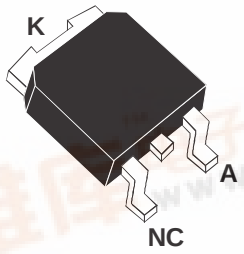
STTA306B

TURBOSWITCH™ ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

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



DPAK

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.

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes. TURBOSWITCH family drastically cuts losses in both the diode and the associated switching IGBT or MOSFET in all freewheel mode operations and is particulary 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
$I_{F(RMS)}$	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
Tj	Maximum operating junction temperature		125	°C
T_{stg}	Storage temperature range		- 65 to + 150	°C

TM : TURBOSWITCH is a trademark from STMicroelectronics

THERMAL AND POWER DATA

Symbol	Parameter	Tests conditions	Value	Unit
$R_{th\ (j-c)}$	Junction to case		6	°C/W
P_1	Conduction power dissipation	$I_{F(AV)}$ = 1.5A, δ = 0.5 T_c = 110°C	2.5	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3$ (P_3 = 10% P_1)	T_c = 108°C	2.8	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Tests conditions		Min.	Typ.	Max.	Unit
V_F **	Forward voltage drop	Tj = 25°C	I_F = 3 A			1.85	V
		Tj = 125°C	I_F = 3 A		1.3	1.65	
I_R *	Reverse leakage current	Tj = 25°C	V_R = 0.8 X V_{RRM}			20	µA
		Tj = 125°C			500	1200	
V_{to}	Threshold voltage	Ip < 3.$I_{F(AV)}$	Tj = 125°C			1.15	V
Rd	Dynamic resistance					175	mΩ

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

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

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}		Tj = 25°C	I_F=0.5A I_R=1A I_{rr}=0.25A I_F=1A dI_F/dt= -50A/µs V_R=30V		20	50	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C	I_F=3A V_R=400V dI_F/dt = -16A/µs dI_F/dt = -50A/µs		2.0	1.2	A
S factor	Softness factor	Tj = 125°C	V_R=400V I_F=3A dI_F/dt = -50A/µs		1.1		-

TURN-ON SWITCHING

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{fr}	Forward recovery time	Tj = 25°C	I_F=3A dI_F/dt = 16A/µs Measured at 1.1 x V_{Fmax}			500	ns
V_{FP}	Peak forward voltage	Tj = 25°C	I_F=2A dI_F/dt = 16A/µs			10	V

Fig. 1: Conduction losses versus average current.

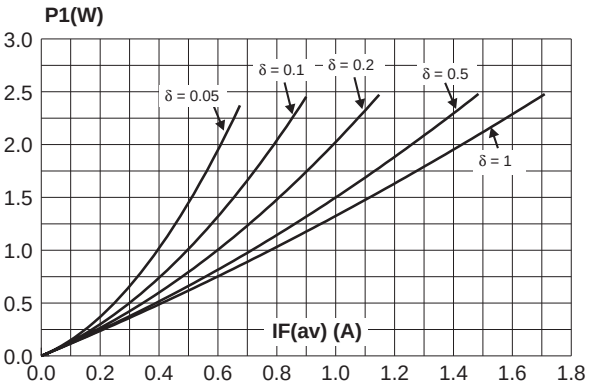


Fig. 2: Forward voltage drop versus forward current (maximum values).

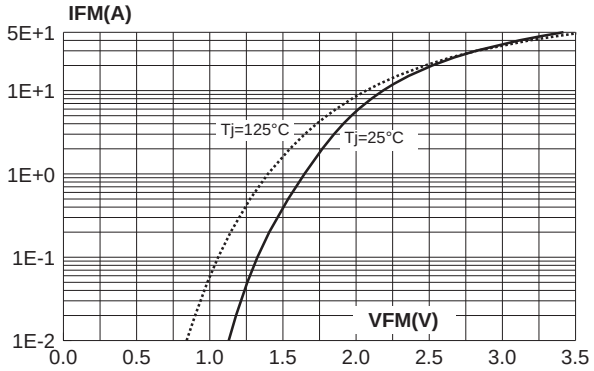


Fig. 3: Relative variation of thermal transient impedance junction to ambient versus pulse duration (recommended pad layout).

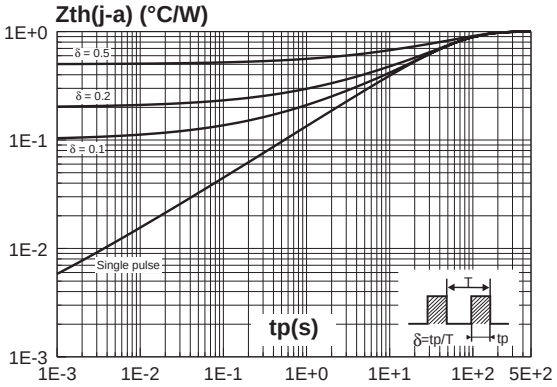


Fig. 4: Peak reverse recovery current versus dI_F/dt (90% confidence).

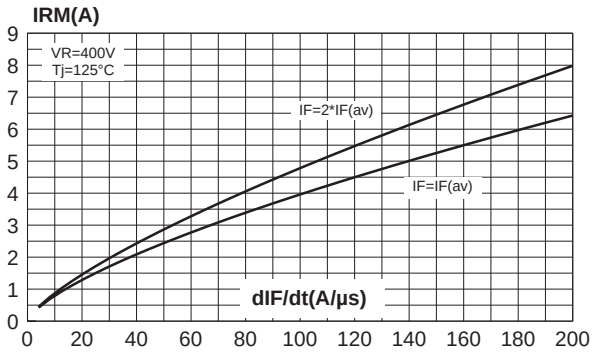


Fig. 5: Reverse recovery time versus dI_F/dt (90% confidence).

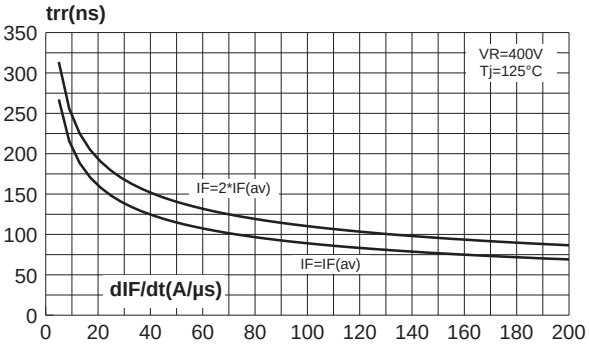


Fig. 6: Softness factor (tb/ta) versus dI_F/dt (typical values).

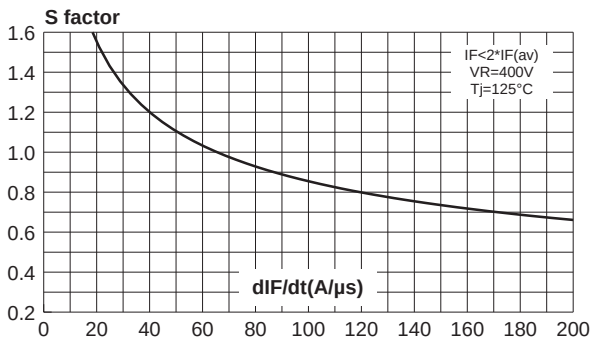


Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

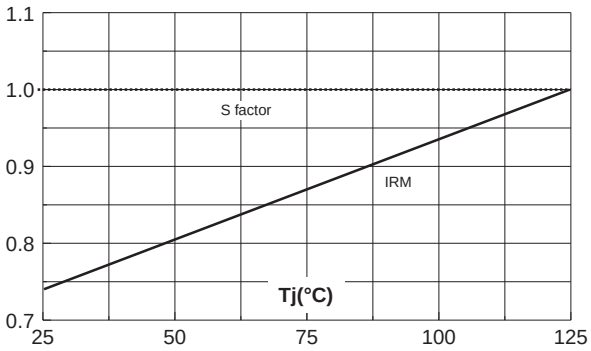


Fig. 8: Transient peak forward voltage versus dI_F/dt (90% confidence).

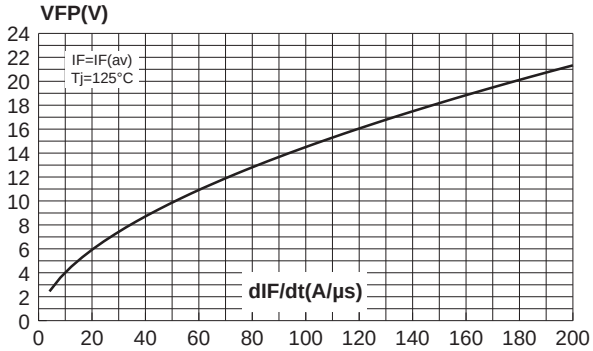


Fig. 9: Forward recovery time versus dI_F/dt (90% confidence).

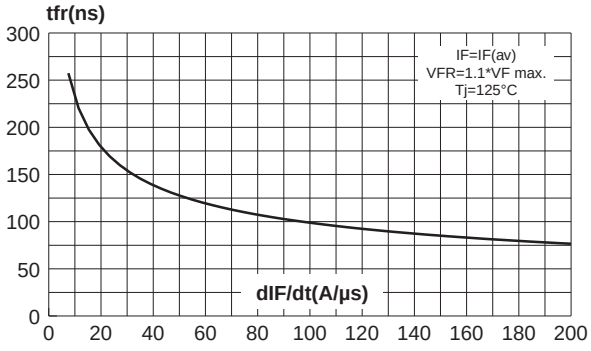
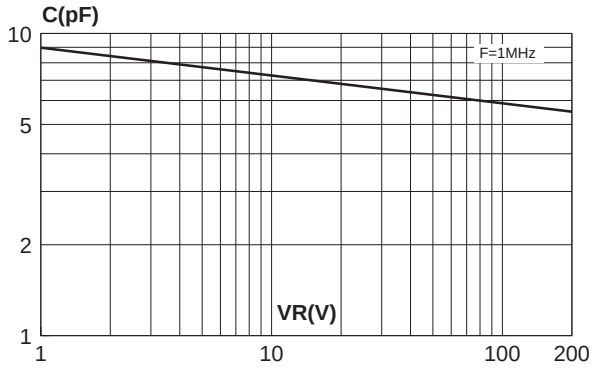


Fig. 10: Junction capacitance versus reverse voltage applied (typical values).



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 :

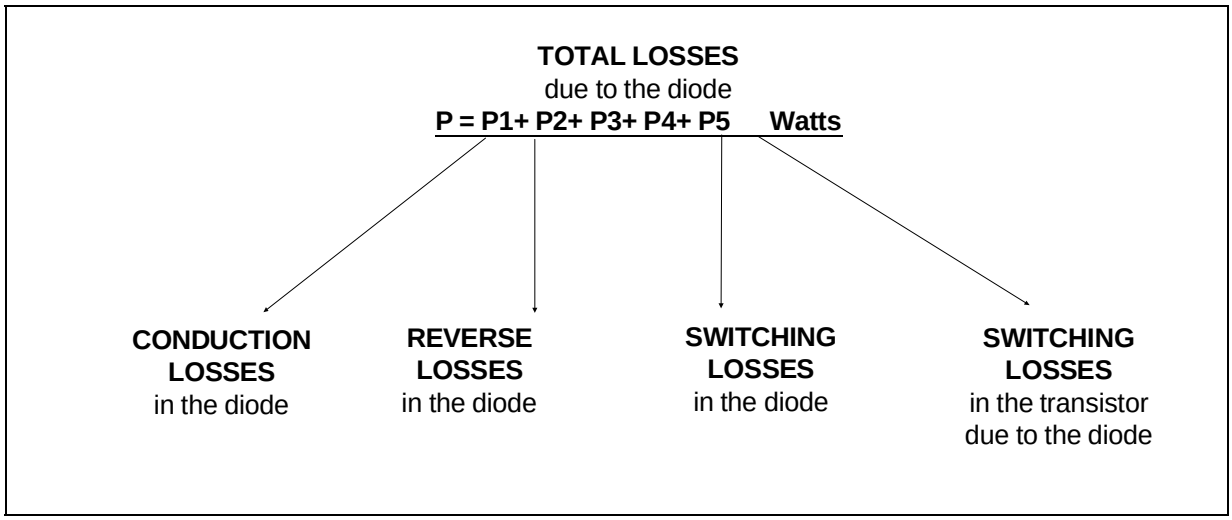
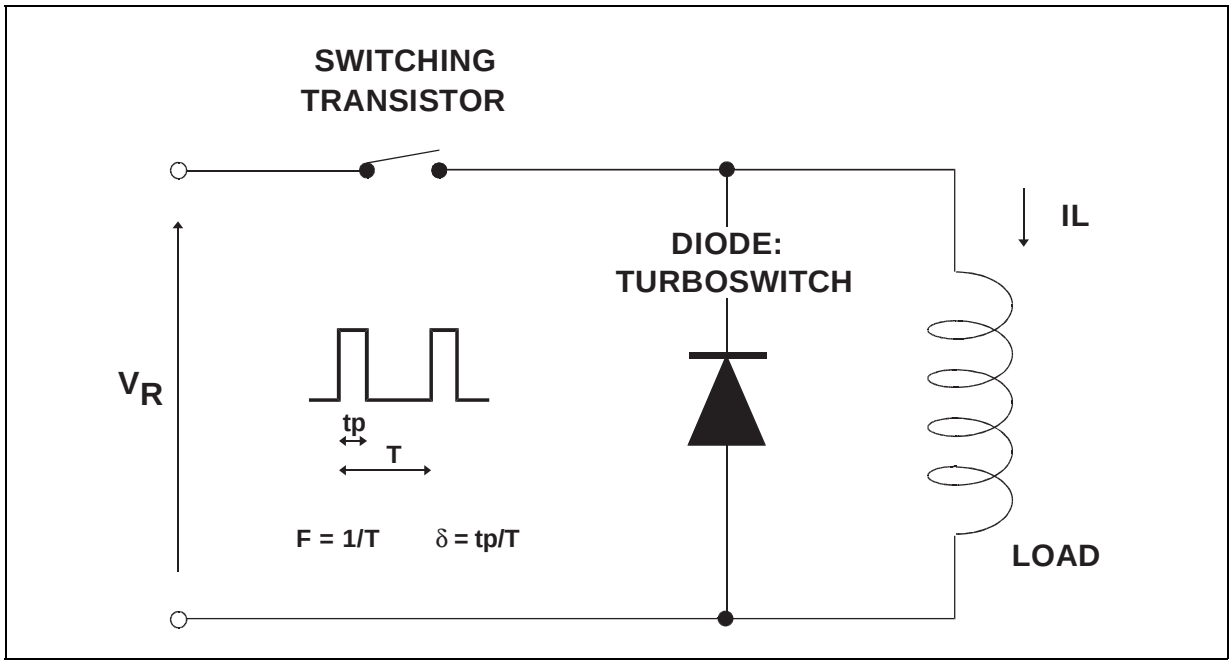
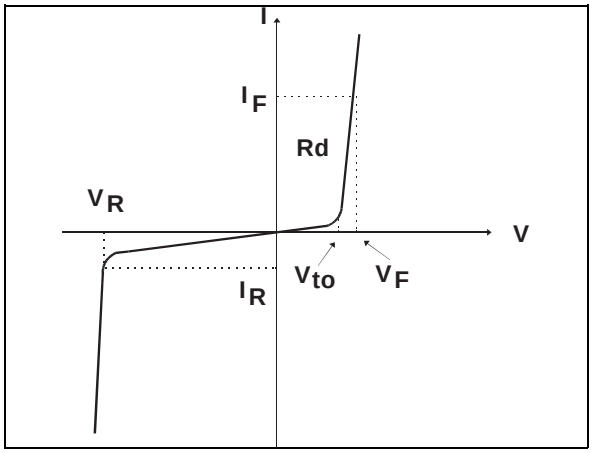


Fig. A : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



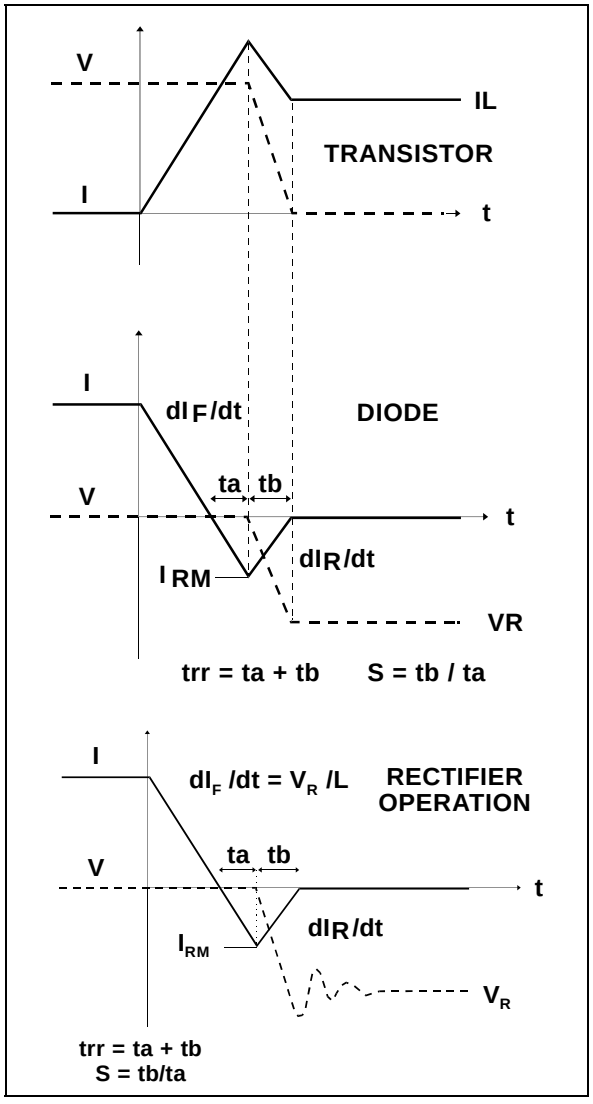
Conduction losses :

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

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)

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

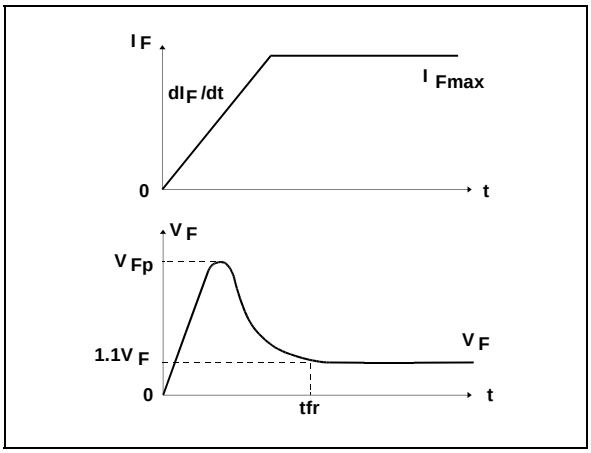
Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

APPLICATION DATA (Cont'd)

Fig. D : TURN-ON CHARACTERISTICS

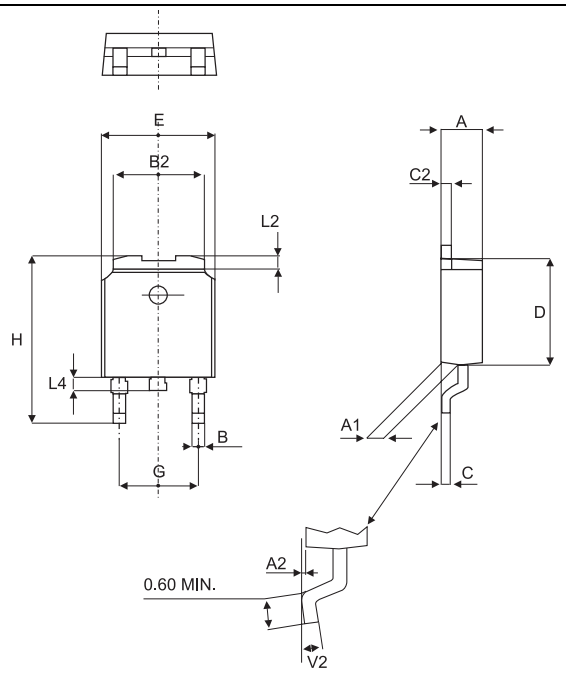


Turn-on losses :

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

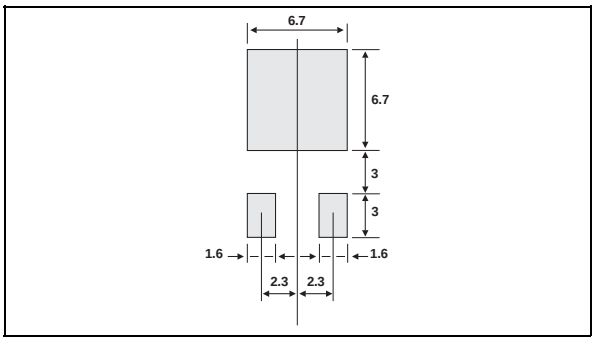
PACKAGE MECHANICAL DATA

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	0.3 g.	75	Tube
STTA306B-TR	A306	DPAK	0.3 g.	2500	Tape & reel

- Epoxy meets UL94,V0