



## TURBOSWITCH™ ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCTS CHARACTERISTICS

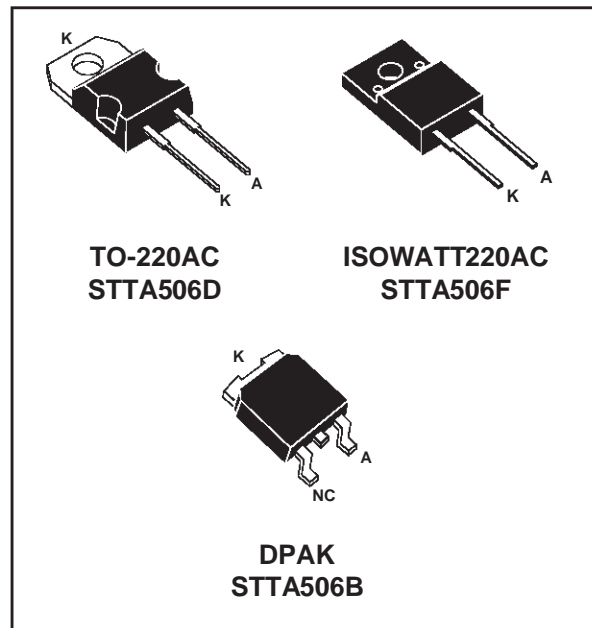
$I_{F(AV)}$	5A
$V_{RRM}$	600V
$t_{rr}$ (typ)	20ns
$V_F$ (max)	1.5V

### 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: ISOWATT220AC  
Electrical insulation : 2000VDC  
Capacitance < 12 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, ISOWATT220AC or in DPAK, 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 ISOWATT220AC	20 A
		DPAK	10 A
$I_{FRM}$	Repetitive peak forward current	$t_p=5\mu s$ F=5kHz square	65 A
$I_{FSM}$	Surge non repetitive forward current	$t_p=10$ ms sinusoidal	55 A
$T_j$	Maximum operating junction temperature	150	°C
$T_{stg}$	Storage temperature range	-65 to 150	°C

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## STTA506D/F/B

### THERMAL AND POWER DATA

Symbol	Parameter	Test conditions		Value	Unit
R <sub>th(j-c)</sub>	Junction to case	TO-220AC/ DPAK		3.5	°C/W
		ISOWATT220AC		6.0	
P <sub>1</sub>	Conduction power dissipation • I <sub>F(AV)</sub> = 5A δ = 0.5	TO-220AC/ DPAK	T <sub>c</sub> = 118°C	9	W
		ISOWATT220AC	T <sub>c</sub> = 96°C		
P <sub>max</sub>	Total power dissipation P <sub>max</sub> = P <sub>1</sub> + P <sub>3</sub> (P <sub>3</sub> = 10% P <sub>1</sub> )	TO-220AC/ DPAK	T <sub>c</sub> = 115°C	10	W
		ISOWATT220AC	T <sub>c</sub> = 90°C		

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V <sub>F</sub> *	Forward voltage drop	I <sub>F</sub> = 5A	T <sub>j</sub> = 25°C		1.25	1.75	V
			T <sub>j</sub> = 125°C			1.5	V
I <sub>R</sub> **	Reverse leakage current	V <sub>R</sub> = 0.8 x V <sub>RRM</sub>	T <sub>j</sub> = 25°C		0.75	100	μA
			T <sub>j</sub> = 125°C			2	mA
V <sub>to</sub>	Threshold voltage	I <sub>p</sub> < 3. I <sub>AV</sub>	T <sub>j</sub> = 125°C			1.15	V
rd	Dynamic resistance					70	mΩ

Test pulse : \* tp = 380 μs, δ < 2%

\*\* tp = 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 <sub>rr</sub>	Reverse recovery time	T <sub>j</sub> = 25°C I <sub>F</sub> = 0.5 A I <sub>R</sub> = 1A I <sub>rr</sub> = 0.25A I <sub>F</sub> = 1 A dI <sub>F</sub> /dt = -50A/μs V <sub>R</sub> = 30V		20	50	ns
I <sub>RM</sub>	Maximum reverse recovery current	T <sub>j</sub> = 125°C V <sub>R</sub> = 400V I <sub>F</sub> = 5A dI <sub>F</sub> /dt = -40 A/μs dI <sub>F</sub> /dt = -500 A/μs		11	3.0	A
S factor	Softness factor	T <sub>j</sub> = 125°C V <sub>R</sub> = 400V I <sub>F</sub> = 5A dI <sub>F</sub> /dt = -500 A/μs		0.55		-

#### TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t <sub>fr</sub>	Forward recovery time	T <sub>j</sub> = 25°C I <sub>F</sub> = 5 A, dI <sub>F</sub> /dt = 40 A/μs measured at 1.1 × V <sub>Fmax</sub>			500	ns
V <sub>Fp</sub>	Peak forward voltage	T <sub>j</sub> = 25°C I <sub>F</sub> = 5A, dI <sub>F</sub> /dt = 40 A/μs			10	V

Fig. 1: Switching OFF losses versus  $di/dt$ .

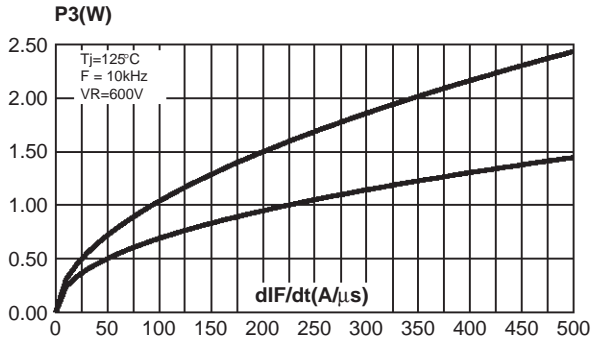


Fig. 2: Forward voltage drop versus forward current.

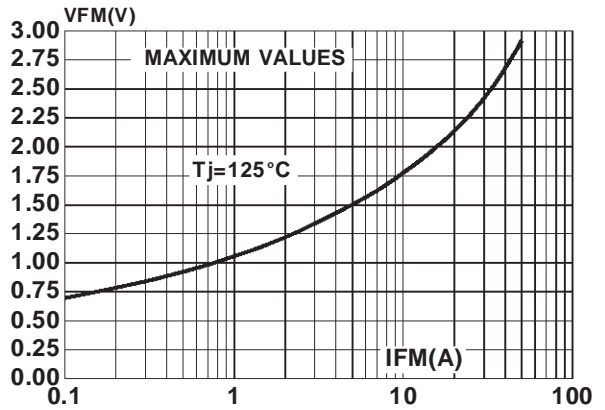


Fig. 3: Peak reverse recovery current versus  $di/dt$ .

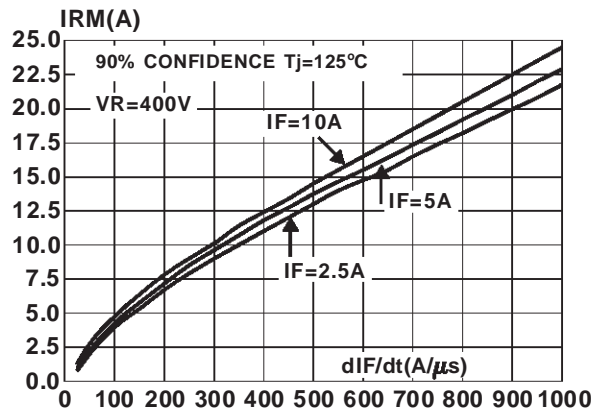


Fig. 4: Reverse recovery time versus  $di/dt$ .

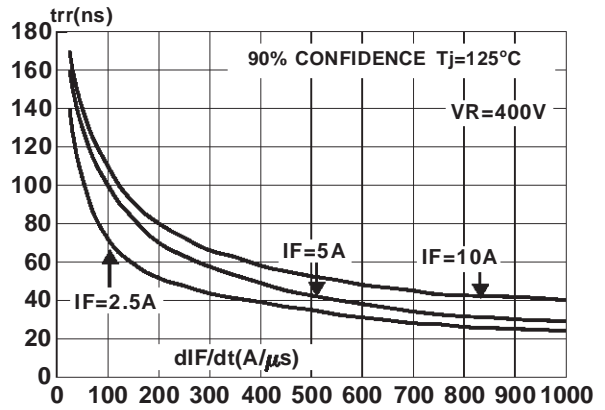


Fig. 5: Softness factor ( $t_b/t_a$ ) versus  $di/dt$ .

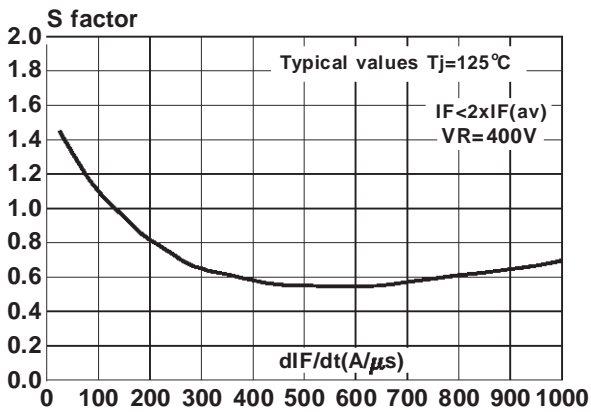


Fig. 6: Relative variation of dynamic parameters versus junction temperature (reference  $T_j = 125^\circ\text{C}$ ).

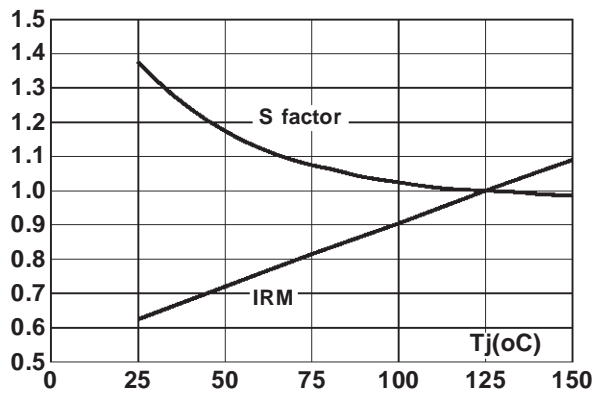


Fig. 7: Transient peak forward voltage versus  $di_F/dt$ .

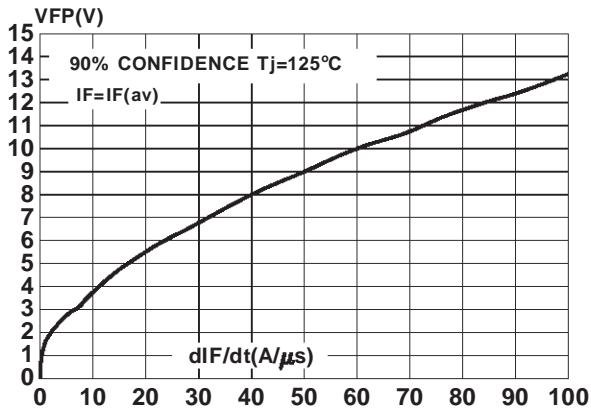


Fig. 8: Forward recovery time versus  $di_F/dt$ .

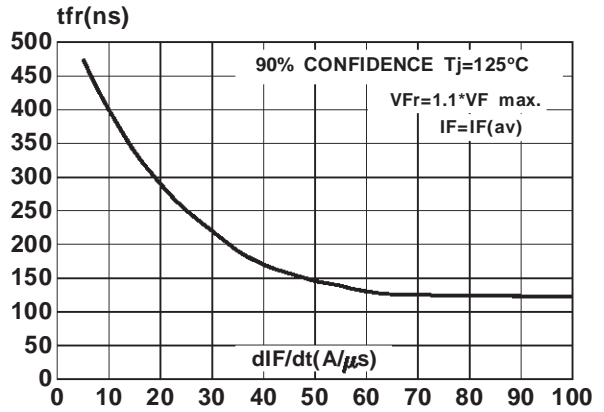


Fig. 9: Relative variation of thermal transient impedance junction to case versus pulse duration (TO-220AC and DPAK).

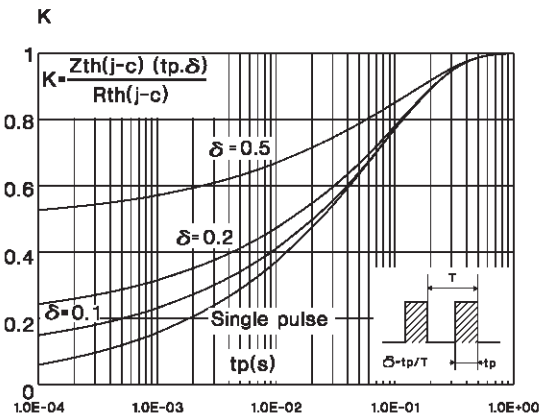
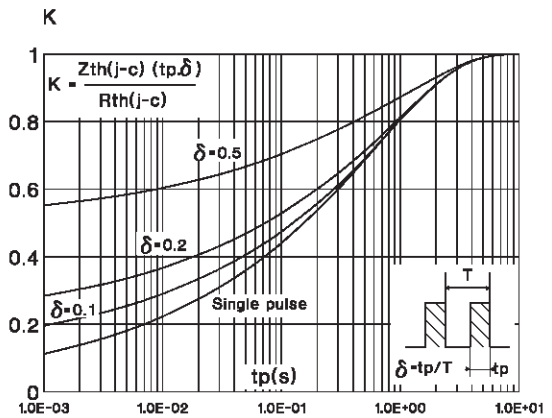


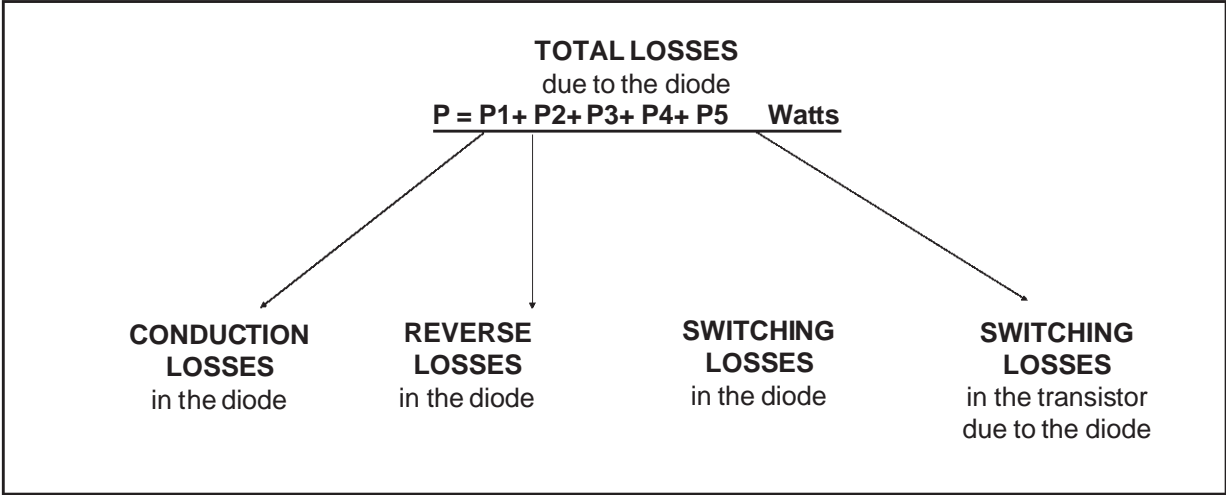
Fig. 10: Relative variation of thermal transient impedance junction to case versus pulse duration (ISOWATT220AC).



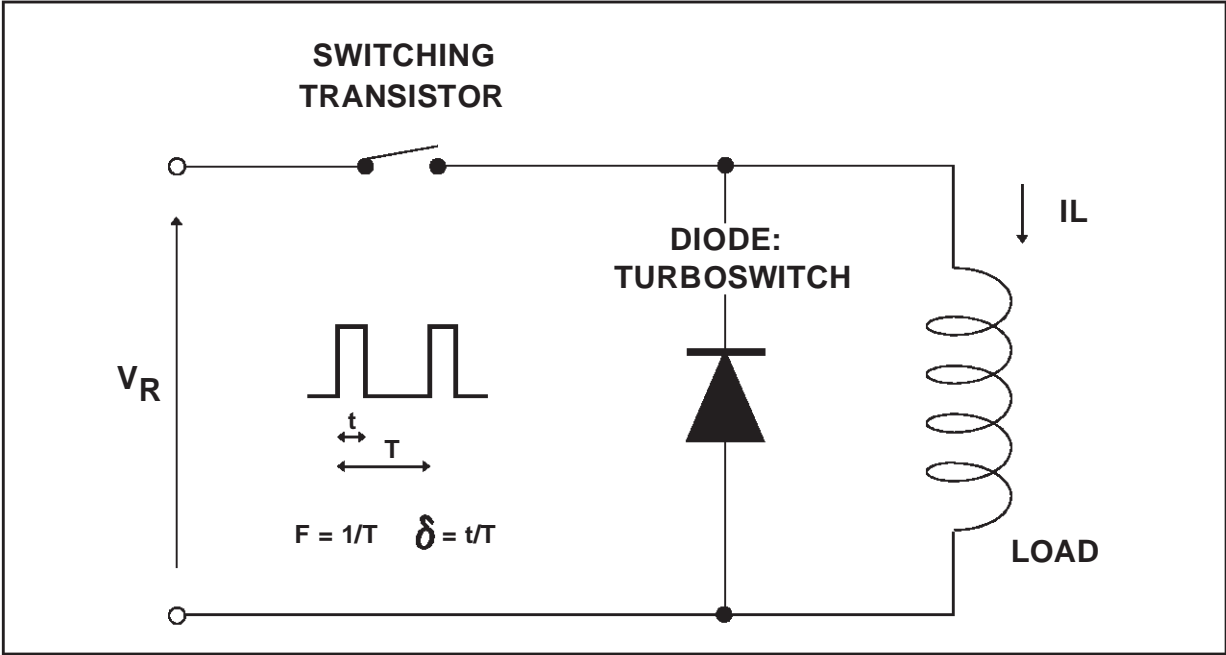
**APPLICATION DATA**

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:

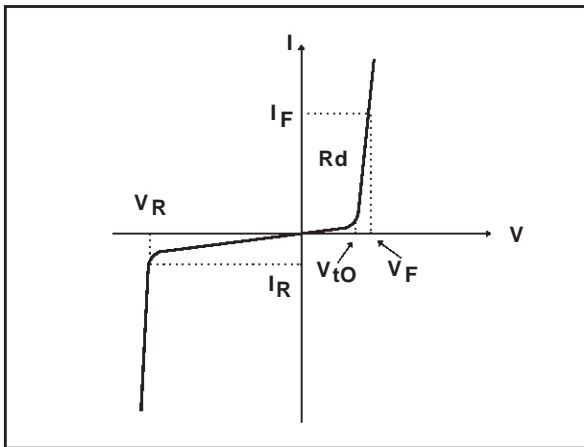


**Fig. A : "FREEWHEEL" MODE**



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



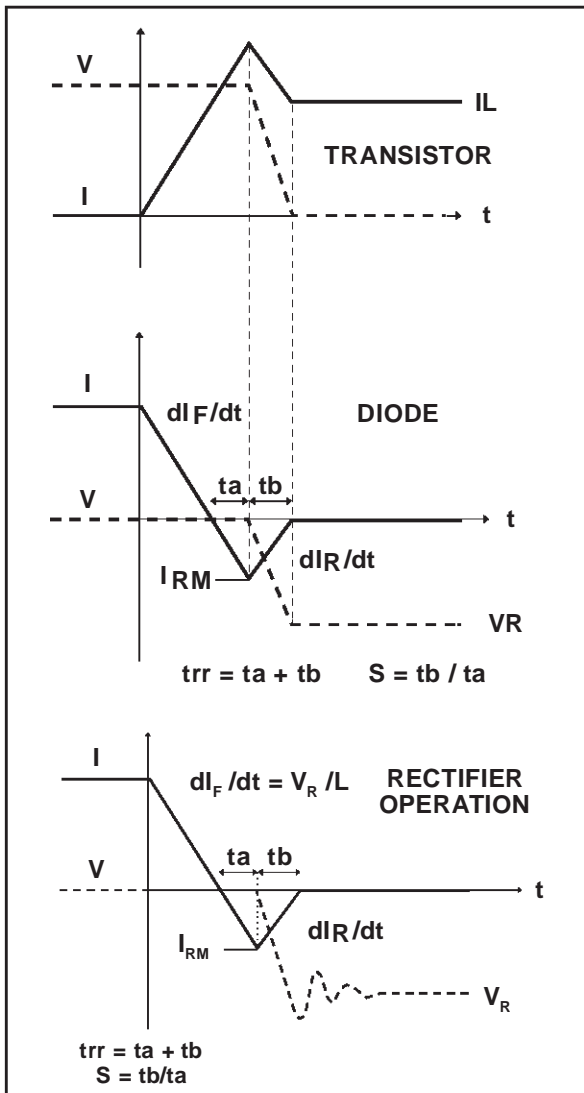
Conduction losses :

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

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)

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

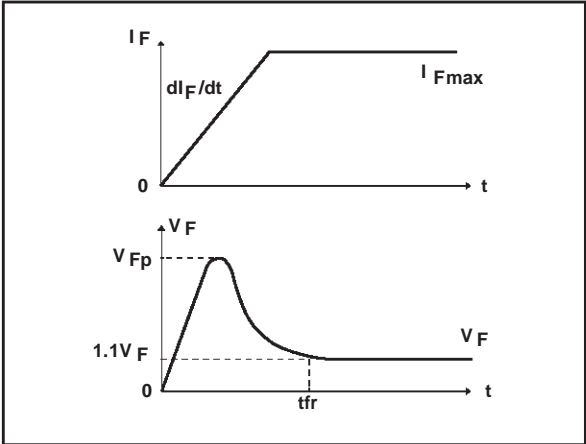
Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

APPLICATION DATA (Cont'd)

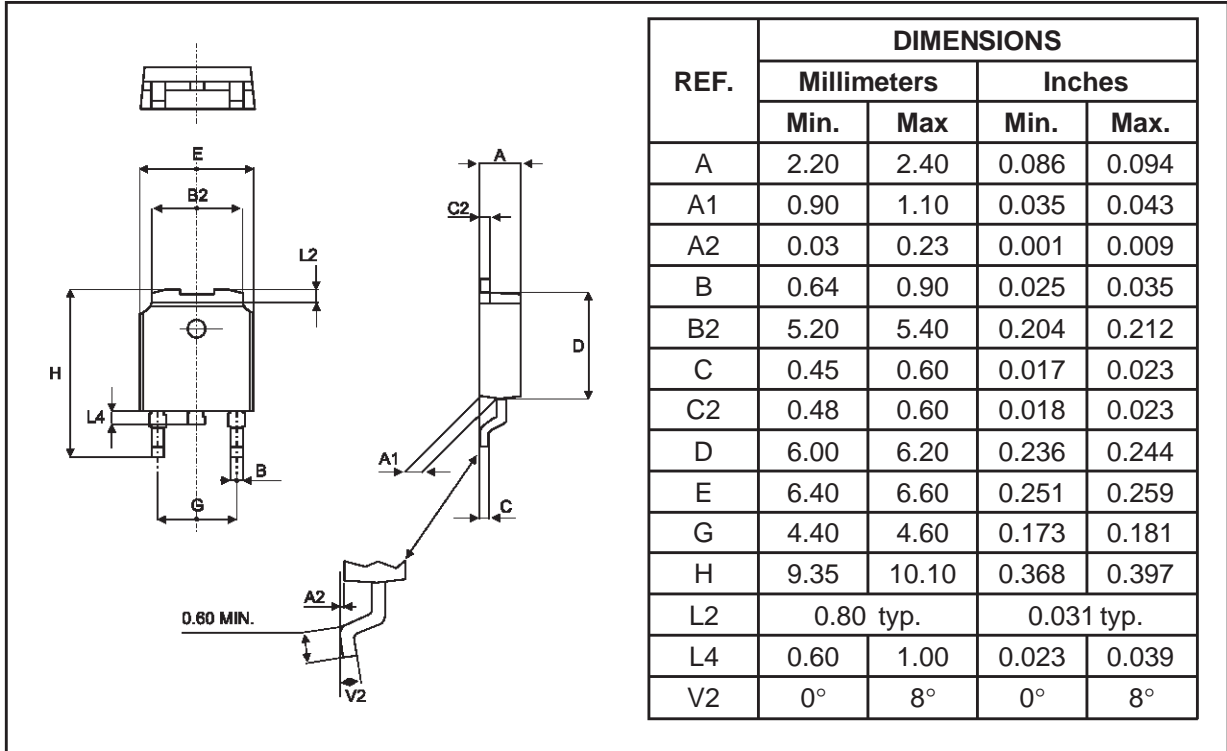
Fig. D : TURN-ON CHARACTERISTICS



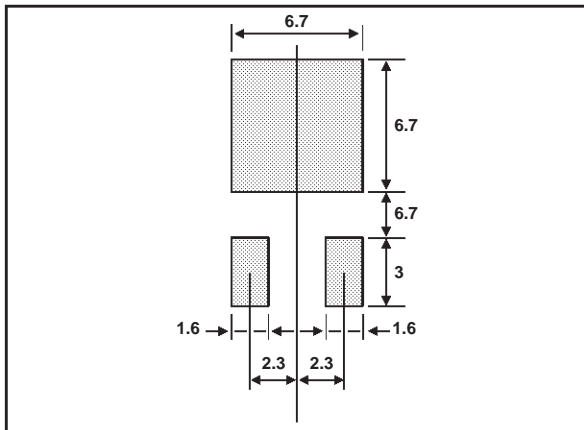
Turn-on losses :  
 $P4 = 0.4 (V_{FP} - V_F) \cdot I_{Fmax} \cdot t_{fr} \cdot F$

**STTA506D/F/B**

**PACKAGE MECHANICAL DATA**  
DPAK



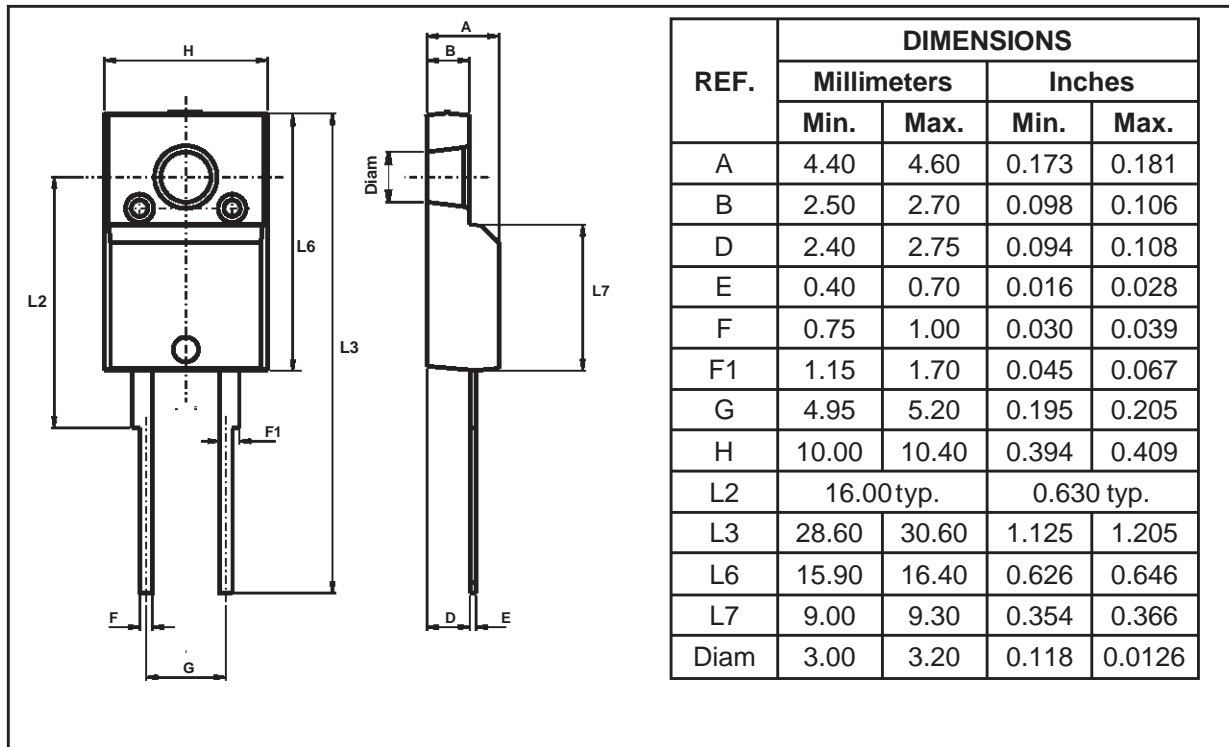
**FOOTPRINT DIMENSIONS** (in millimeters)



- Cooling method : by conduction (C)



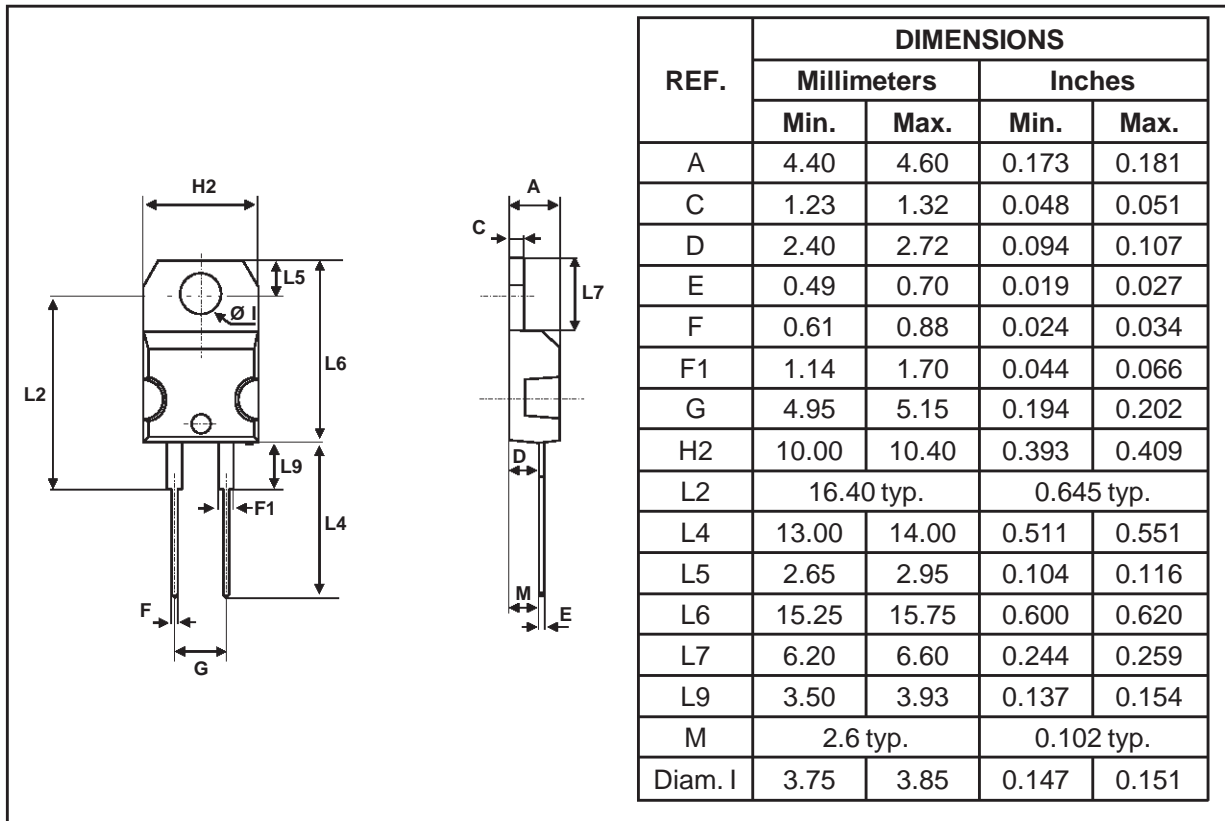
**PACKAGE MECHANICAL DATA**  
ISOWATT220AC



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

# STTA506D/F/B

## PACKAGE MECHANICAL DATA TO-220AC



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

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA506D	STTA506D	TO-220AC	1.86g	50	Tube
STTA506F	STTA506F	ISOWATT220AC	2g	50	Tube
STTA506B	STTA506B	DPAK	0.3g	75	Tube
STTA506B-TR	STTA506B	DPAK	0.3g	2500	Tape & reel

- Epoxy meets UL94,V0

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