STTA206S

TURBOSWITCH ™ "A". ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCTS CHARACTERISTICS

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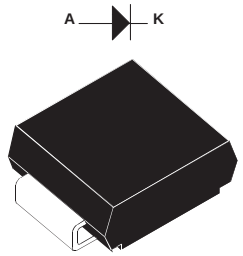
$I_{F(AV)}$	**2A**
V_{RRM}	**600V**
t_{rr} (typ)	**20ns**
V_F (max)	**1.5V**



SMC

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
- SURFACE MOUNT DEVICE

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.
TURBOSWITCH "A" 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 SMC surface mount envelope, these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE MAXIMUM RATINGS

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	8	A
I_{FRM}	Repetitive peak forward current (tp = 5 µs, f = 5kHz)	50	A
T_j	Maximum operating junction temperature	125	°C
T_{stg}	Storage temperature range	- 65 to + 150	°C

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THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-l)}$	Junction to lead		21	°C/W
P_1	Conduction power dissipation (see fig. 2)	$I_{F(AV)}$ = 1.5A δ = 0.5 Tlead= 72°C	2.5	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 67°C	2.8	W

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STATIC ELECTRICAL CHARACTERISTICS (see Fig. 2)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F = 2A	Tj = 25°C Tj = 125°C		 1.1	1.75 1.5	V
I_R **	Reverse leakage current	V_R = 0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 400	20 1200	µA

Test pulses widths : * tp = 380 µs, duty cycle < 2%
** tp = 5 ms , duty cycle < 2%

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see Fig. 3)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	Tj = 25°C I_F = 0.5 A I_R = 1A Irr = 0.25A I_F = 1 A dI_F/dt =-50A/µs V_R = 30V		20	 50	ns
I_{RM}	Maximum recovery current	Tj = 125°C VR = 400V I_F = 2A dI_F/dt = -16 A/µs dI_F/dt = -50 A/µs		 2.0	1.2	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F = 2A dI_F/dt = -50 A/µs		TBD		-

TURN-ON SWITCHING (see Fig.8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F = 1 A dI_F/dt = 8 A/µs measured at, 1.1 × V_F max			500	ns
V_{Fp}	Peak forward voltage				10	V

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APPLICATION DATA

The TURBOSWITCH^{TM} "A" is especially designed to provide the lowest overall power losses in any "Freewheel Mode" application (see fig. 1) 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 :

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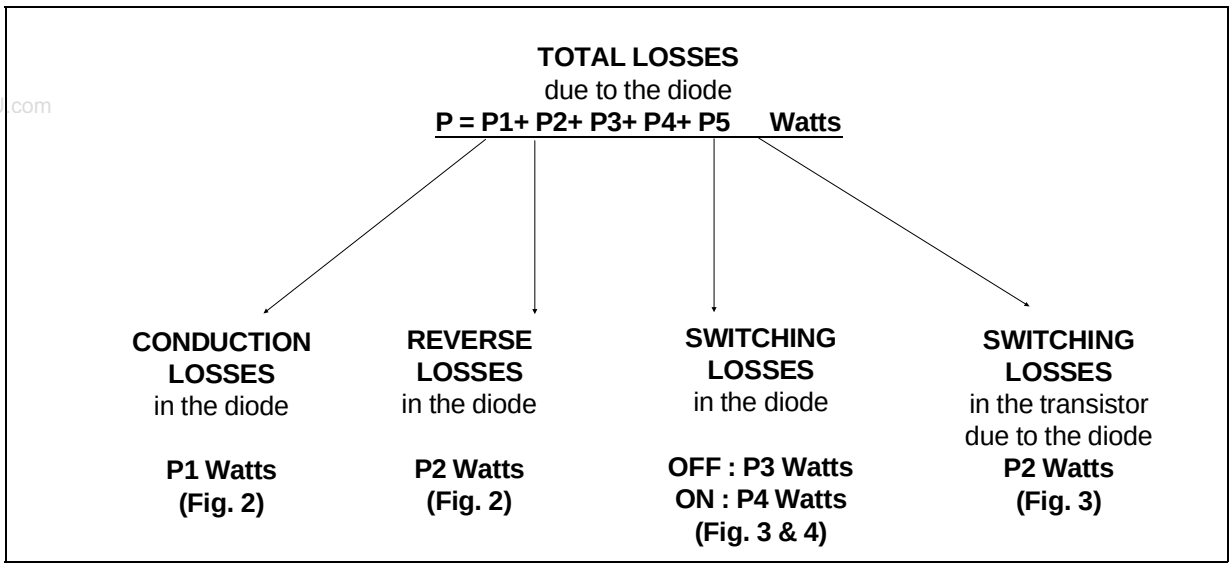
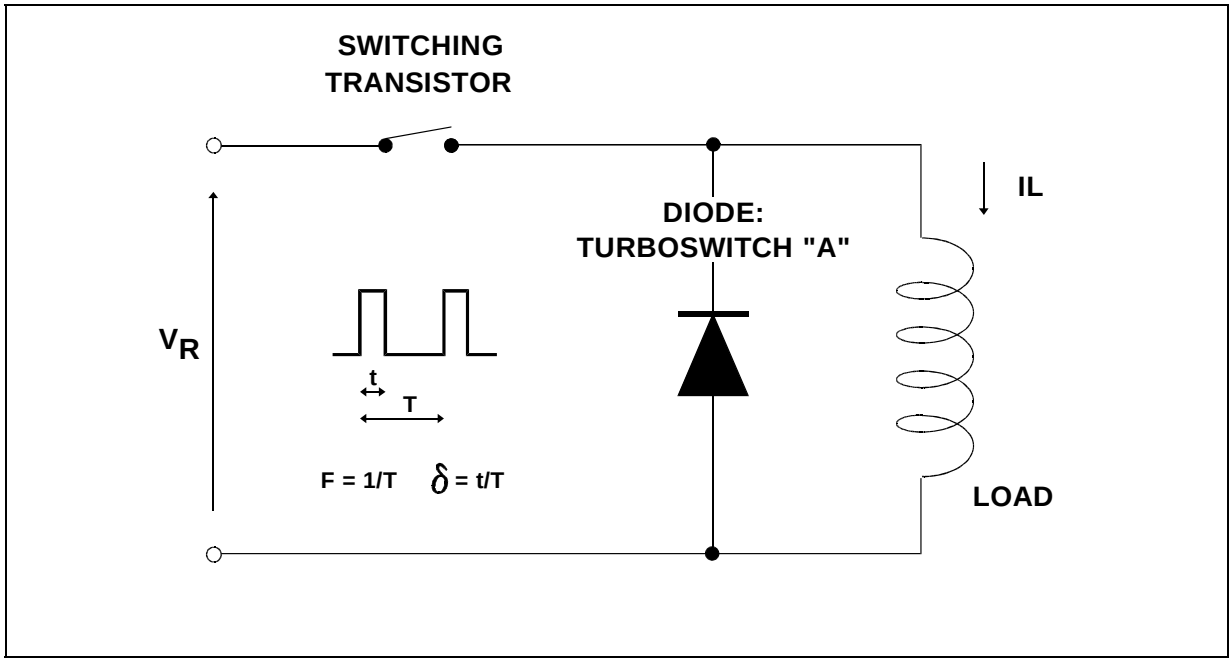


Fig. 1 : "FREEWHEEL" MODE



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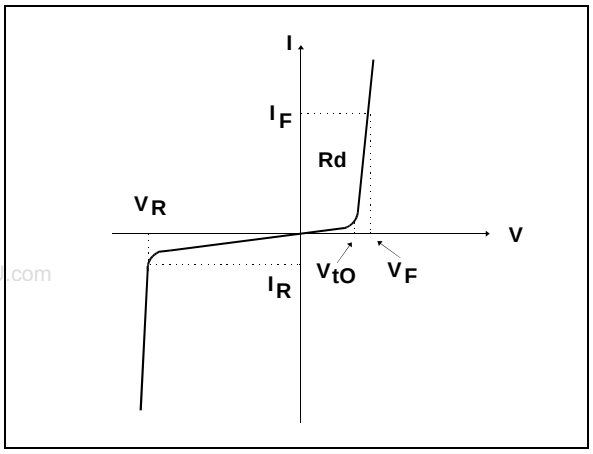
APPLICATION DATA (Cont'd)

Fig. 2 : STATIC CHARACTERISTICS



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Conduction losses :

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

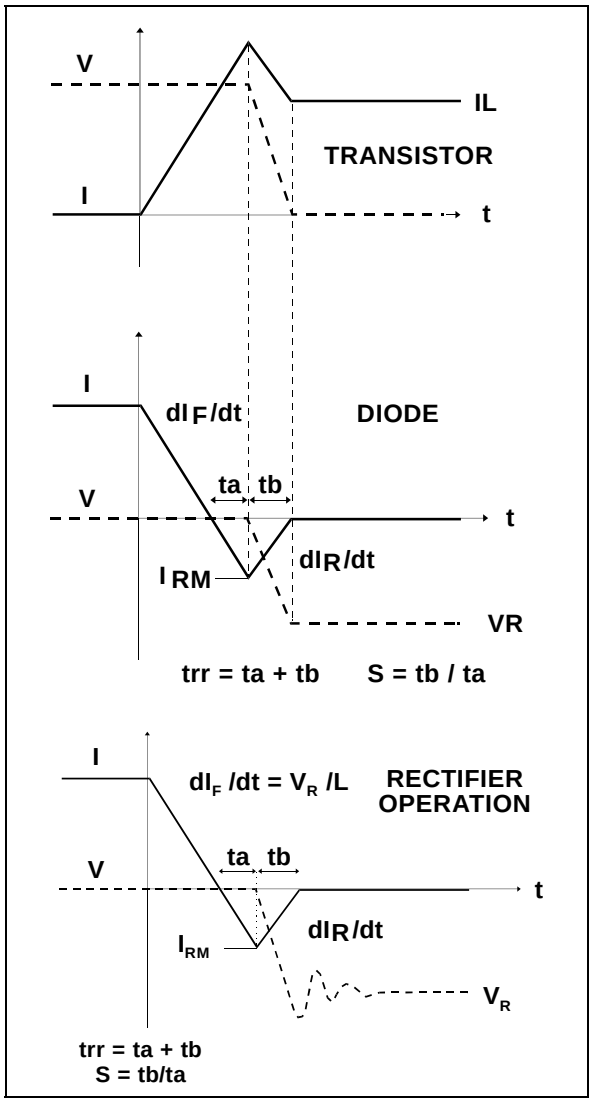
with

$V_{t0} = 1.15$ V
$R_d = 0.175$ Ohm
(Max values at 125°C)

Reverse losses :

$P2 = V_R \times I_{R \times (1 - \delta)}$

Fig. 3 : 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

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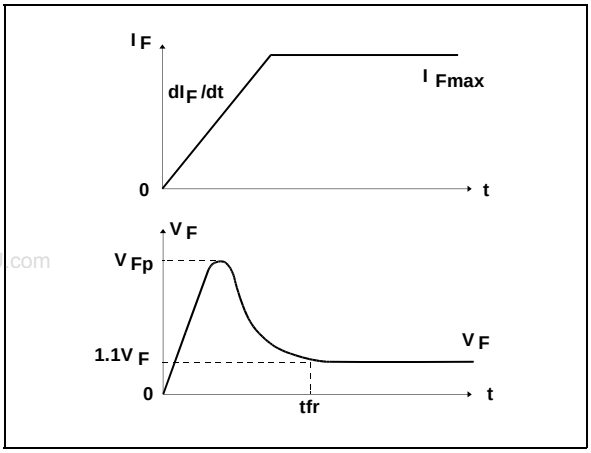
APPLICATION DATA (Cont'd)

Fig. 4 : TURN-ON CHARACTERISTICS



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Ratings and characteristics curves are ON GOING.

Turn-on losses :

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

Fig. 5: Conduction losses versus average current.

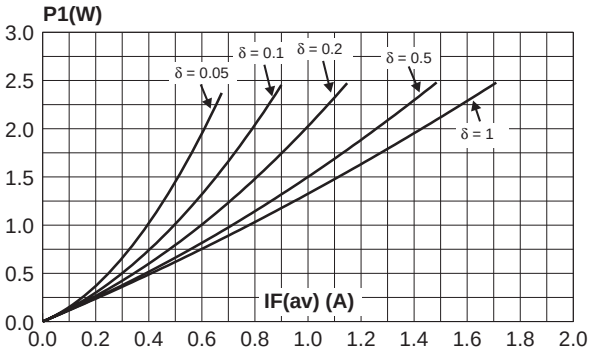

Fig. 6: Switching OFF losses versus dIF/dt.

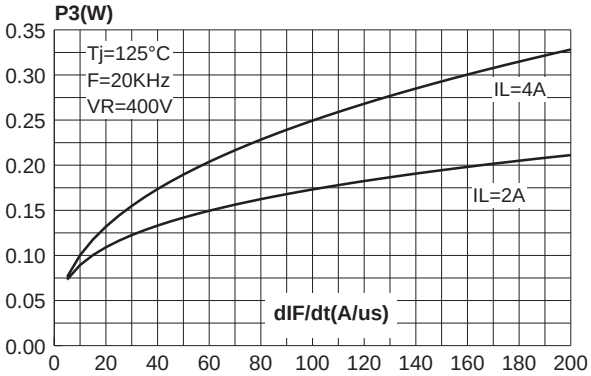

Fig. 7: Switching ON losses versus dIF/dt.

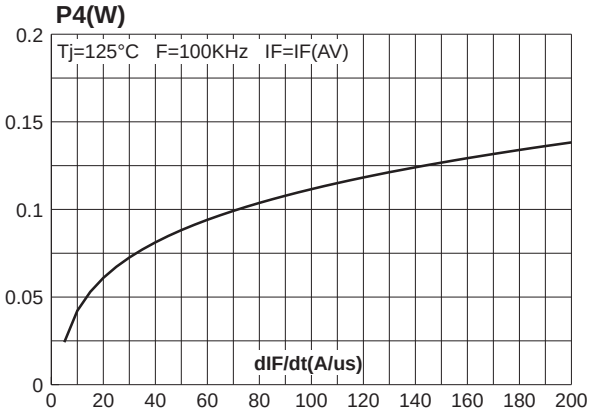

Fig. 8: Switching losses in transistor due to the diode.

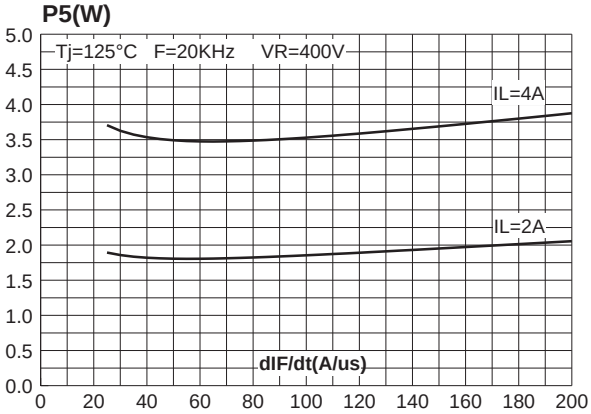

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Fig. 9: Forward voltage drop versus forward current (maximum values).

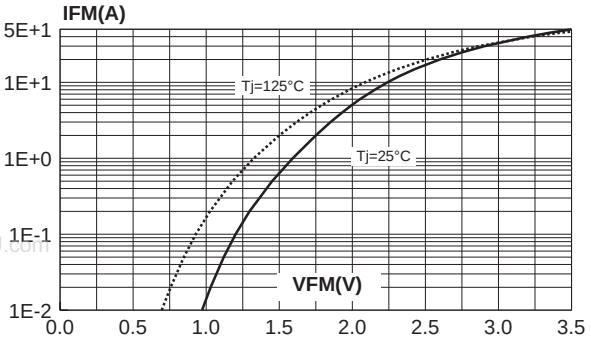

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Fig. 10: Relative variation of thermal impedance junction to ambient versus pulse duration (recommended pad layout).

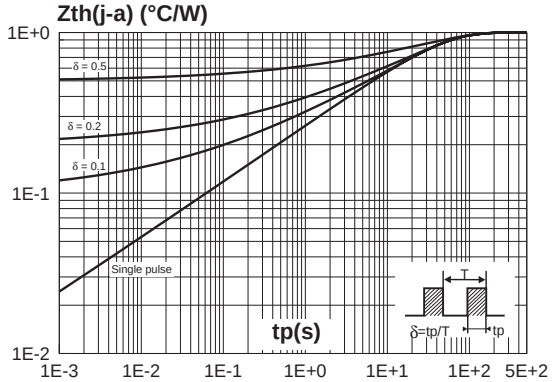

Fig. 11: Peak reverse recovery current versus dIF/dt (90% confidence).

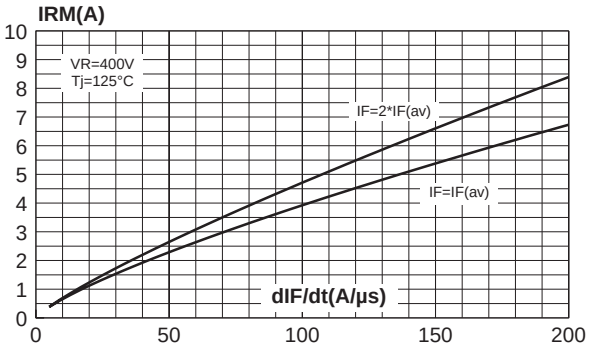

Fig. 12: Reverse recovery time versus dIF/dt (90% confidence).

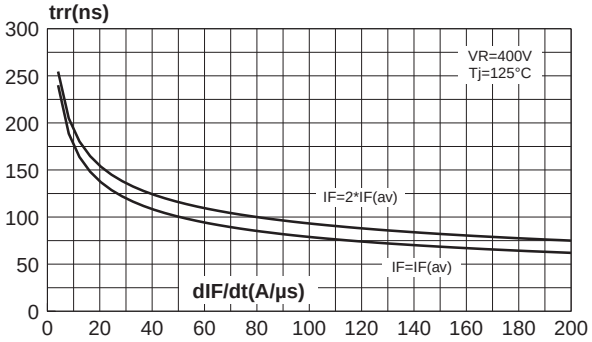

Fig. 13: Softness factor (tb/ta) versus dIF/dt (typical values).

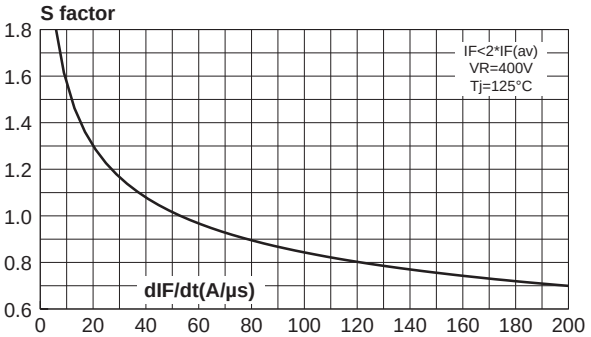

Fig. 14: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

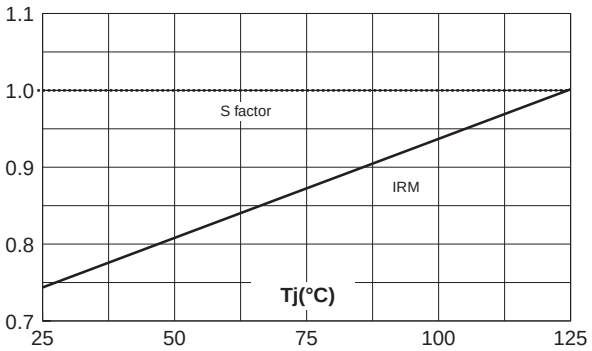

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Fig. 15: Transient peak forward voltage versus dIF/dt (90% confidence).

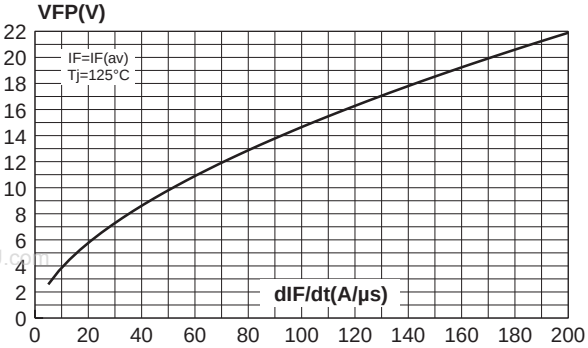

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Fig. 16: Forward recovery time versus dIF/dt (90% confidence).

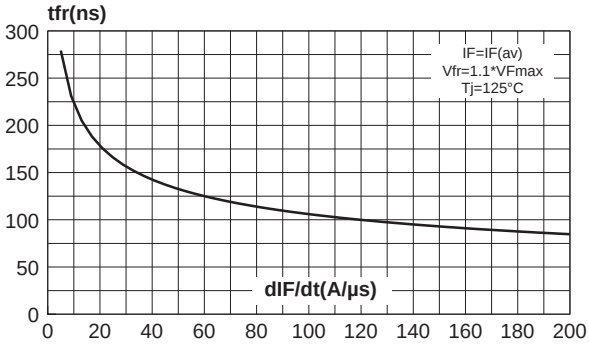
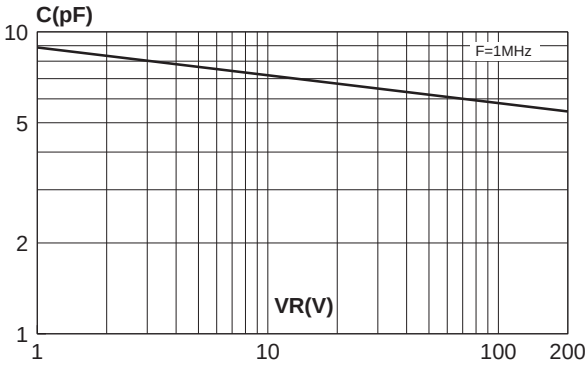


Fig. 17: Junction capacitance versus reverse voltage applied (typical values).



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PACKAGE MECHANICAL DATA
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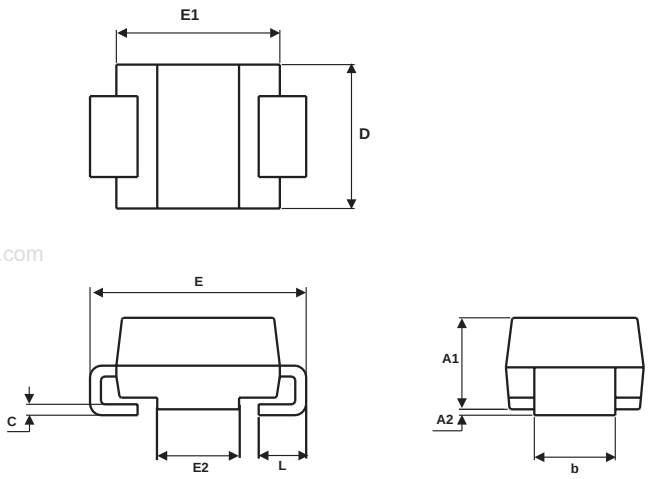

REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	2.90	3.2	0.114	0.126
c	0.15	0.41	0.006	0.016
E	7.75	8.15	0.305	0.321
E1	6.60	7.15	0.260	0.281
E2	4.40	4.70	0.173	0.185
D	5.55	6.25	0.218	0.246

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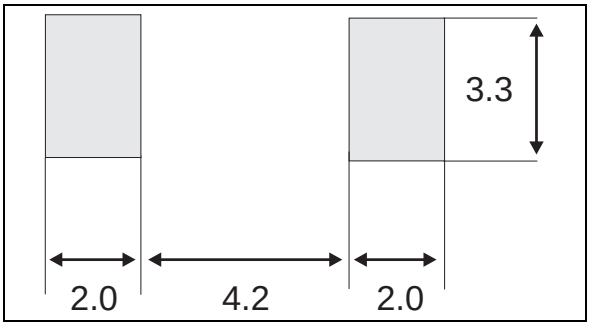
FOOTPRINT DIMENSIONS (in millimeters)



Type	Marking	Package	Weight	Base qty	Delivery mode
STTA206S	T51	SMC	0.243g	2500	Tape & Reel

- Band indicates cathode
- Epoxy meets UL94, V0

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