



STTA1206D/DI/G

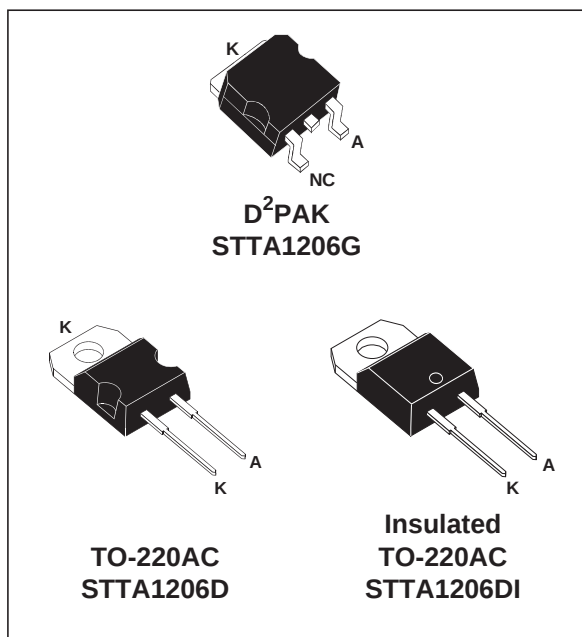
TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

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_{RMS}
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 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	TO-220AC/D2PAK	160	A
		TO-220AC ins.	120	A
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

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THERMAL AND POWER DATA

Symbol	Parameter	Test conditions		Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	TO-220AC / D ² 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 ² 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 ² 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	μA 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 Ω

Test pulse :

* $t_p = 380 \mu s$, δ cycle < 2%

** $t_p = 5 ms$, δ 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

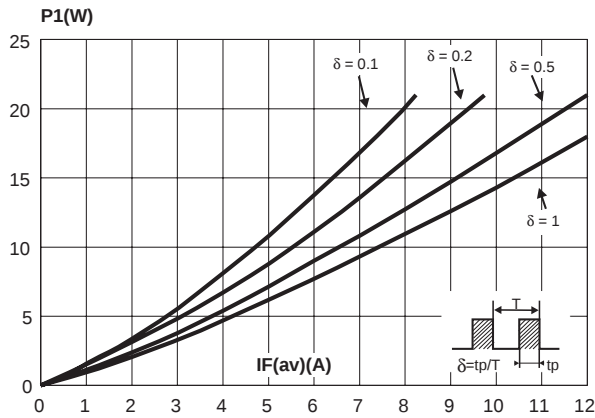
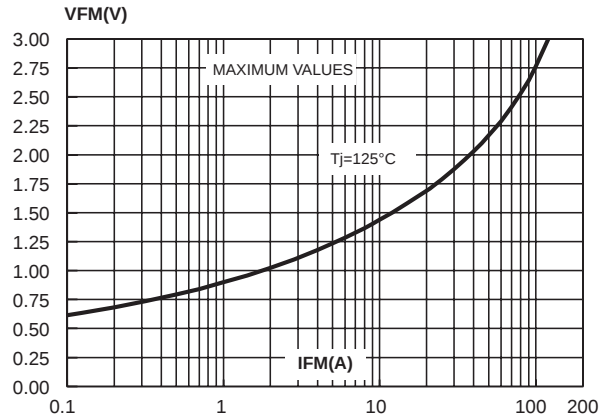
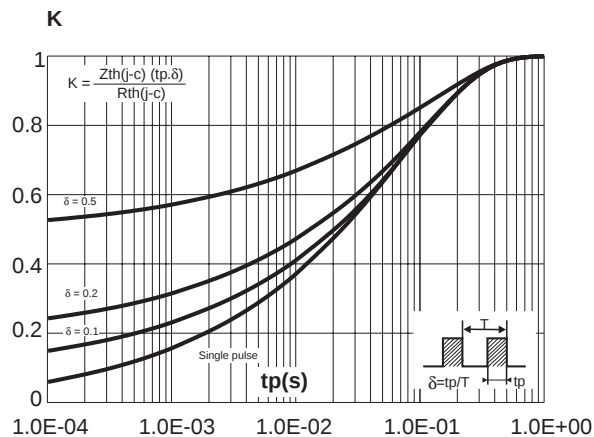
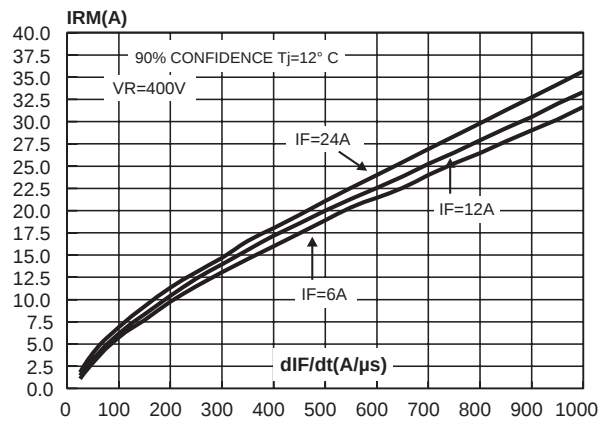
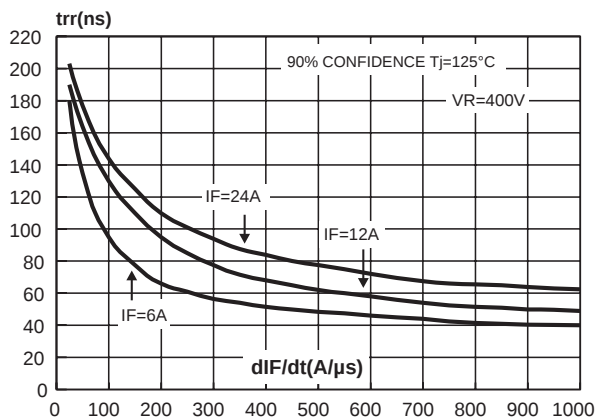
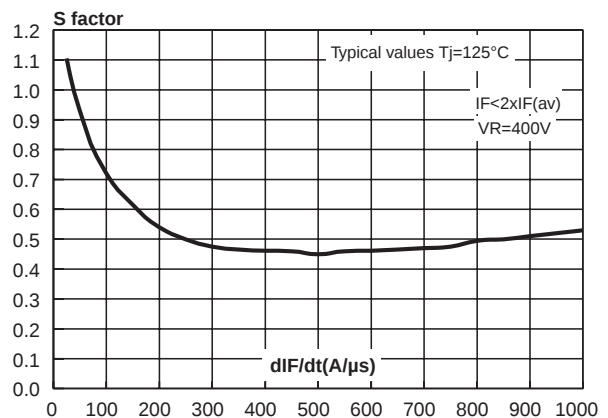
Fig. 1: Conduction losses versus average current.**Fig. 2:** Forward voltage drop versus forward current.**Fig. 3:** Relative variation of thermal transient impedance junction to case versus pulse duration.**Fig. 4:** Peak reverse recovery current versus dI_F/dt .**Fig. 5:** Reverse recovery time versus dI_F/dt .**Fig. 6:** Softness factor (tb/ta) versus dI_F/dt .

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

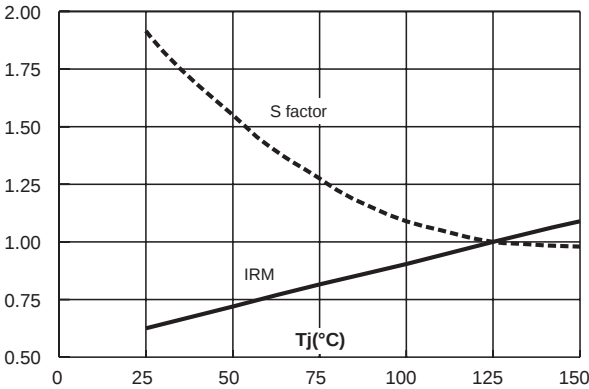


Fig. 8: Transient peak forward voltage versus dI_F/dt .

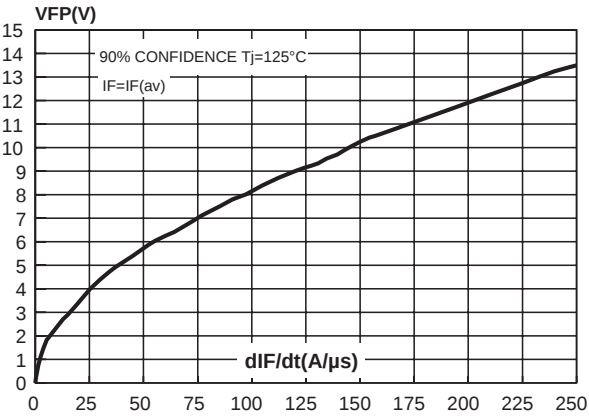
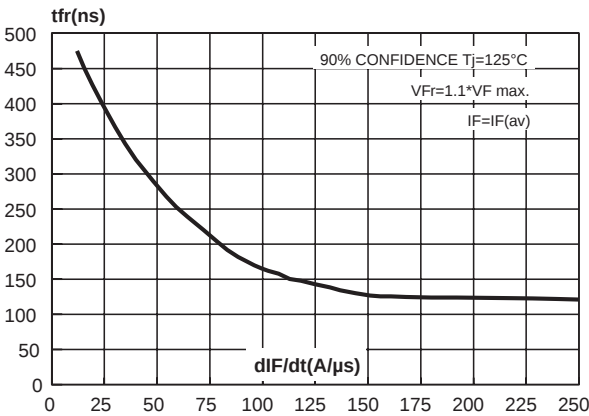


Fig. 9: Forward recovery time versus dI_F/dt .



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:

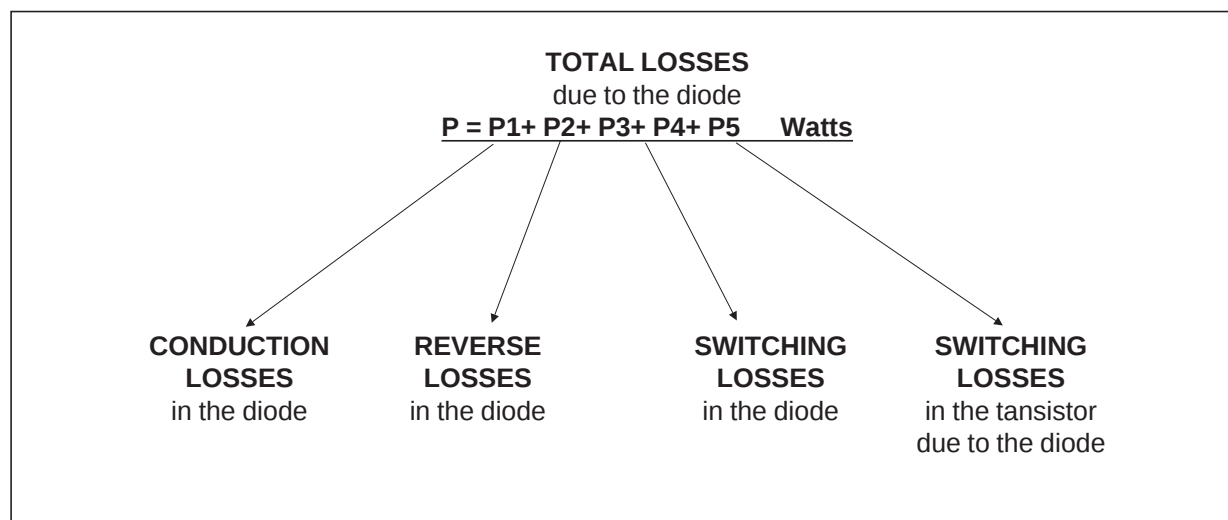
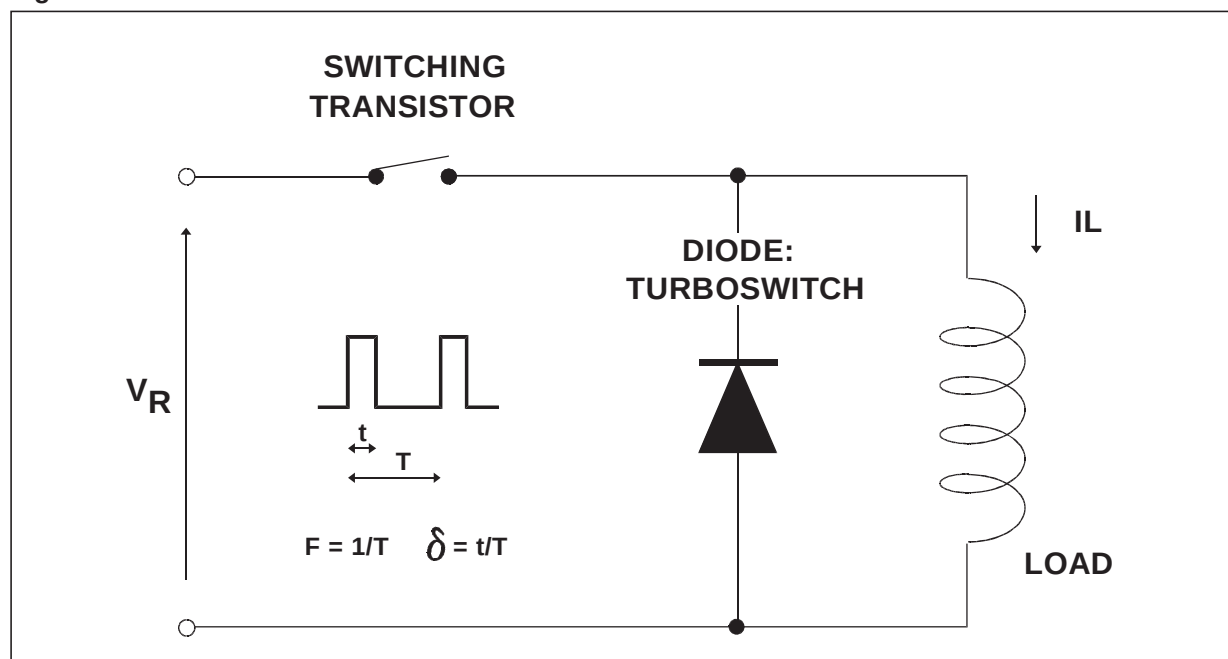
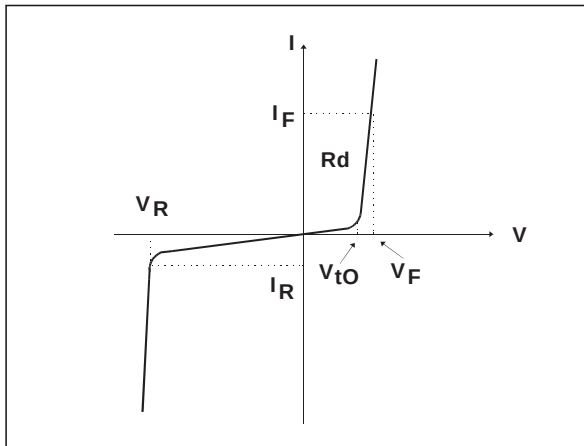


Fig. A : "FREEWHEEL" MODE.



APPLICATION DATA (Cont'd)

Fig. B: STATIC CHARACTERISTICS



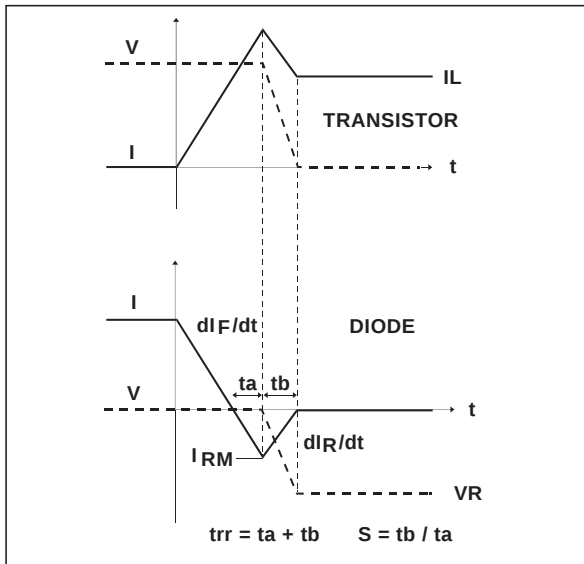
Conduction losses :

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

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)

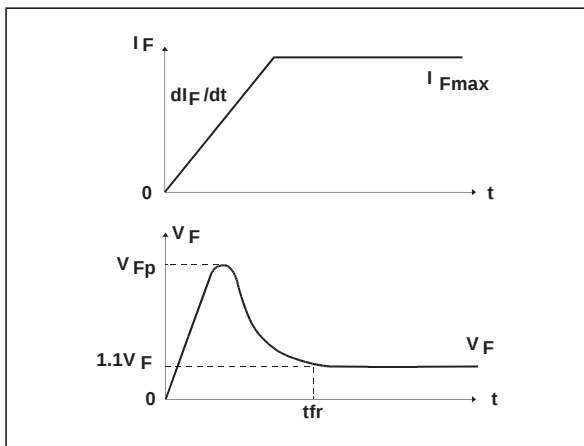
$$P5 = \frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dI_F/dt}$$

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

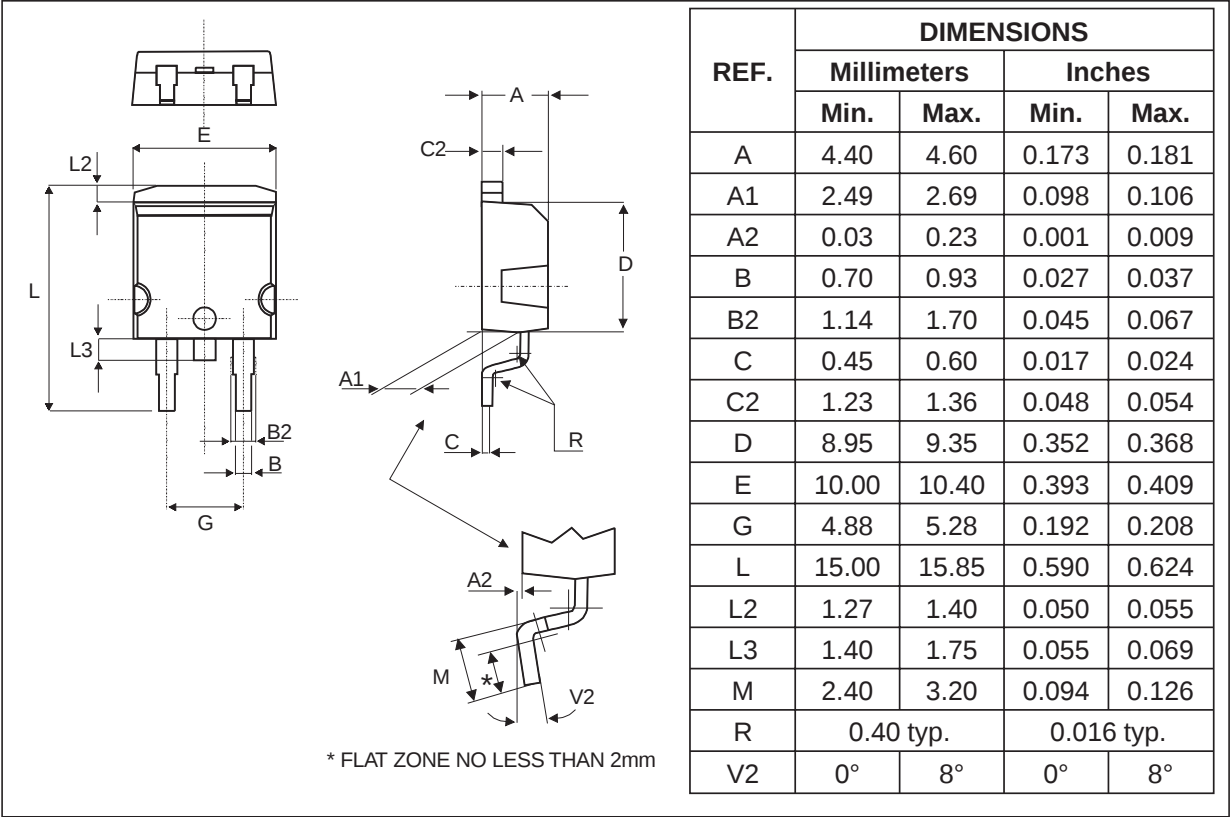
Fig. D: TURN-ON CHARACTERISTICS



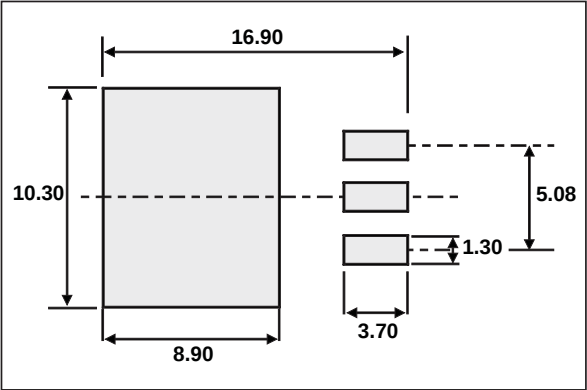
Turn-on losses :

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

PACKAGE DATA
D2PAK

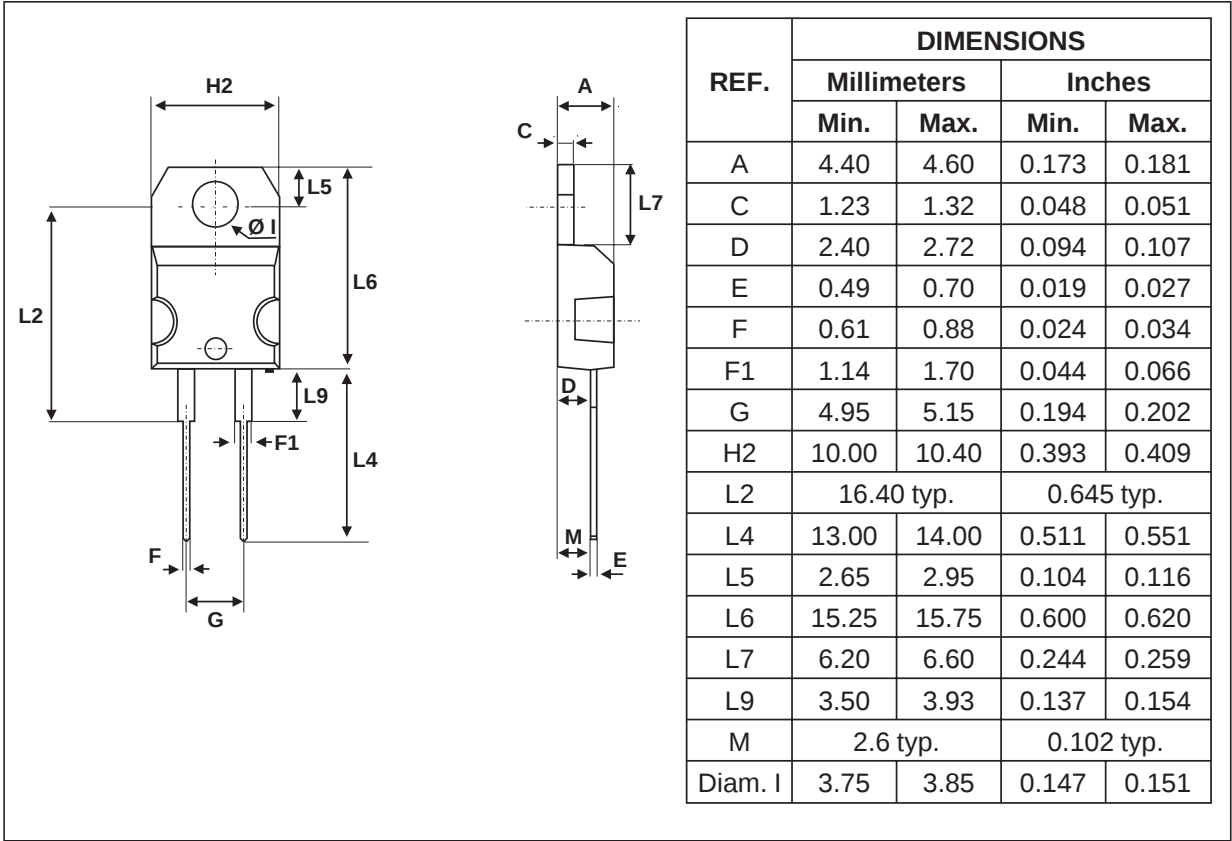


FOOTPRINT DIMENSIONS (in millimeters)



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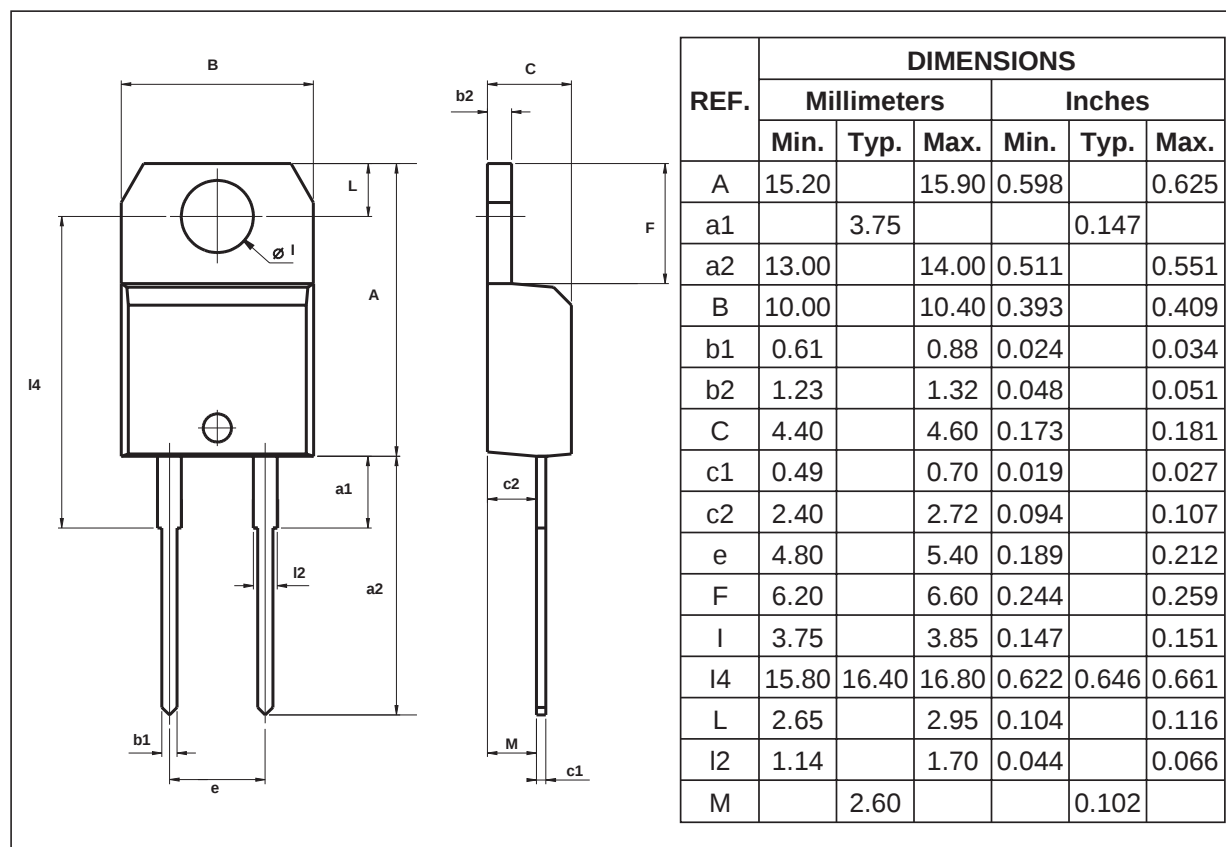
PACKAGE DATA
TO-220AC (JEDEC outline)



- 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 ² PAK	1.48g	50	Tube
STTA1206G-TR	STTA1206G	D ² PAK	1.48g	500	Tape & reel

- Epoxy meets UL94,V0

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