



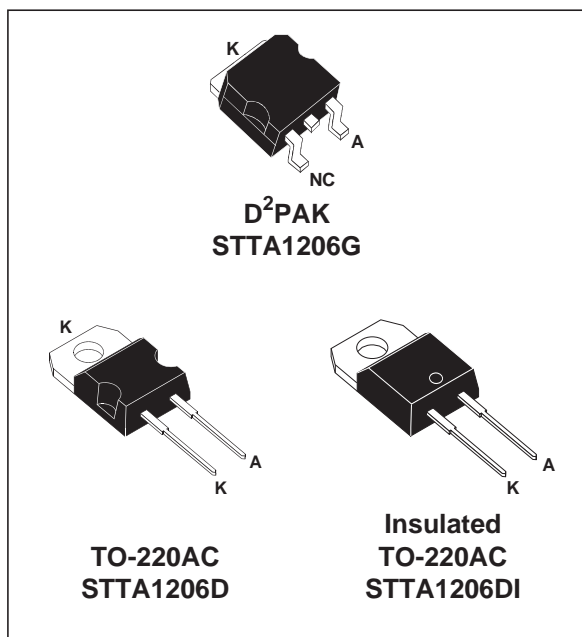
## TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	12A
$V_{RRM}$	600V
$t_{rr}$ (typ)	28ns
$V_F$ (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

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 in TO-220AC, isolated TO-220AC and D<sup>2</sup>PAK, 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	TO-220AC/D2PAK	160	A
		TO-220AC ins.		
$I_{FSM}$	Surge non repetitive forward current	tp=10 ms sinusoidal	110	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

## STTA1206D/DI/G

### THERMAL AND POWER DATA

Symbol	Parameter	Test conditions		Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	TO-220AC / D <sup>2</sup> PAK TO-220AC ins.		1.9 3.0	°C/W
$P_1$	Conduction power dissipation $I_{F(AV)} = 12A$ $\delta = 0.5$	TO-220AC / D <sup>2</sup> PAK TO-220AC ins.	$T_c = 108^\circ C$ $T_c = 84^\circ C$	22	W
$P_{max}$	Total power dissipation $P_{max} = P_1 + P_3$ ( $P_3 = 10\% P_1$ )	TO-220AC / D <sup>2</sup> PAK TO-220AC ins.	$T_c = 104^\circ C$ $T_c = 78^\circ C$	24	W

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
$V_F^*$	Forward voltage drop	$I_F = 12A$	$T_j = 25^\circ C$ $T_j = 125^\circ C$			1.75 1.5	V V
$I_R^{**}$	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$	$T_j = 25^\circ C$ $T_j = 125^\circ C$		2	100 5	$\mu A$ mA
$V_{to}$	Threshold voltage	$I_p < 3 \cdot I_{AV}$	$T_j = 125^\circ C$			1.15	V
$r_d$	Dynamic resistance					29	m $\Omega$

Test pulse :

\*  $t_p = 380 \mu s$ ,  $\delta$  cycle < 2%

\*\*  $t_p = 5 ms$ ,  $\delta$  cycle < 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	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$			28	55	ns
$I_{RM}$	Maximum reverse recovery current	$T_j = 125^\circ C$ $V_R = 400V$ $I_F = 12A$ $di_F/dt = -96 A/\mu s$ $di_F/dt = -500 A/\mu s$			16	7.5	A
S factor	Softness factor	$T_j = 125^\circ C$ $V_R = 400V$ $I_F = 12A$ $di_F/dt = -500 A/\mu s$			0.45		-

#### TURN-ON SWITCHING

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

Fig. 1: Conduction losses versus average current.

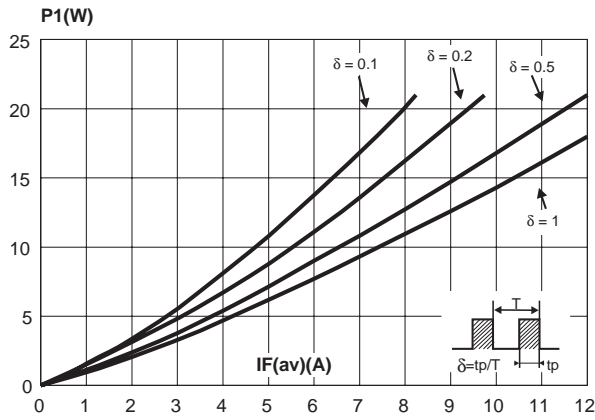


Fig. 2: Forward voltage drop versus forward current.

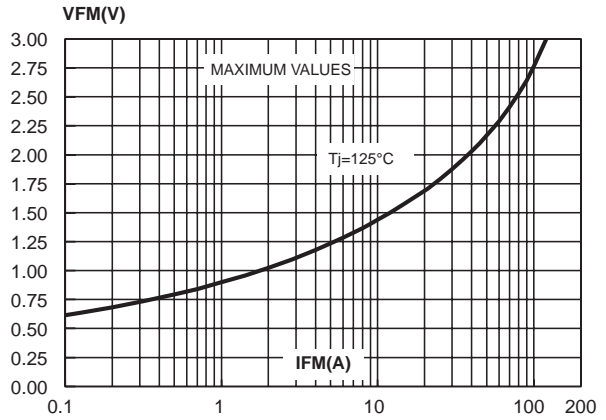


Fig. 3: Relative variation of thermal transient impedance junction to case versus pulse duration.

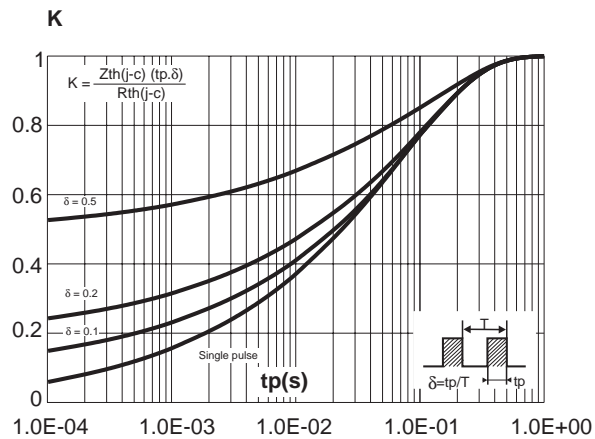


Fig. 4: Peak reverse recovery current versus dIF/dt.

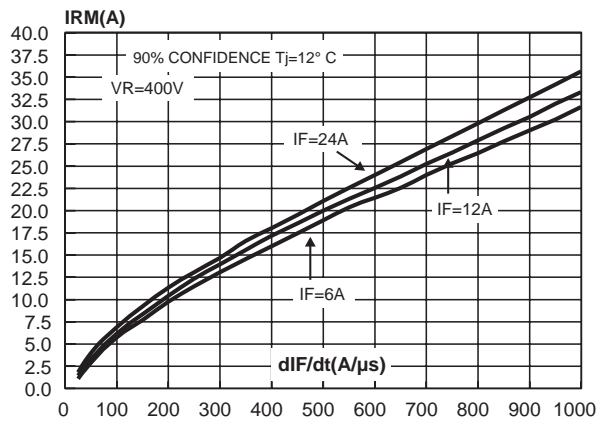


Fig. 5: Reverse recovery time versus dIF/dt.

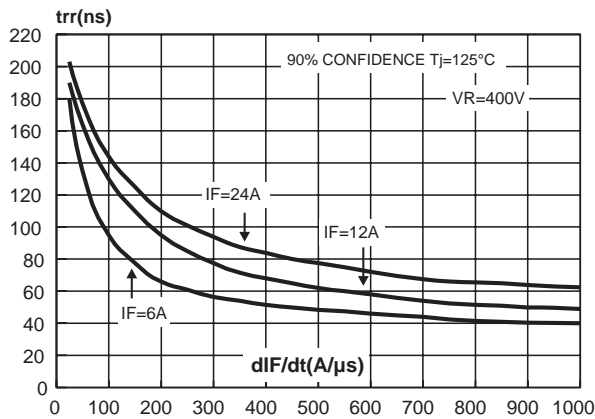
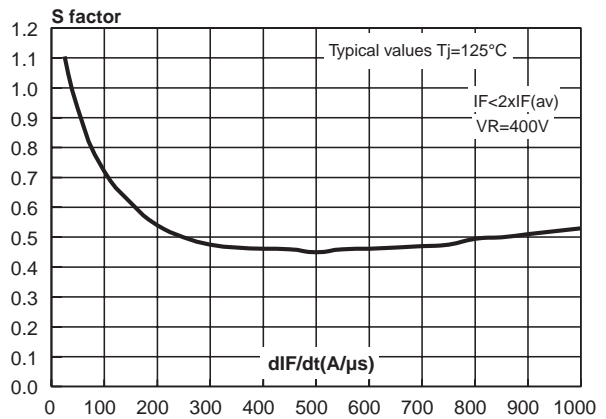
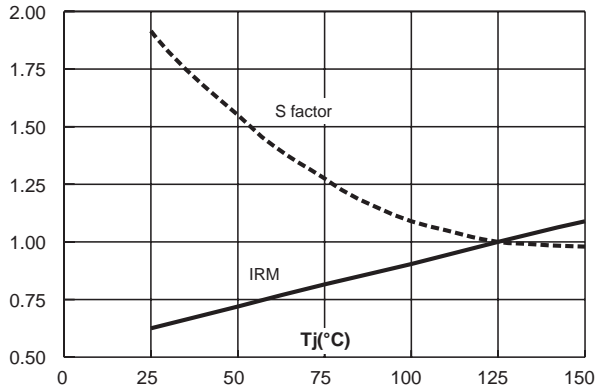


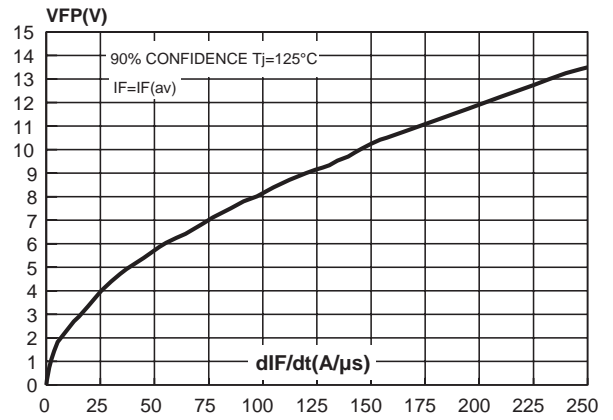
Fig. 6: Softness factor (tb/ta) versus dIF/dt.



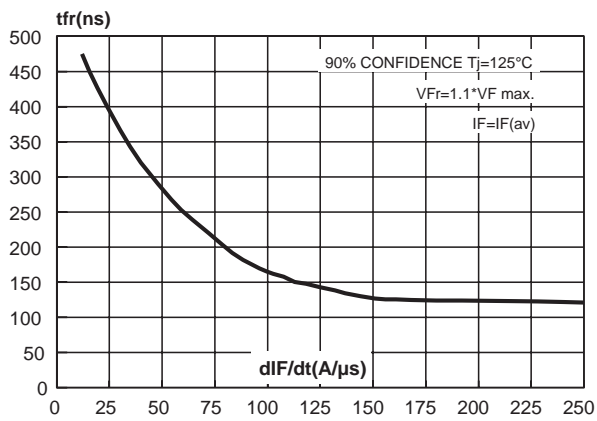
**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (Reference  $T_j=125^\circ\text{C}$ ).



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



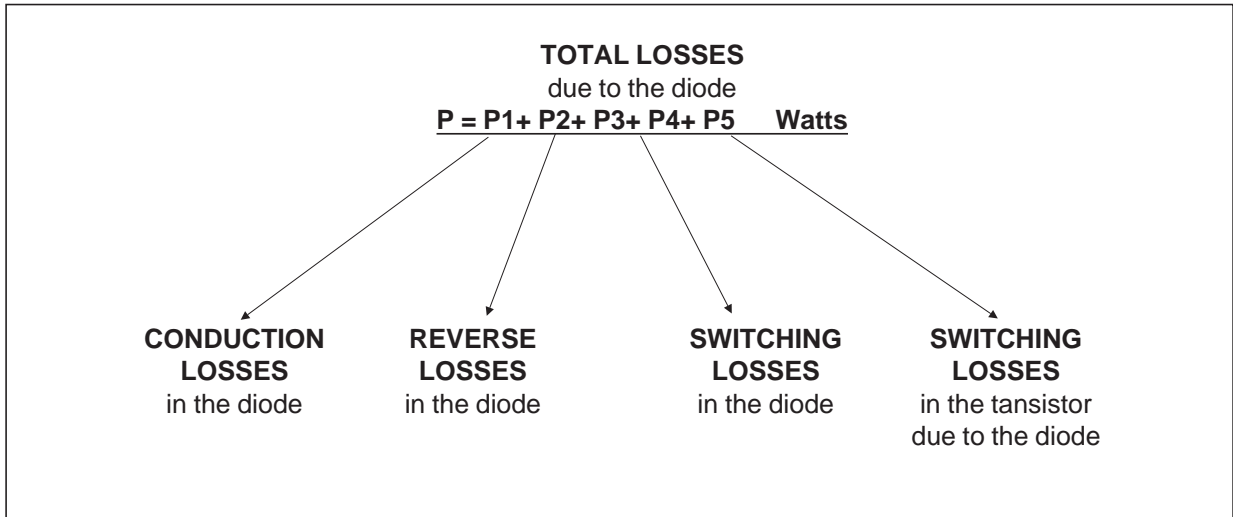
**Fig. 9:** Forward recovery time versus  $dI_F/dt$ .



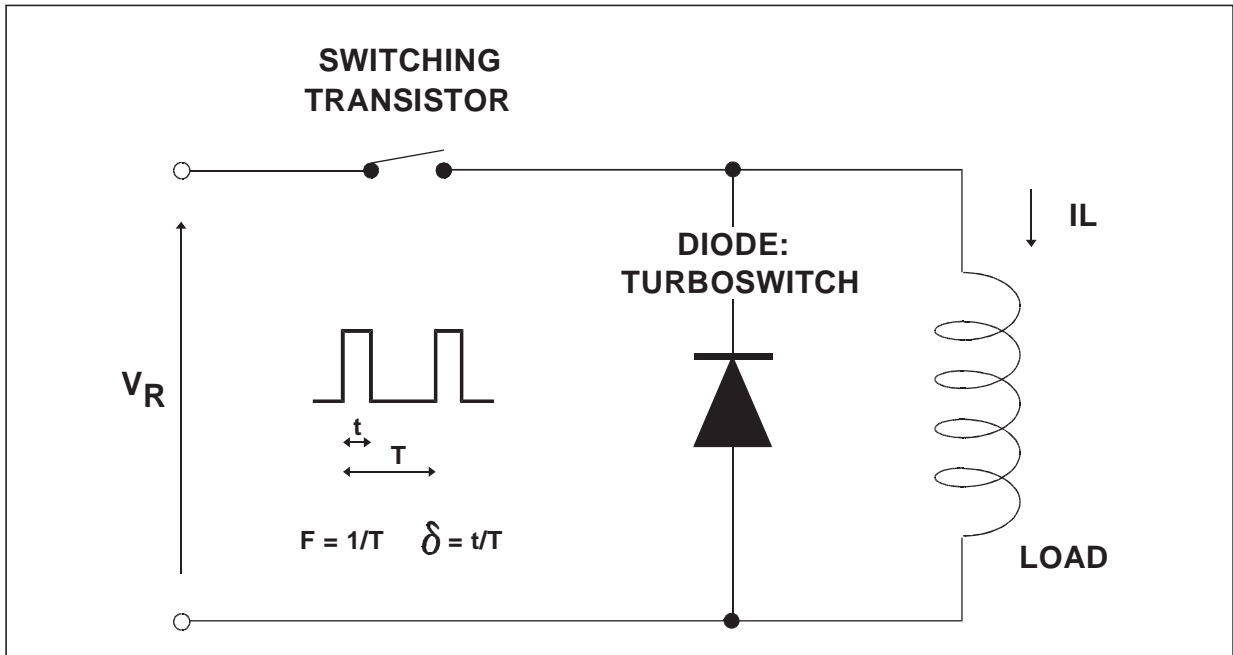
**APPLICATION DATA**

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:

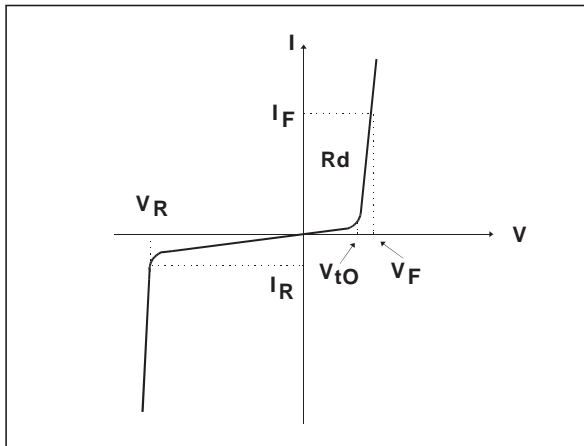


**Fig. A : "FREEWHEEL" MODE.**



APPLICATION DATA (Cont'd)

Fig. B: STATIC CHARACTERISTICS



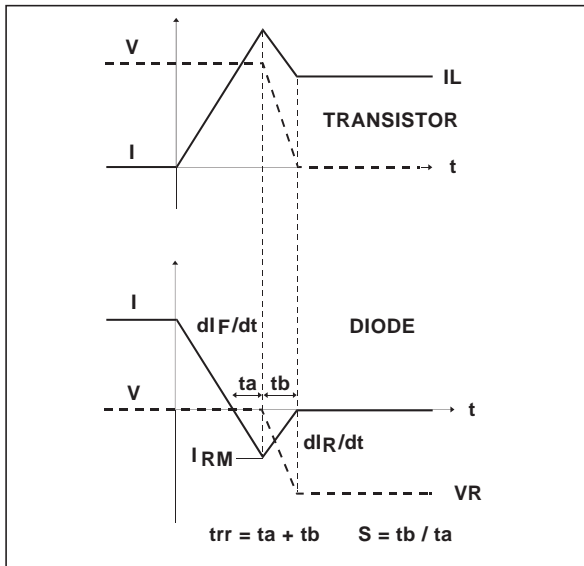
Conduction losses :

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

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)

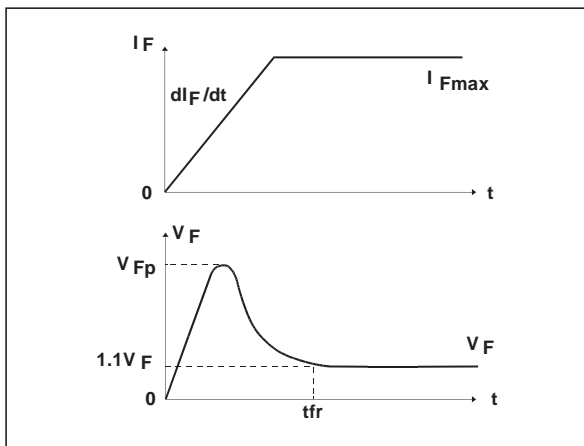
$$P5 = \frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dl_F / dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dl_F / dt}$$

Turn-off losses (in the diode) :

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

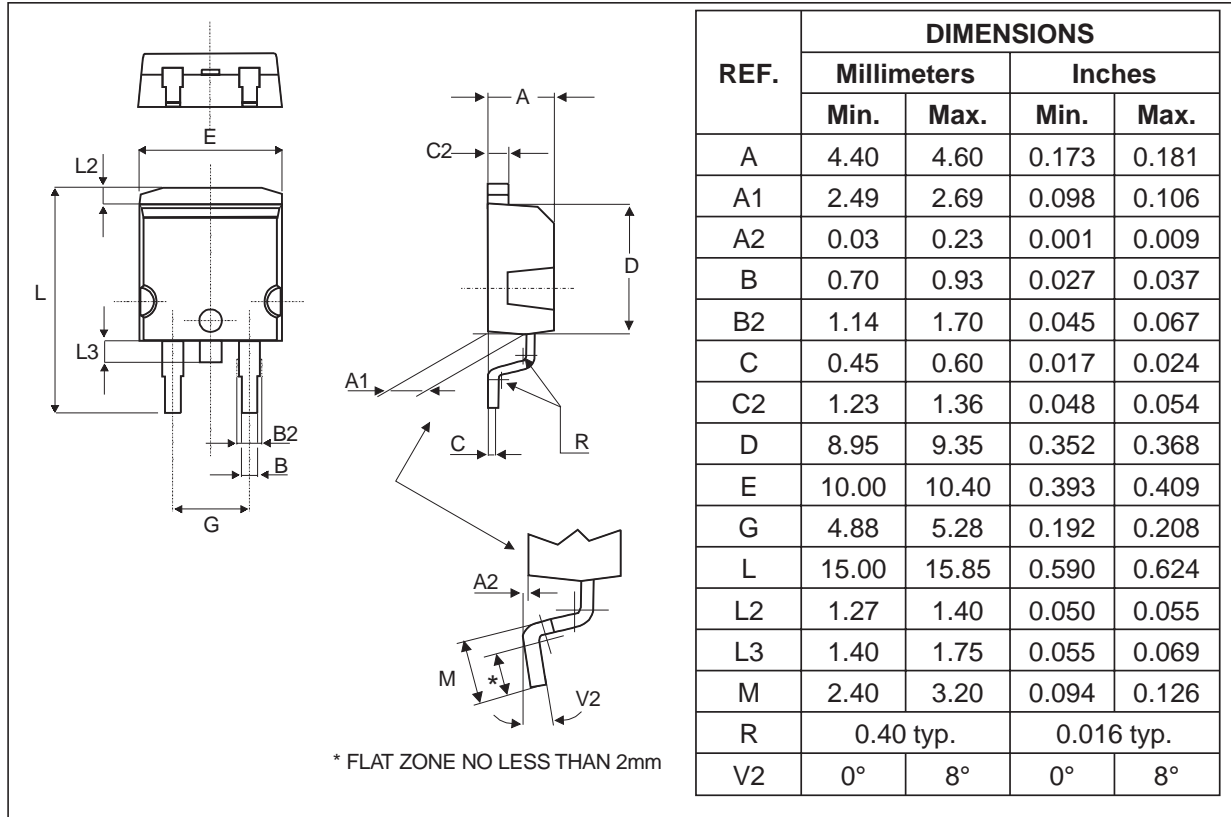
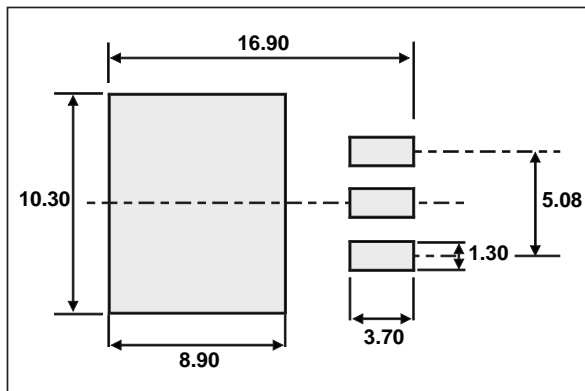
P3 and P5 are suitable for power MOSFET and IGBT

Fig. D: TURN-ON CHARACTERISTICS



Turn-on losses :

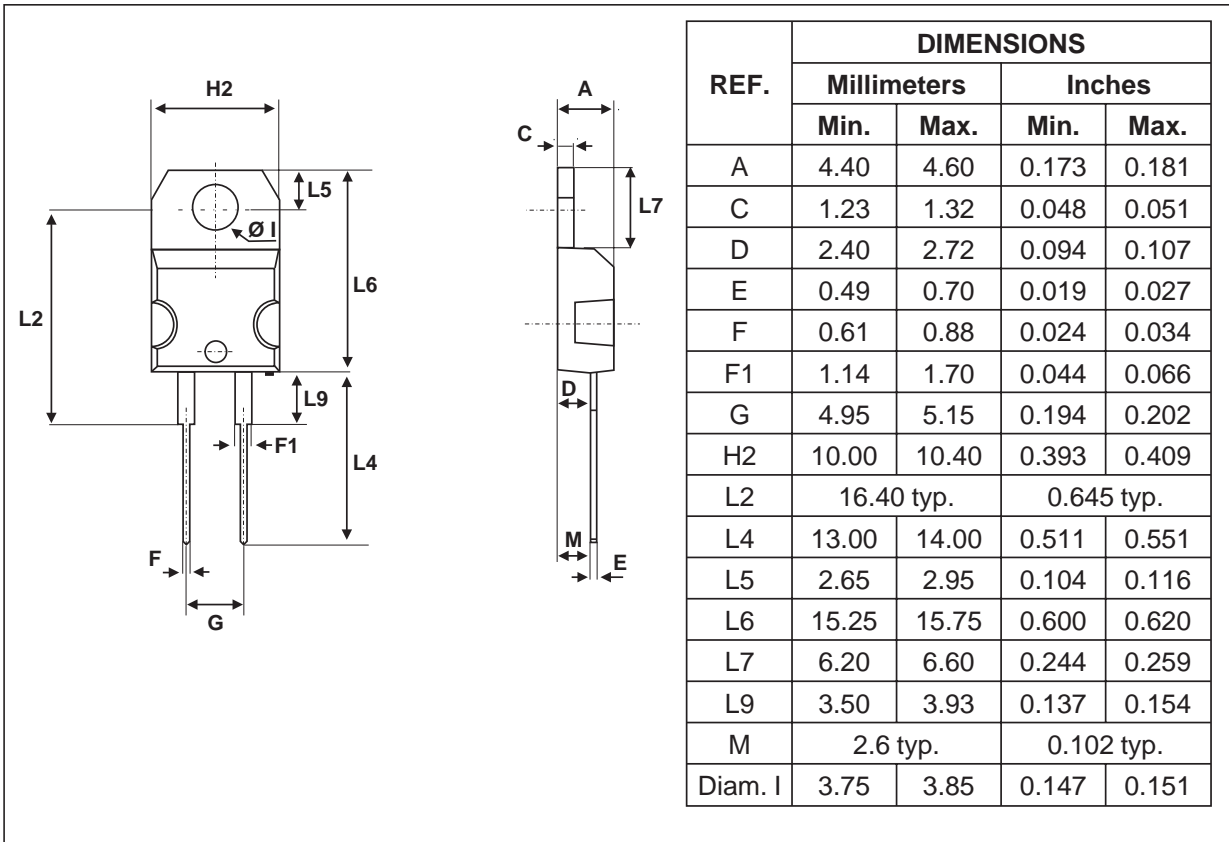
$$P4 = 0.4 (V_{FP} - V_F) \cdot I_{Fmax} \cdot t_{fr} \cdot F$$

**PACKAGE DATA**  
**D2PAK**

**FOOTPRINT DIMENSIONS (in millimeters)**


**STTA1206D/DI/G**

**PACKAGE DATA**

TO-220AC (JEDEC outline)

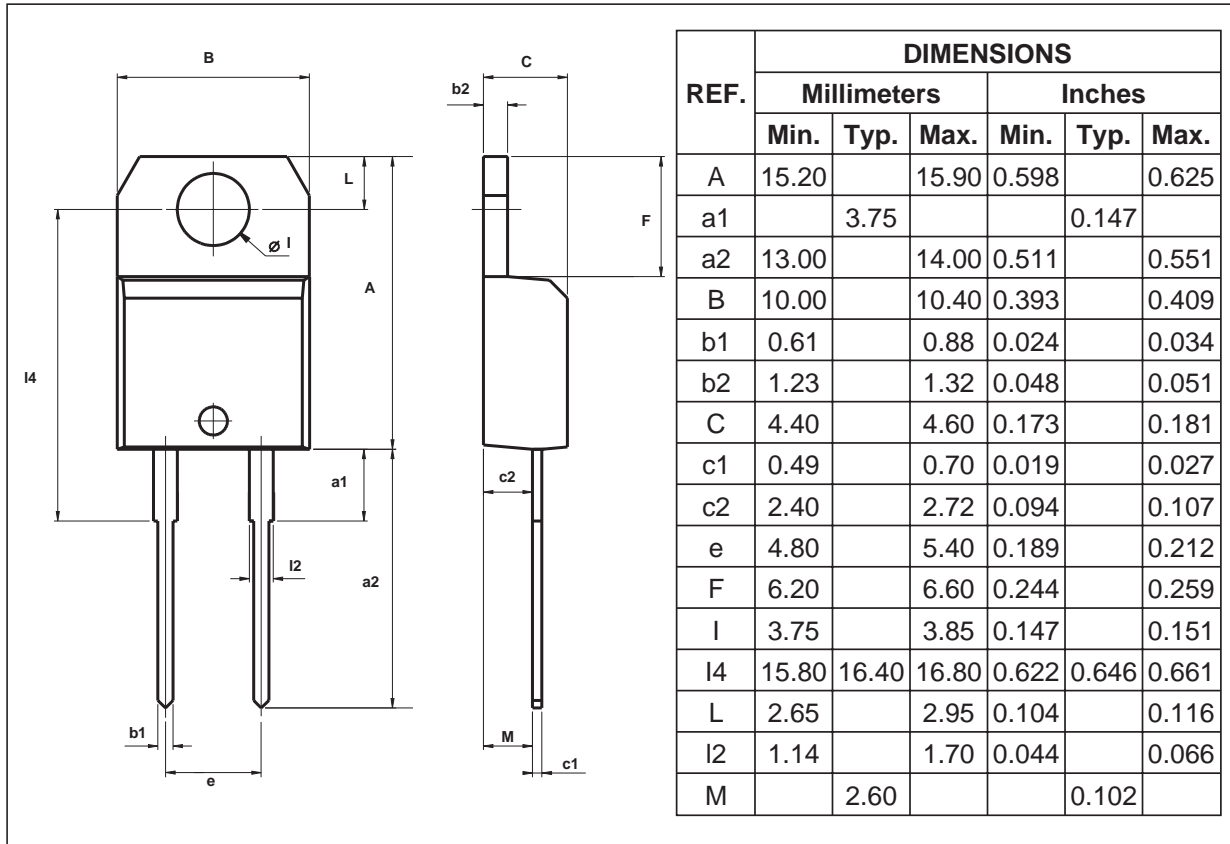


- Cooling method : by conduction (C)
- Recommended maximum torque value : 0.7m.N



**PACKAGE DATA**

INSULATED TO-220AC (JEDEC outline)



Cooling method : by conduction (C).

Recommended maximum torque value : 1 m.N

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA1206D	STTA1206D	TO-220AC	1.86g	50	Tube
STTA1206DI	STTA1206DI	TO-220AC Ins.	1.86g	250	Bulk
STTA1206G	STTA1206G	D <sup>2</sup> PAK	1.48g	50	Tube
STTA1206G-TR	STTA1206G	D <sup>2</sup> PAK	1.48g	500	Tape & reel

- Epoxy meets UL94,V0

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