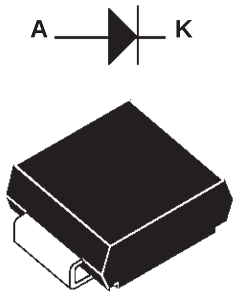
STTA112U

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

MAIN PRODUCTS CHARACTERISTICS

$I_{F(AV)}$	**1A**
V_{RRM}	**1200V**
t_{rr} (typ)	**65ns**
V_F (max)	**1.5V**



SMB

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- 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

TURBOSWITCH 1200V drastically cuts losses in all high voltage operations which require extremely fast, soft and noise-free power diodes.

Due to their optimized switching performances they also highly decrease power losses in any associated switching IGBT or MOSFET in all ”Freewheel Mode” operations.

They are particularly suitable in Motor Control circuitries, or in primary of SMPS as snubber, clamping or demagnetizing diodes, and also in at the secondary of SMPS as high voltage rectifier diodes.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1200	V
V_{RSM}	Non repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		3.5	A
I_{FRM}	Repetitive peak forward current	tp = 5 µs f = 5kHz	22	A
I_{SFM}	Surge non repetitive forward current	tp = 10ms Sine	20	A
T_j	Maximum operating junction temperature		125	°C
T_{stg}	Storage temperature range		- 65 to + 150	°C

TURBOSWITCH is a trademark of STMicroelectronics

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-l)}$	Junction to lead thermal resistance		23	°C/W
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)}$ = 0.8A δ = 0.5 Tlead= 93°C	1.4	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 90°C	1.5	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig. 6)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F = 1A	Tj = 25°C Tj = 125°C		 1.1	1.65 1.5	V
I_R **	Reverse leakage current	V_R = 0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 90	10 300	µA
V_{to}	Threshold voltage	Ip < 3.I_{AV}	Tj = 125°C			1.15	V
rd	Dynamic resistance					350	mΩ

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

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see Fig. 7)

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		 65 	 115	ns
I_{RM}	Maximum recovery current	Tj = 125°C VR = 600V I_F = 1A dI_F/dt = -8 A/µs dI_F/dt = -50 A/µs		 5	 1.8 	A
S factor	Softness factor	Tj = 125°C V_R = 600V I_F =1A dI_F/dt = -50 A/µs		 0.7		-

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			900	ns
V_{Fp}	Peak forward voltage				35	V

APPLICATION DATA

The 1200V TURBOSWITCH™ series has been designed to provide the lowest overall power losses in all frequency or high pulsed current operations.

In such application (fig. 1 to 5), the way of calculating the power losses is given below :

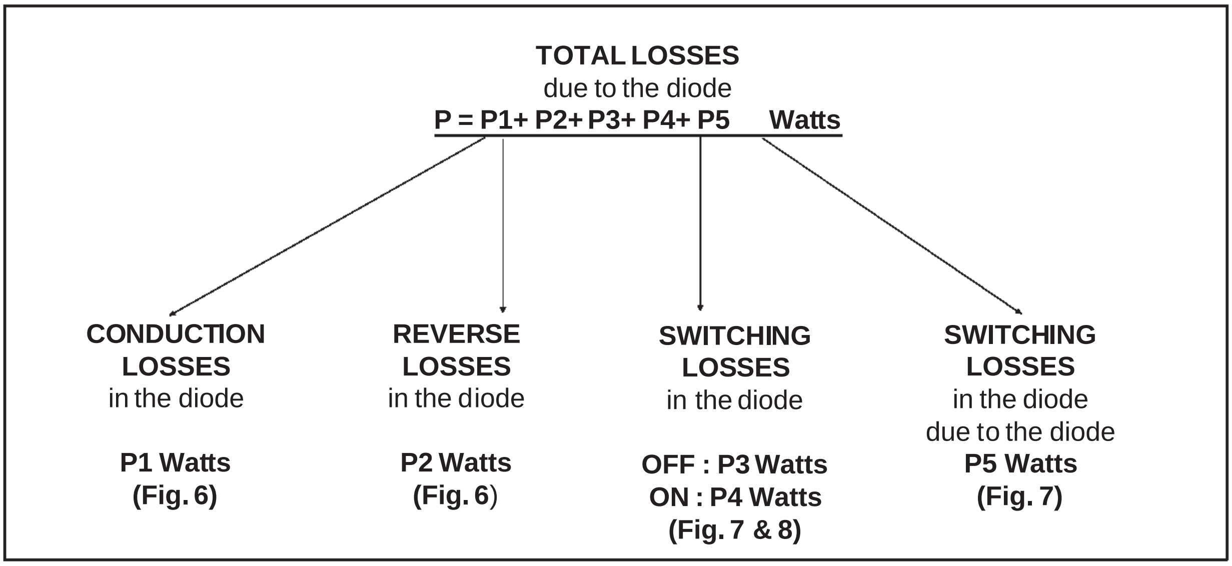
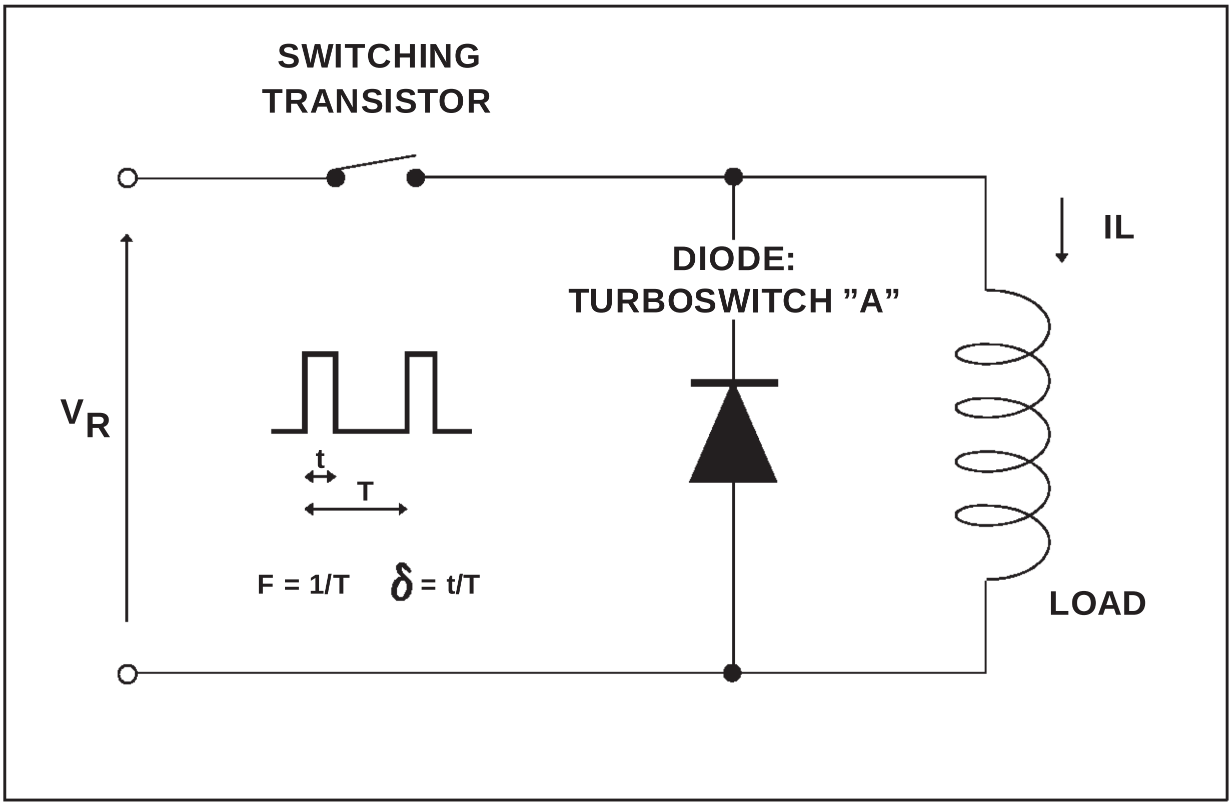


Fig. 1 : "FREEWHEEL MODE".



APPLICATION DATA (Cont'd)

Fig. 2 : SNUBBER DIODE.

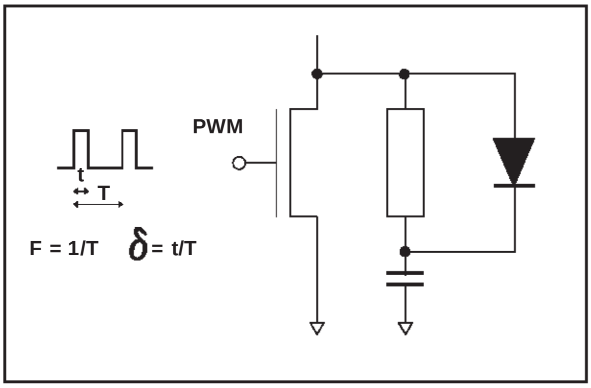


Fig. 3 : CLAMPING DIODE.

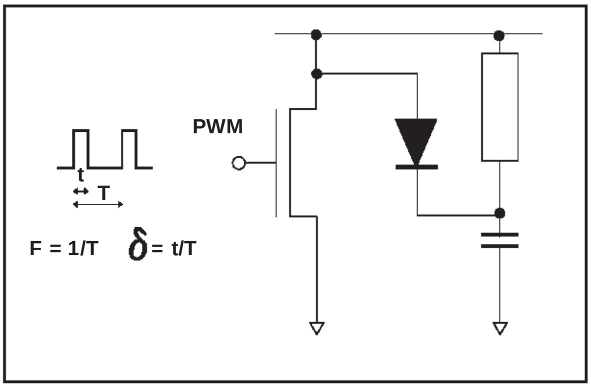


Fig. 4 : DEMAGNETIZING DIODE.

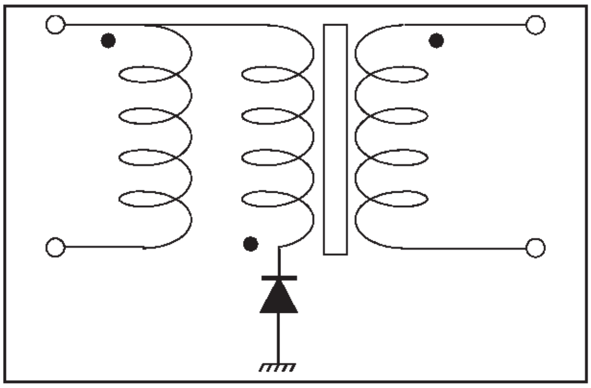


Fig. 5 : RECTIFIER DIODE.

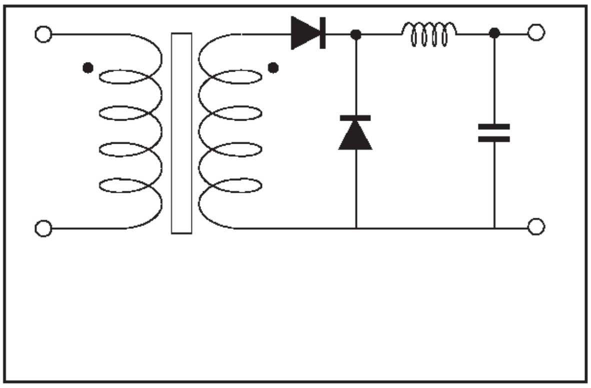
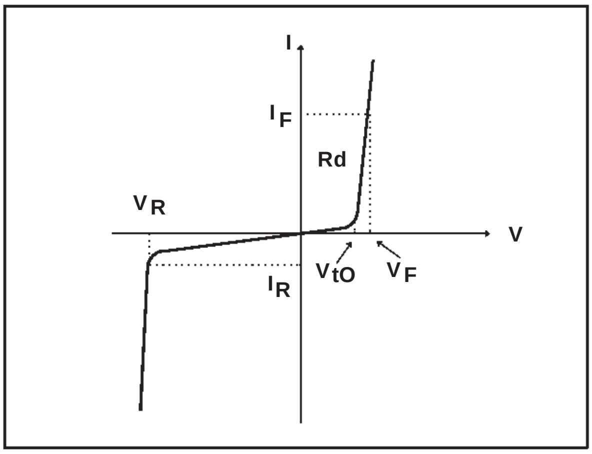


Fig. 6 : STATIC CHARACTERISTICS.



Conduction losses :

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

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. 7 : TURN-OFF CHARACTERISTICS.

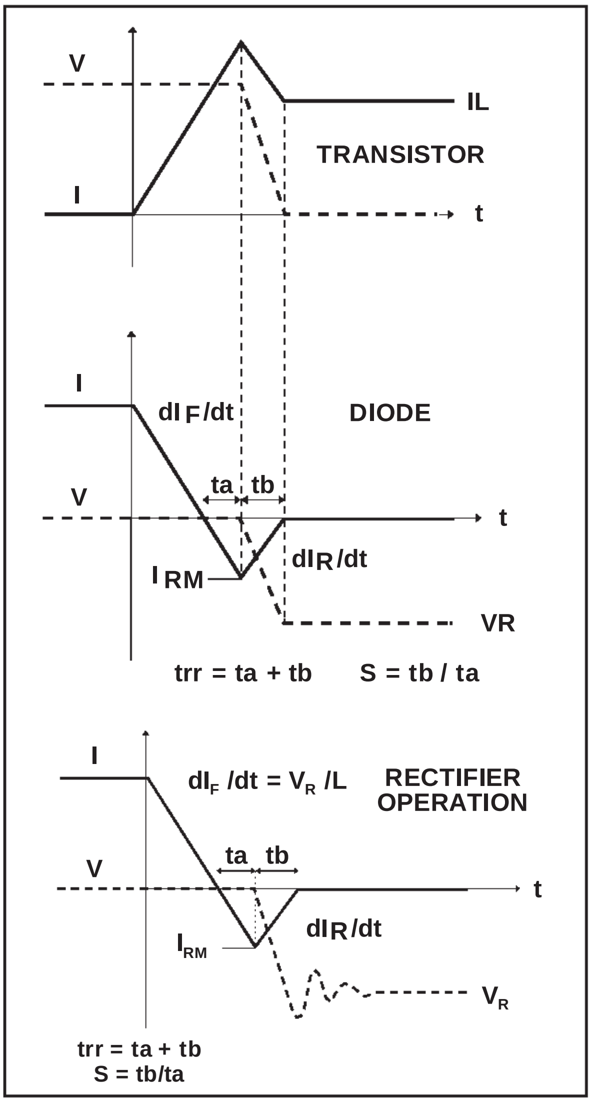
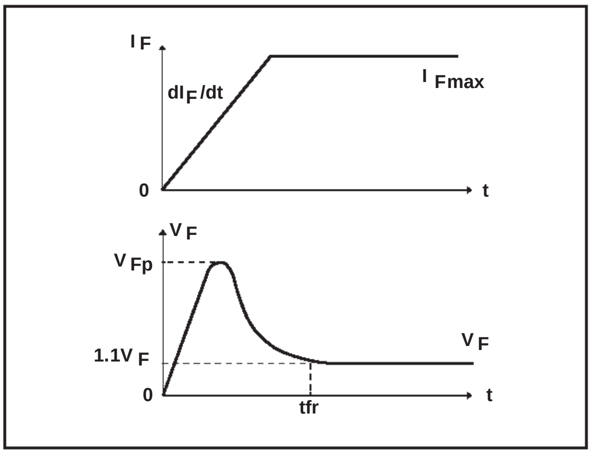


Fig. 8 : TURN-ON CHARACTERISTICS.



Ratings and characteristics curves are ON GOING.

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

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

Turn-off losses :

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

Turn-off losses :
with non negligible serial inductance

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

P3, P3' and P5 are suitable for power MOSFET and IGBT

Turn-on losses :

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

Fig. 9: Conduction losses versus average current.

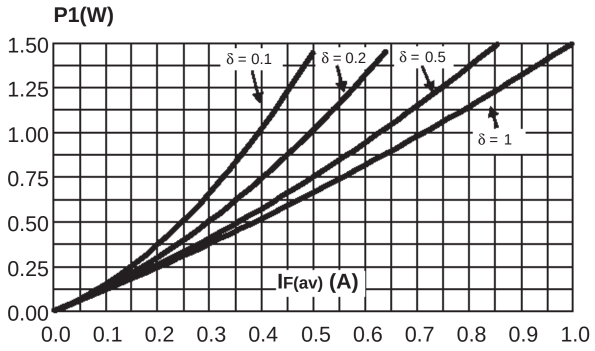


Fig. 10: Switching OFF losses versus dI_F/dt.

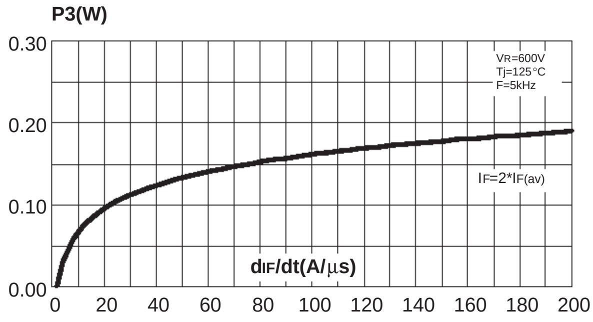


Fig. 11: Switching ON losses versus dI_F/dt.

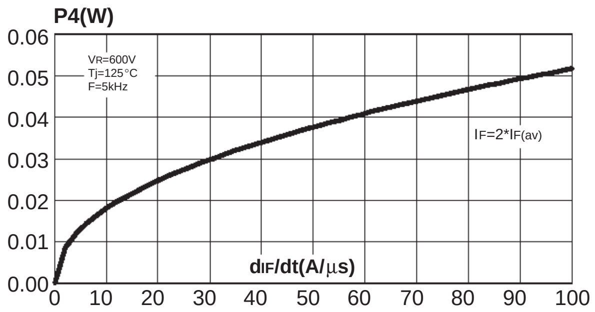


Fig. 12: Switching losses in transistor due to the diode.

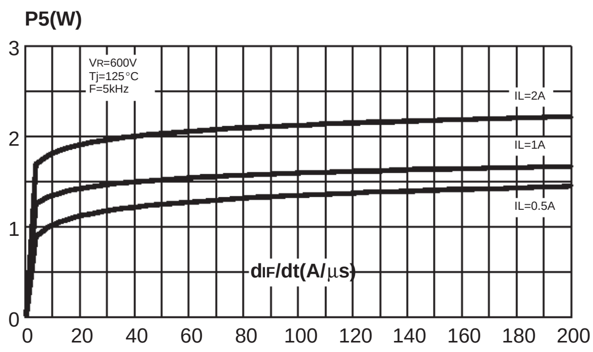


Fig. 13: Forward voltage drop versus forward current (Maximum values).

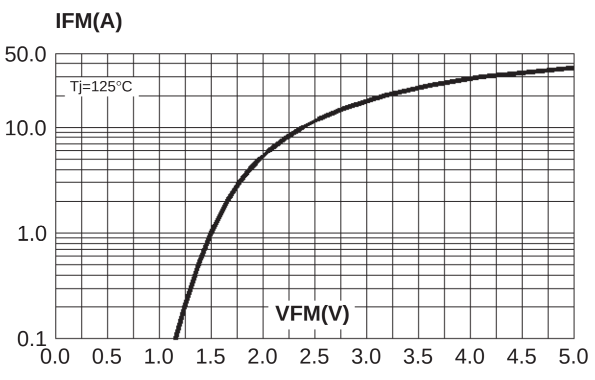


Fig. 14: Relative variation of thermal transient impedance junction to lead versus pulse duration.

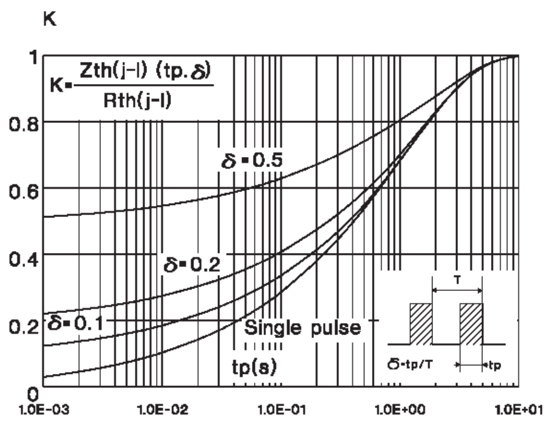


Fig. 15: Peak reverse recovery current versus dI_F/dt (90% confidence).

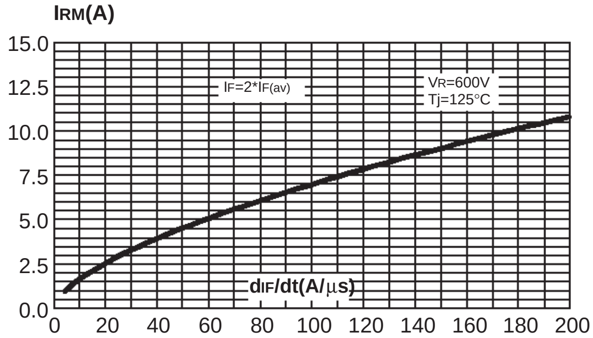


Fig. 16: Reverse recovery time versus dI_F/dt (90% confidence).

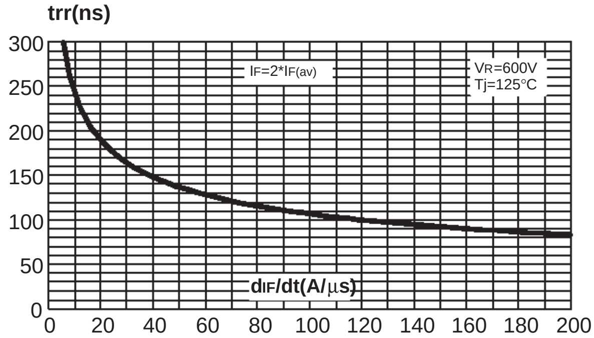


Fig. 17: Softness factor (tb/ta) versus dI_F/dt (Typical values).

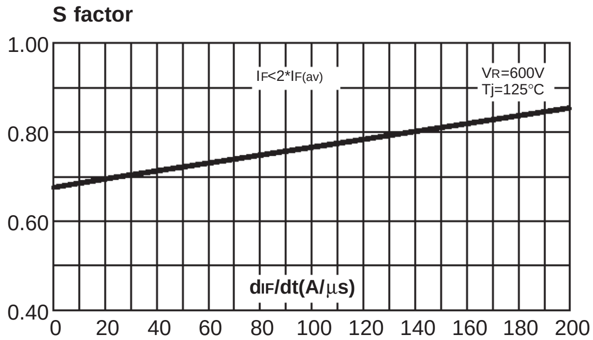


Fig. 18: Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C).

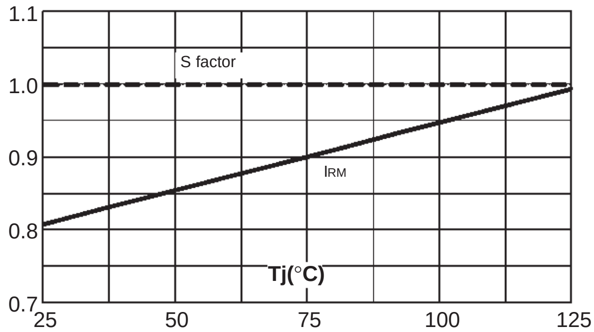


Fig. 19: Transient peak forward voltage versus dI_F/dt (90% confidence).

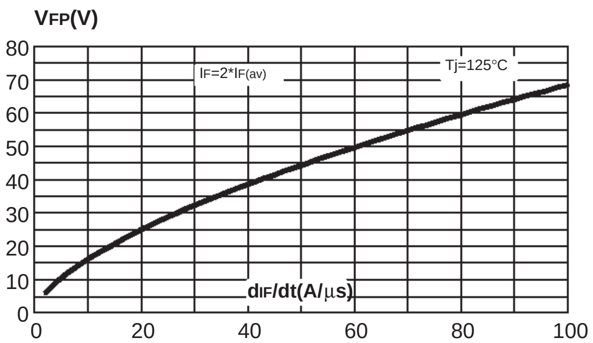
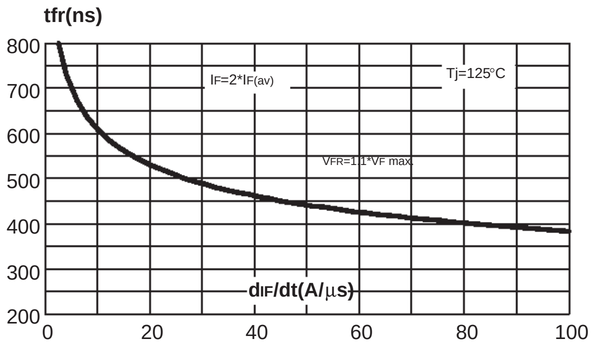
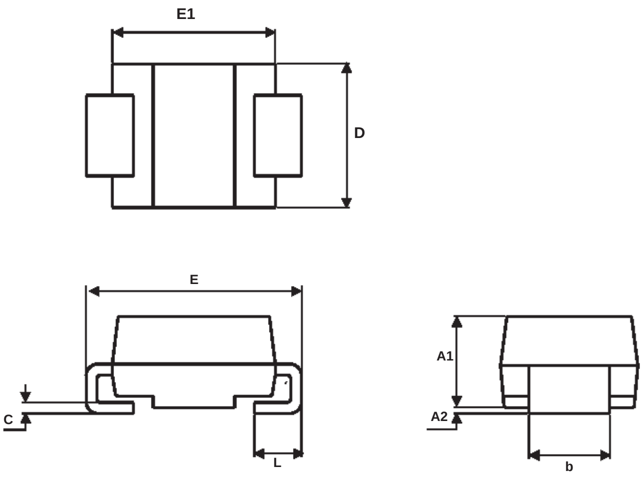


Fig. 20: Forward recovery time versus dI_F/dt (90% confidence).



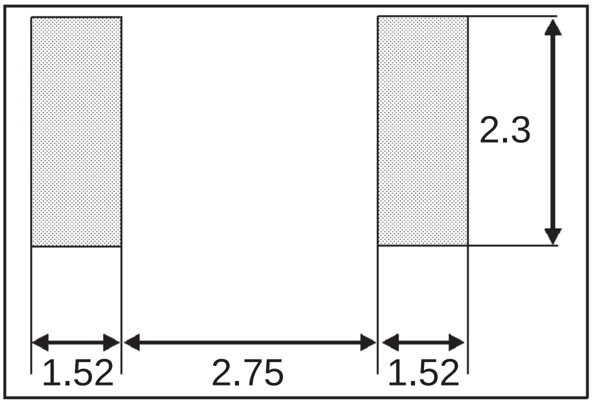
PACKAGE MECHANICAL DATA

SMB



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	1.95	2.20	0.077	0.087
c	0.15	0.41	0.006	0.016
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
D	3.30	3.95	0.130	0.156
L	0.75	1.60	0.030	0.063

FOOTPRINT DIMENSIONS (in millimeters)



- **Marking:** T03
- Laser marking
- Band indicates cathode