

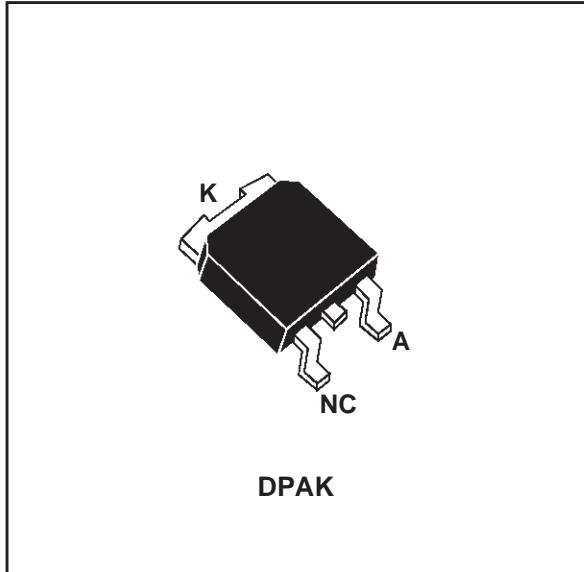
## TURBOSWITCH™ ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	3 A
$V_{RRM}$	600 V
$t_{rr} \text{ (typ)}$	20 ns
$V_F \text{ (max)}$	1.65 V

### FEATURES AND BENEFITS

- SPECIFICTO "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



### 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 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 surge reverse voltage		600	V
$I_{F(RMS)}$	RMS forward current		6	A
$I_{FRM}$	Repetitive peak forward current	tp=5 µs F=5 kHz square	20	A
$I_{FSM}$	Surge non repetitive forward current	tp=10 ms sinusoidal	35	A
$T_j$	Maximum operating junction temperature		125	°C
$T_{stg}$	Storage temperature range		- 65 to + 150	°C

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## STTA306B

### THERMAL AND POWER DATA

Symbol	Parameter	Tests conditions	Value	Unit
R <sub>th</sub> (j-c)	Junction to case		6	°C/W
P <sub>1</sub>	Conduction power dissipation	I <sub>F(AV)</sub> = 1.5A, δ = 0.5 T <sub>L</sub> = 110°C	2.5	W
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> )	T <sub>L</sub> = 108°C	2.8	W

### STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Tests conditions		Min.	Typ.	Max.	Unit
V <sub>F</sub> **	Forward voltage drop	T <sub>j</sub> = 25°C	I <sub>F</sub> = 3 A			1.85	V
		T <sub>j</sub> = 125°C	I <sub>F</sub> = 3 A		1.3	1.65	
I <sub>R</sub> *	Reverse leakage current	T <sub>j</sub> = 25°C	V <sub>R</sub> = 0.8 X V <sub>RRM</sub>			20	μA
		T <sub>j</sub> = 125°C			500	1200	
V <sub>to</sub>	Threshold voltage	I <sub>p</sub> < 3.I <sub>AV</sub>	T <sub>j</sub> = 125°C			1.15	V
r <sub>d</sub>	Dynamic resistance					175	mΩ

Test pulse : \* tp = 380 μs, δ cycle < 2%  
\*\* tp = 5 ms, δ cycle < 2%

To evaluate the maximum conduction losses use the following equation :  
 $P = V_{to} \times I_{F(AV)} + r_d \times I_{F}^2(\text{RMS})$

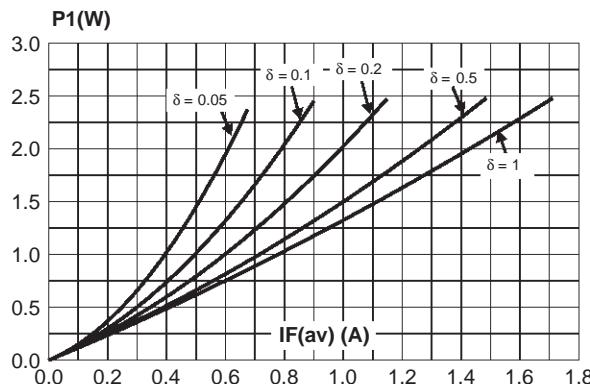
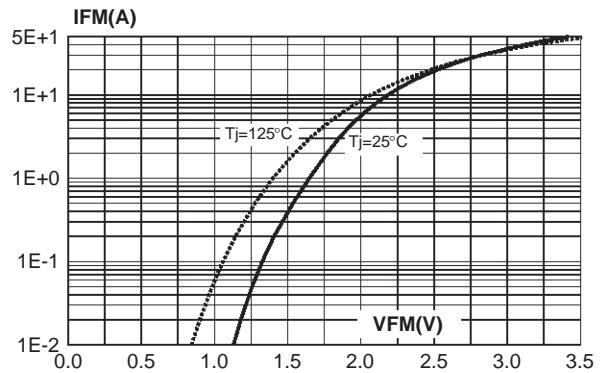
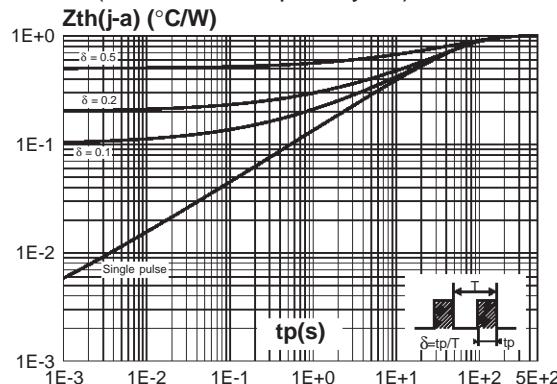
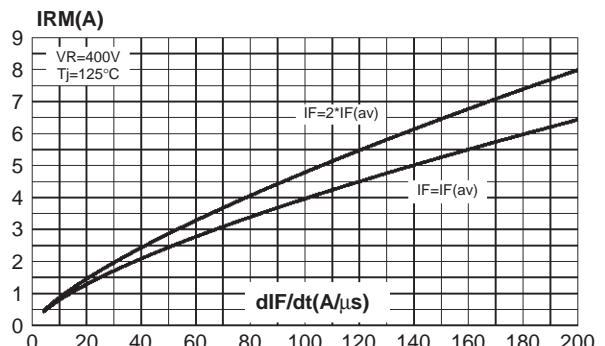
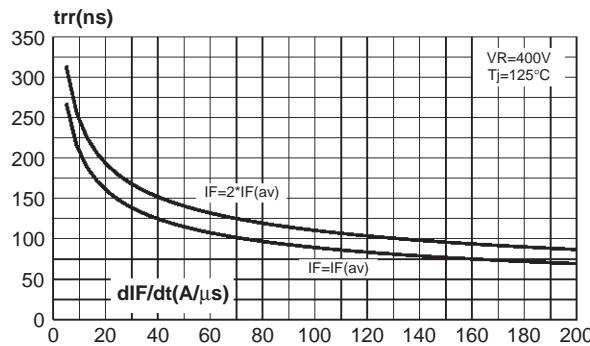
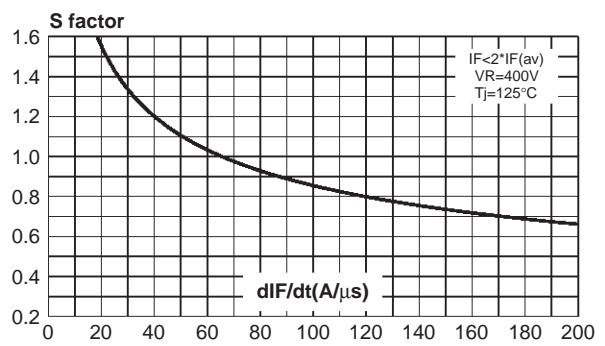
### DYNAMIC ELECTRICAL CHARACTERISTICS

#### TURN-OFF SWITCHING

Symbol	Parameter	Test conditions			Min.	Typ.	Max.	Unit
t <sub>rr</sub>		T <sub>j</sub> = 25°C	I <sub>F</sub> =0.5A I <sub>R</sub> =1A I <sub>rr</sub> =0.25A I <sub>F</sub> =1A 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	I <sub>F</sub> =3A V <sub>R</sub> =400V dI <sub>F</sub> /dt = -16A/μs dI <sub>F</sub> /dt = -50A/μs		2.0	1.2		A
S factor	Softness factor	T <sub>j</sub> = 125°C	V <sub>R</sub> =400V I <sub>F</sub> =3A dI <sub>F</sub> /dt = -50A/μs		1.1			-

#### TURN-ON SWITCHING

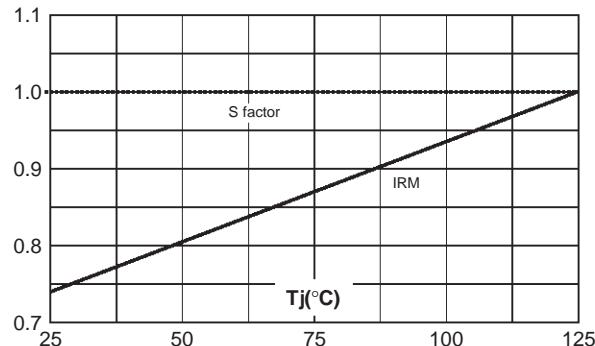
Symbol	Parameter	Test conditions			Min.	Typ.	Max.	Unit
t <sub>fr</sub>	Forward recovery time	T <sub>j</sub> = 25°C	I <sub>F</sub> =3A dI <sub>F</sub> /dt = 16A/μs Measured at 1.1 x V <sub>Fmax</sub>			500		ns
V <sub>FP</sub>	Peak forward voltage	T <sub>j</sub> = 25°C	I <sub>F</sub> =2A dI <sub>F</sub> /dt = 16A/μs			10		V

**Fig. 1:** Conduction losses versus average current.**Fig. 2:** Forward voltage drop versus forward current (maximum values).**Fig. 3:** Relative variation of thermal transient impedance junction to ambient versus pulse duration (recommended pad layout).**Fig. 4:** Peak reverse recovery current versus dIF/dt(90% confidence).**Fig. 5:** Reverse recovery time versus dIF/dt (90% confidence).**Fig. 6:** Softness factor (tb/ta) versus dIF/dt (typical values).

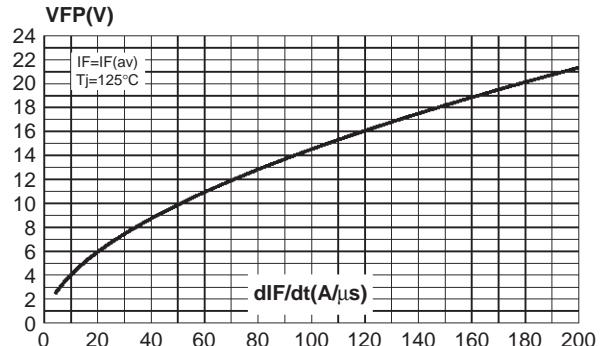
## STTA306B

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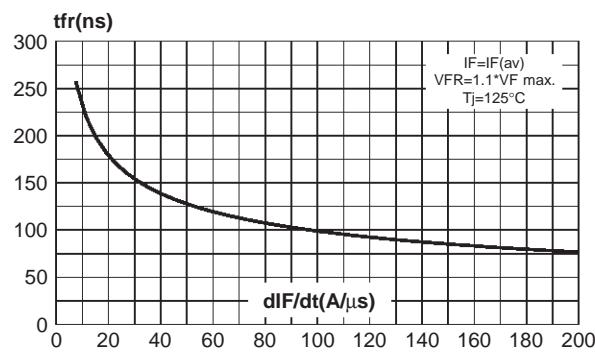
**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (reference  $T_j=125^\circ\text{C}$ ).



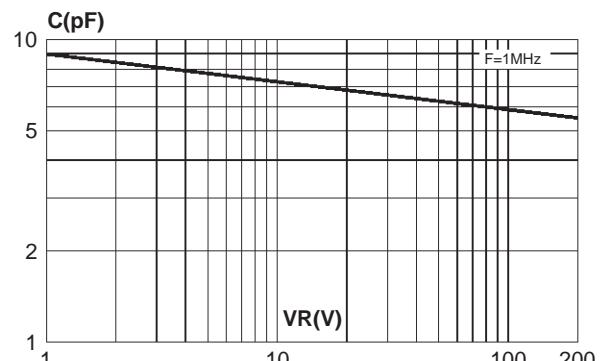
**Fig. 8:** Transient peak forward voltage versus  $dIF/dt$  (90% confidence).



**Fig. 9:** Forward recovery time versus  $dIF/dt$  (90% confidence).



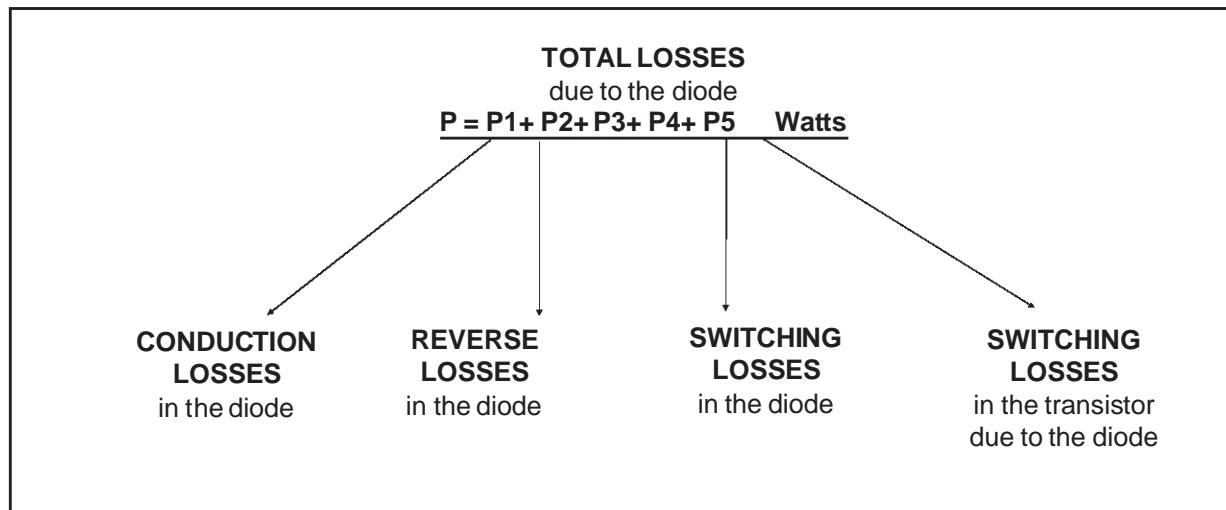
**Fig. 10:** Junction capacitance versus reverse voltage applied (typical values).



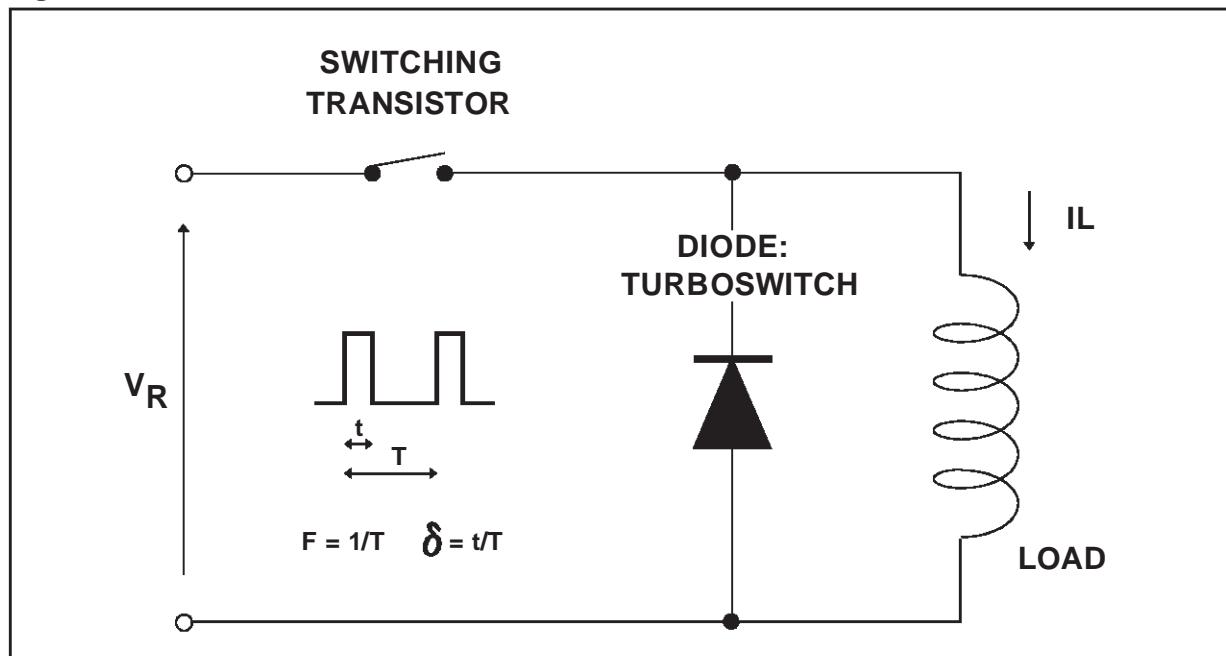
**APPLICATION DATA**

The TURBOSWITCH™ is especially designed to provide the lowest overall power losses in any "Freewheel Mode" application (see 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:

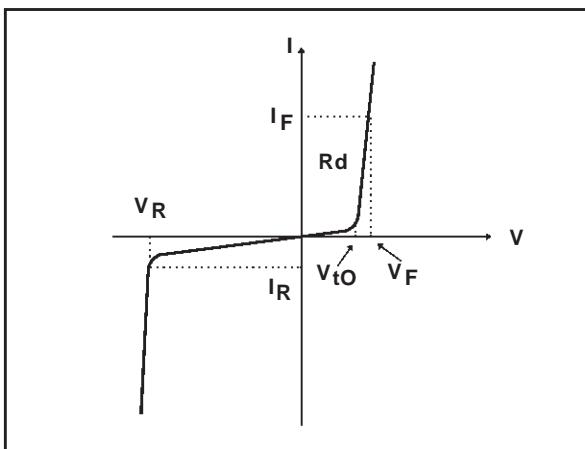


**Fig. A : "FREEWHEEL" MODE**



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



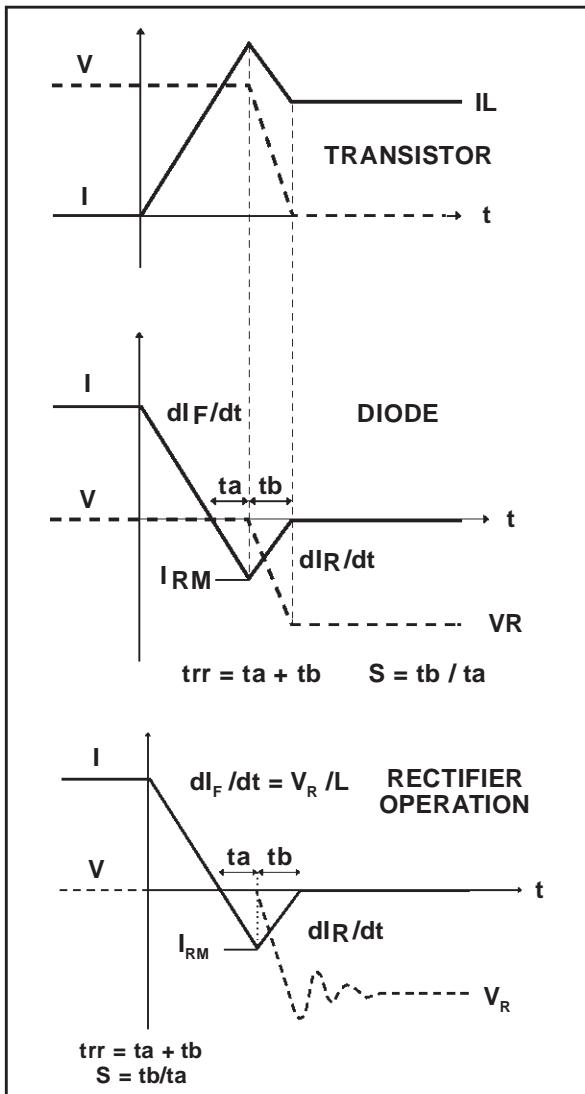
**Conduction losses :**

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

**Reverse losses :**

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

Fig. C : TURN-OFF CHARACTERISTICS



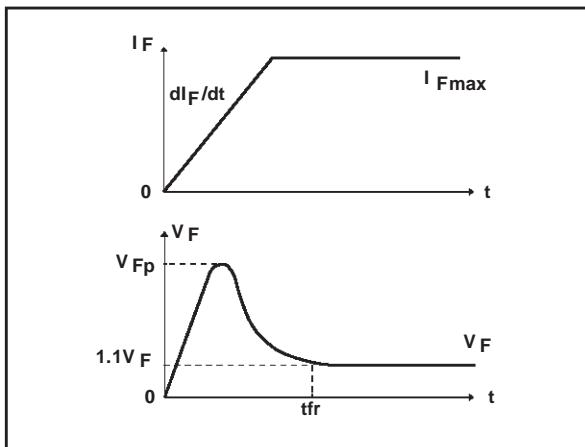
**Turn-on losses :**  
(in the transistor, due to the diode)

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

**Turn-off losses (in the diode) :**

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

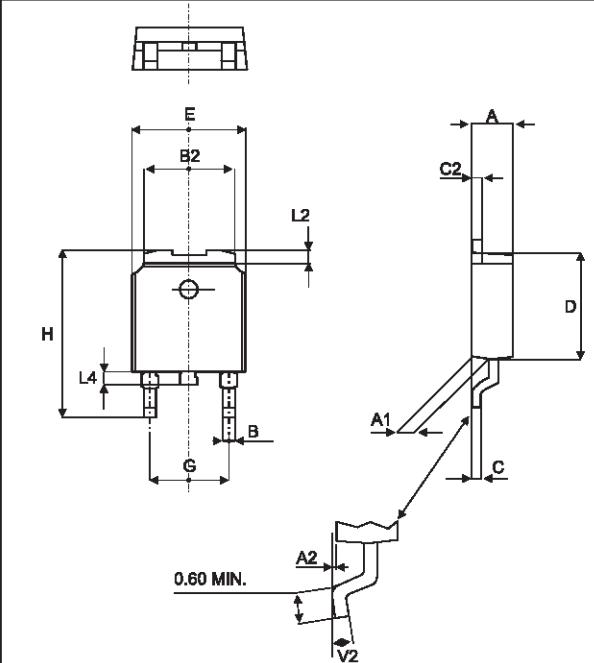
P3 and P5 are suitable for power MOSFET and IGBT

**APPLICATION DATA (Cont'd)****Fig. D : TURN-ON CHARACTERISTICS****Turn-on losses:**

$$P_4 = 0.4 (V_{FP} - V_F) \times I_{F\max} \times t_{fr} \times F$$

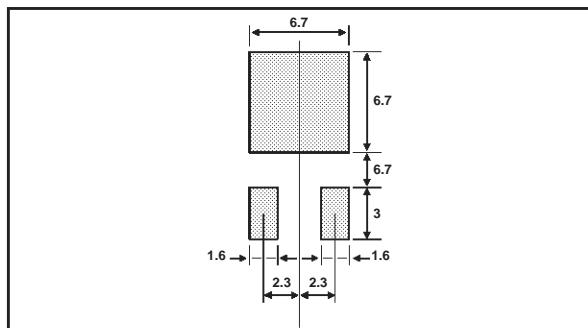
## STTA306B

### PACKAGE MECHANICAL DATA DPAK



REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.40	0.086	0.094
A1	0.90	1.10	0.035	0.043
A2	0.03	0.23	0.001	0.009
B	0.64	0.90	0.025	0.035
B2	5.20	5.40	0.204	0.212
C	0.45	0.60	0.017	0.023
C2	0.48	0.60	0.018	0.023
D	6.00	6.20	0.236	0.244
E	6.40	6.60	0.251	0.259
G	4.40	4.60	0.173	0.181
H	9.35	10.10	0.368	0.397
L2	0.80 typ.		0.031 typ.	
L4	0.60	1.00	0.023	0.039
V2	0°	8°	0°	8°

### FOOTPRINT DIMENSIONS (in millimeters)



Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA306B	A306	DPAK	0.3g	75	Tube
STTA306B-TR	A306	DPAK	0.3g	2500	Tape & reel

■ Epoxy meets UL94,V0

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