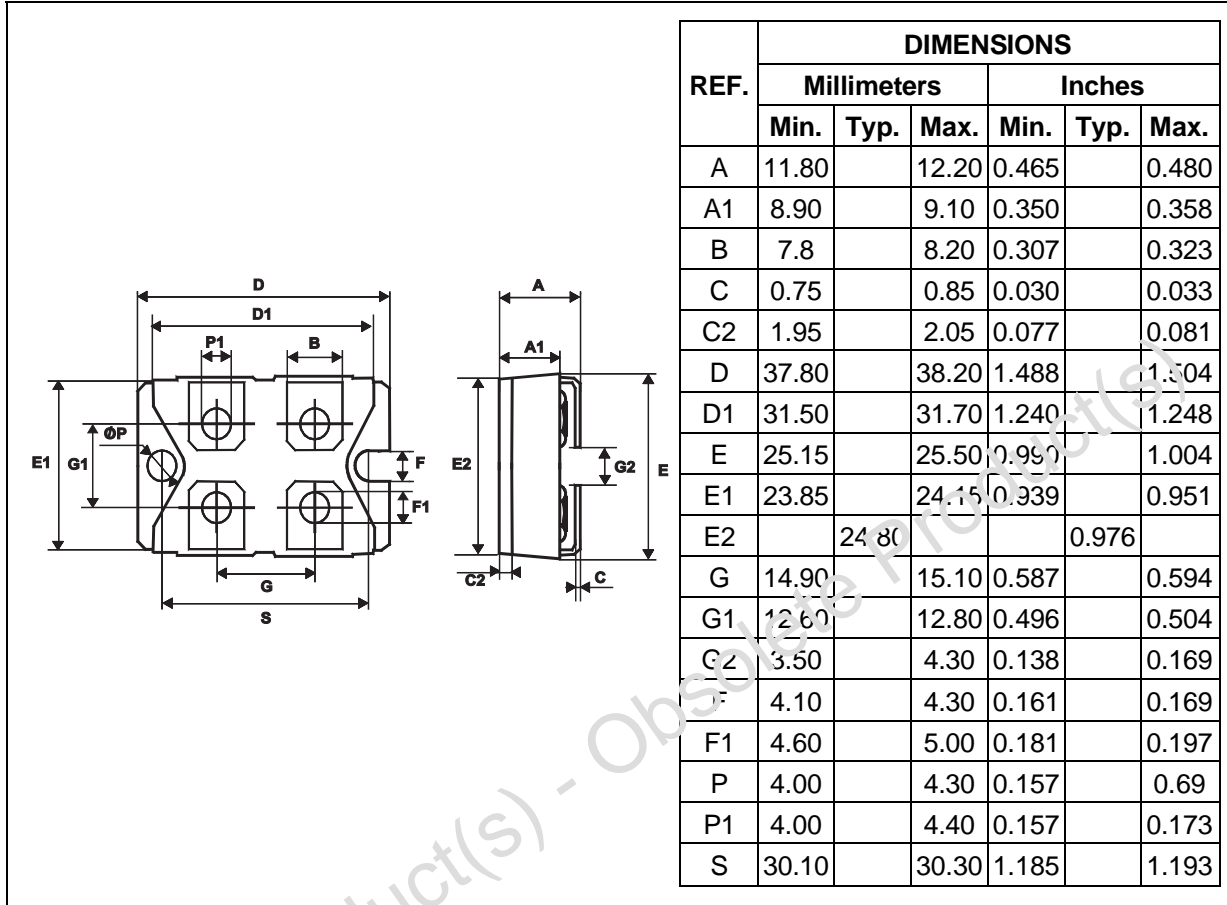
P3 and P5 are suitable for power MOSFET and IGBT

Fig. D: TURN-ON CHARACTERISTICS



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

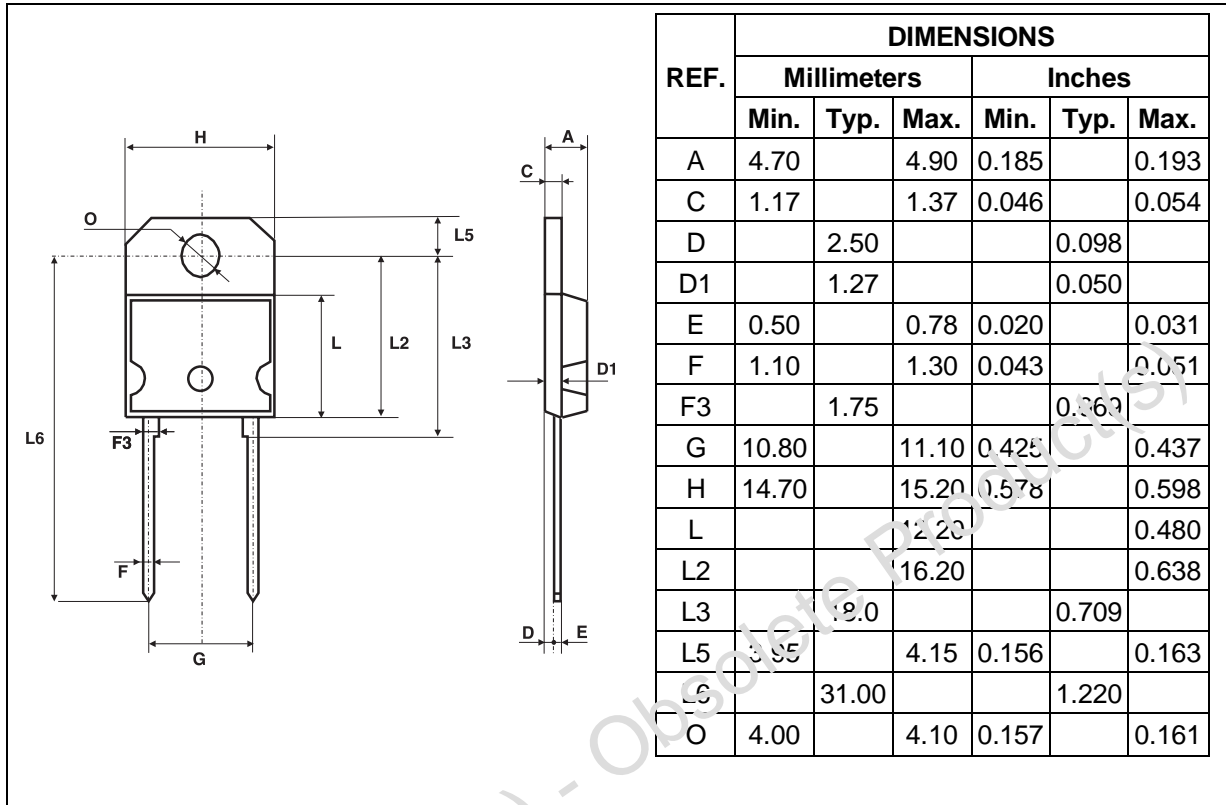
PACKAGE MECHANICAL DATA
ISOTOP



Cooling method : by conduction (C)

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PACKAGE MECHANICAL DATA
SOD93

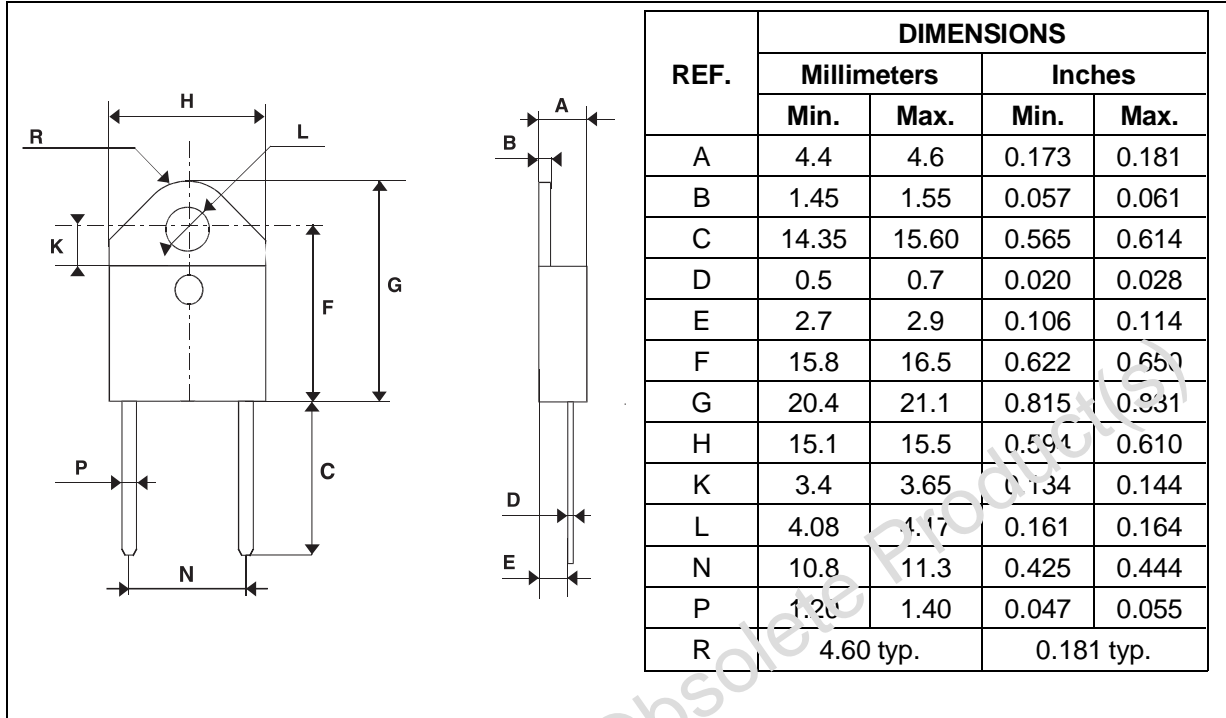


Cooling method : by conduction (C)

Recommended torque value : 0.8 m.N

Maximum torque value : 1m.N

PACKAGE MECHANICAL DATA
DOP3I



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

| Ordering type | Marking | Package | Weight | Base qty | Delivery mode |
|---------------|-------------|---------|----------------|----------|---------------|
| STTA6006P | STTA6006P | SOD93 | 3.79g | 30 | Tube |
| STTA6006PI | STTA6006PI | DOP3I | 4.52g | 30 | Tube |
| STTA6006TV1 | STTA6006TV1 | ISOTOP | 27g | 10 | Tube |
| STTA6006TV2 | STTA6006TV2 | ISOTOP | without screws | 10 | Tube |

■ Ency meets UL94,V0

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