STTA212S

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

MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	**2A**
V_{RRM}	**1200V**
t_{rr} (typ)	**65ns**
V_F (max)	**1.5V**

SMC

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGHETIZATION AND RECTIFICATION
- ULTRA-FAST AND SOFT RECOVERY
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR
- HIGH FREQUENCY OPERATION
- HIGH REVERSE VOLTAGE CAPABILITY
- 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 aloso highly decrease power losses in any associated switching IGBT or MOSFET in all "Freewheel Mode" operations and is particulary suitable and efficient in Motor Control circuitries, or in primary of SMPS as snubber, clamping or demagnetizing diodes, and also 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		8	A
I_{FRM}	Repetitive peak forward current	(tp = 5 µs f = 5kHz)	50	A
I_{FSM}	Surge non repetitive forward current	tp = 10ms sine	25	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 thermal resistance		21	°C/W
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)}$ = 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

STATIC ELECTRICAL CHARACTERISTICS (see Fig. 6)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F = 2A	Tj = 25°C Tj = 125°C		 1.1	1.65 1.5	V
I_R **	Reverse leakage current	V_R = 0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 150	20 400	µA
Vto	Threshold voltage		Tj = 125°C			1.15	V
rd	Dynamic resistance					175	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 = 2A dI_F/dt = -16 A/µs dI_F/dt = -50 A/µs		 6.0	 3.6	A
S factor	Softness factor	Tj = 125°C V_R = 600V I_F = 2A dI_F/dt = -50 A/µs		0.9		/

TURN-ON SWITCHING (see Fig. 8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F = 2 A dI_F/dt = 16 A/µs measured at 1.1 × $V_F$max			900	ns
V_{Fp}	Peak forward voltage				35	V

APPLICATION DATA

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

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

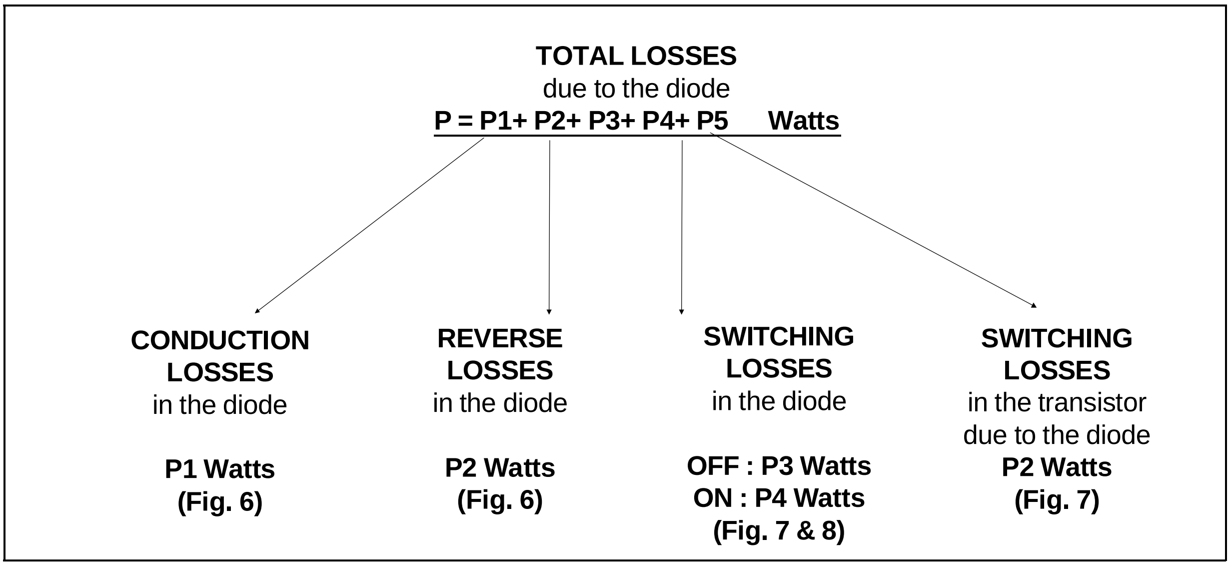
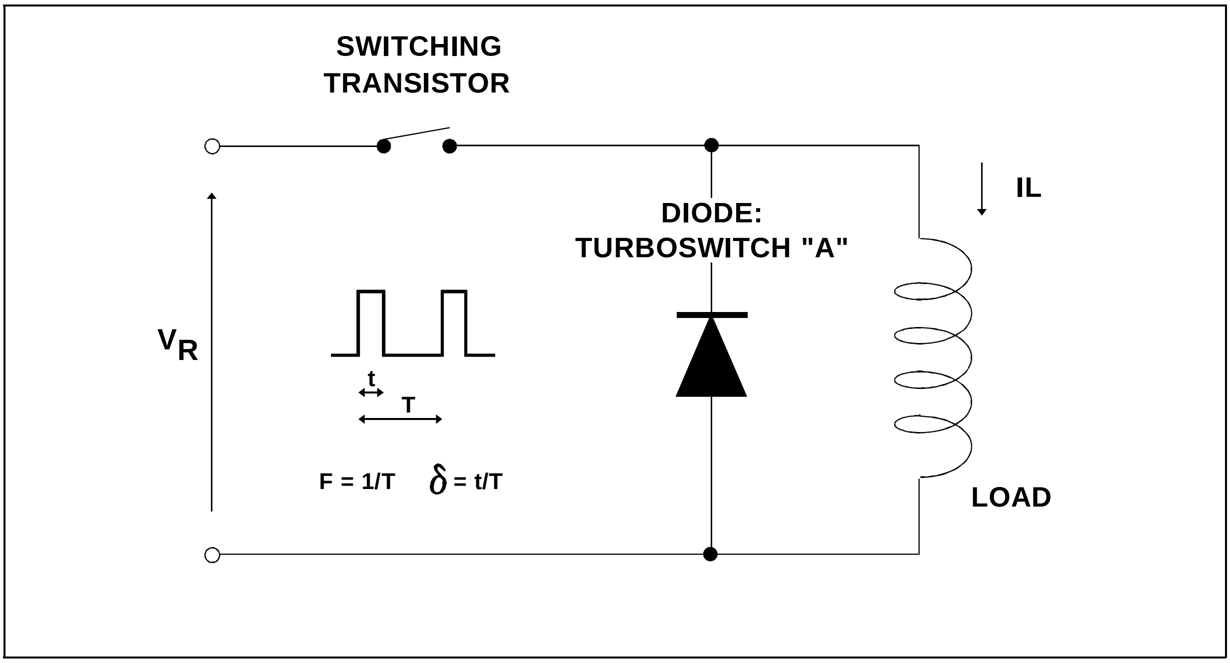


Fig. 1 : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

Fig. 2 : SNUBBER DIODE.

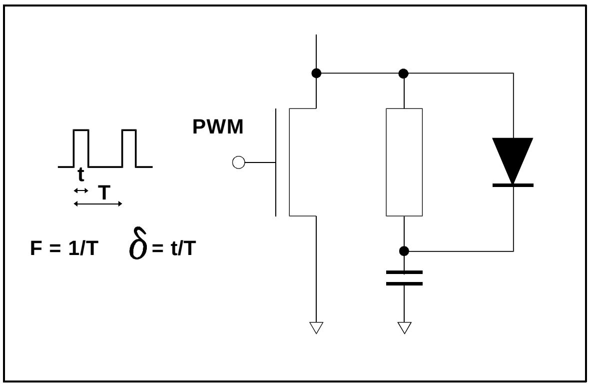


Fig. 3 : CLAMPING DIODE.

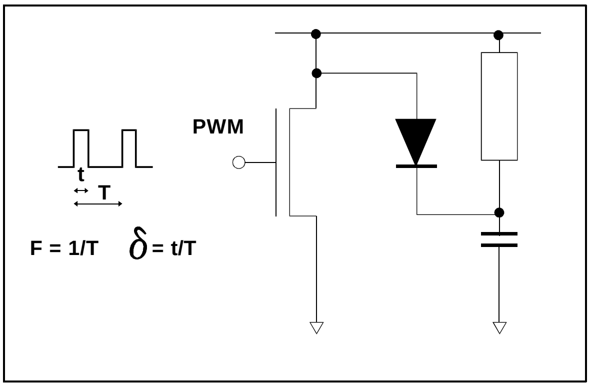


Fig. 4 : DEMAGNETIZING DIODE.

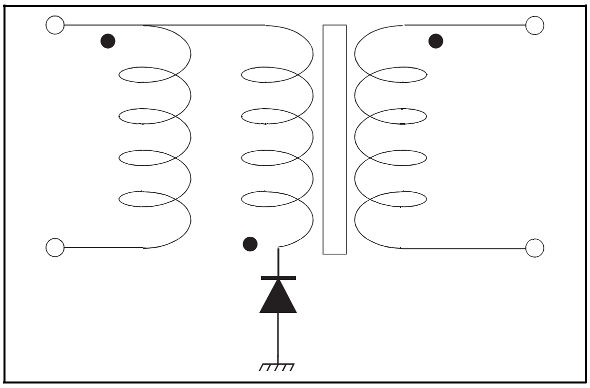


Fig. 5 : RECTIFIER DIODE.

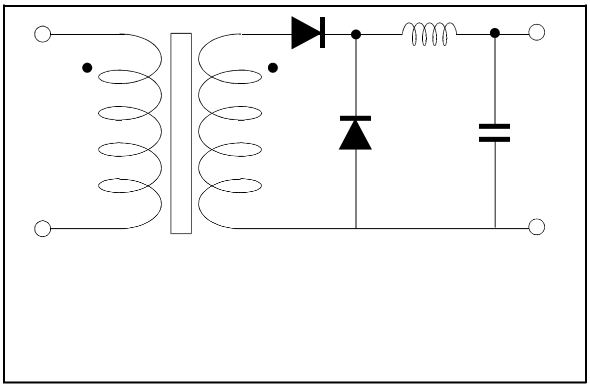
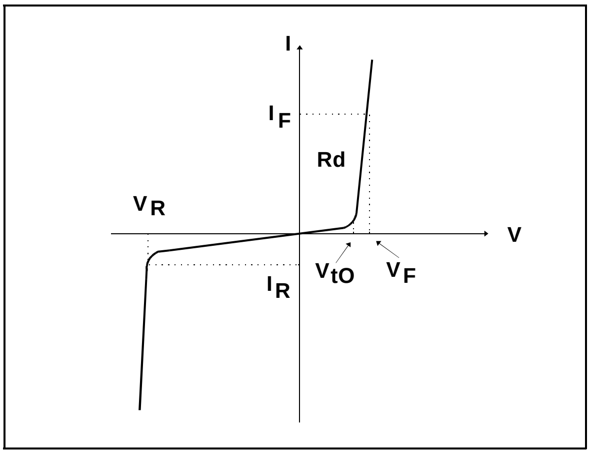


Fig. 6 : STATIC CHARACTERISTICS



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

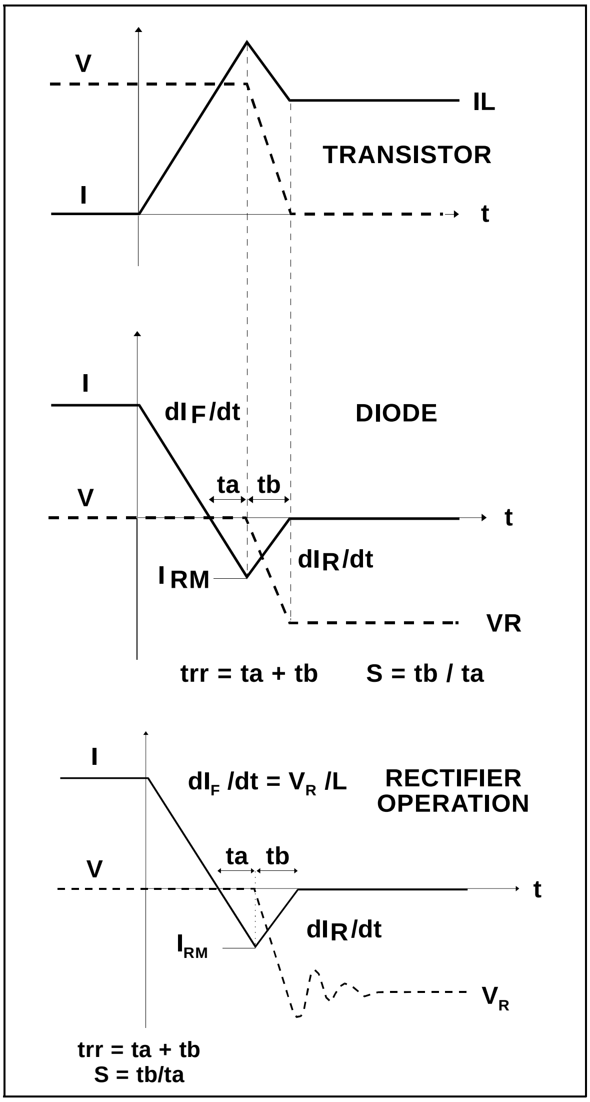
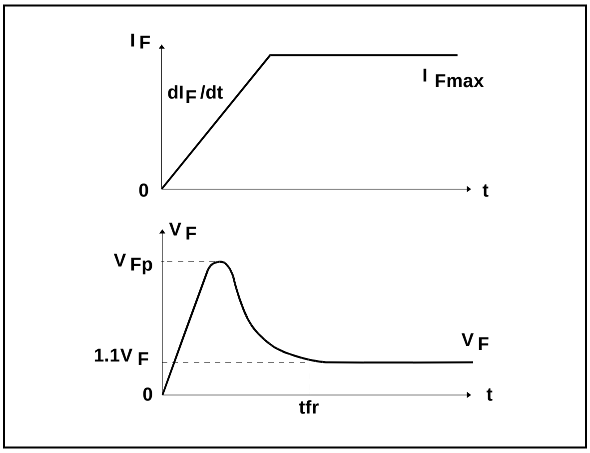


Fig. 8 : TURN-ON CHARACTERISTICS



Ratings and characteristics curves are ON GOING.

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

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

Turn-off losses (in the diode) :

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

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.

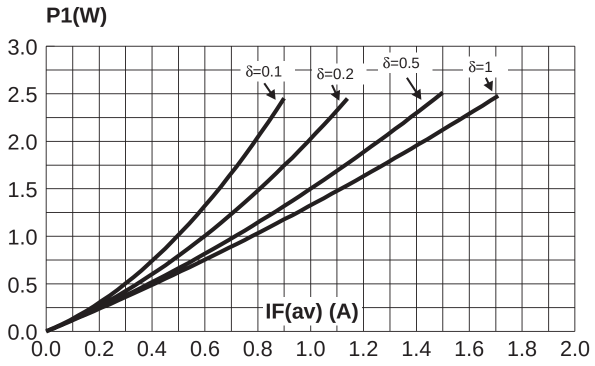


Fig. 10: Switching OFF losses versus dI_F/dt.

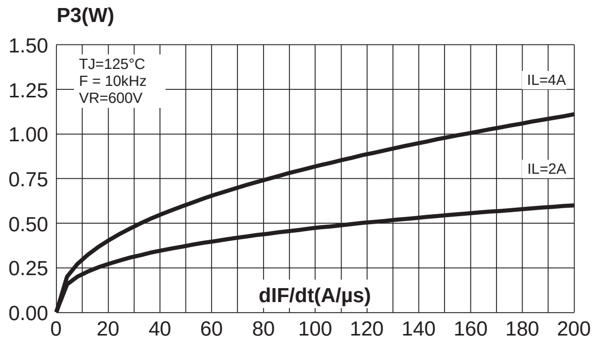


Fig. 11: Switching ON losses versus dI_F/dt.

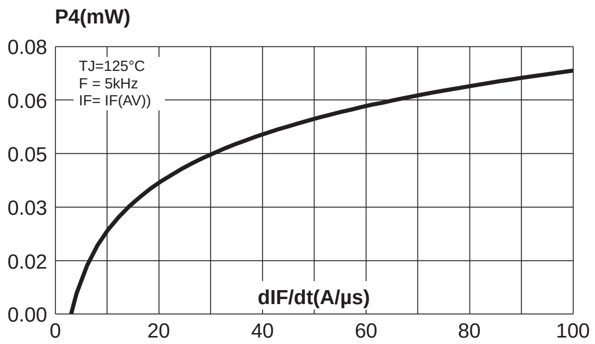


Fig. 12: Switching losses in transistor due to the diode.

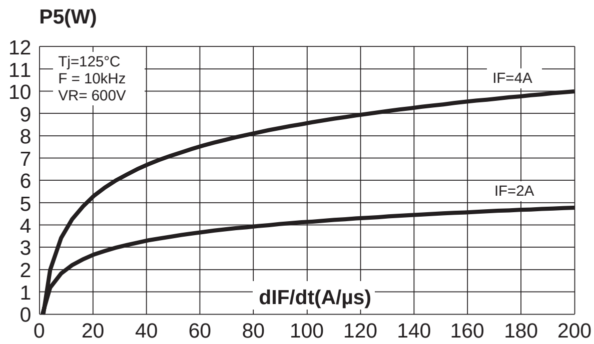


Fig. 13: Forward voltage drop versus forward current (maximum values).

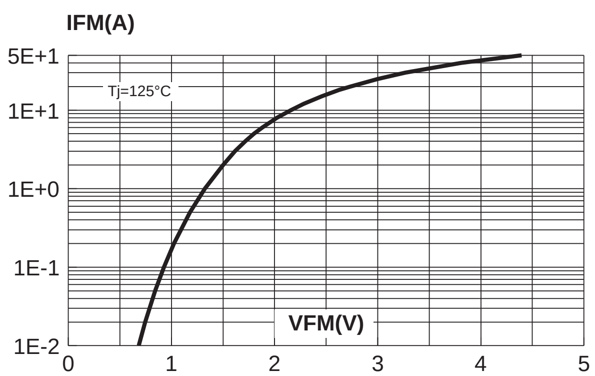


Fig. 14: Variation of thermal impedance junction to ambient versus pulse duration (epoxy printed circuit board FR4, e(Cu)=35µm, S(Cu)=1cm2).

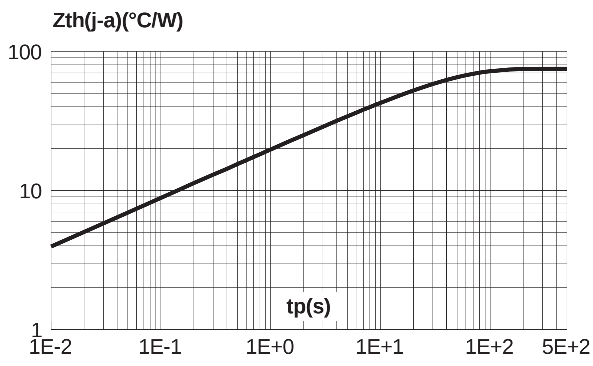


Fig. 15: Peak reverse recovery current versus dI_F/dt (90% confidence).

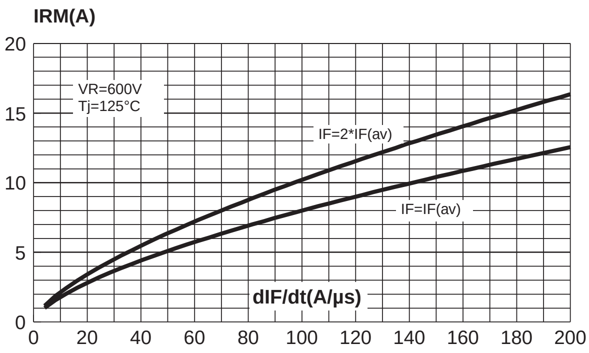


Fig. 16: Softness factor (tb/ta) versus dI_F/dt (typical values).

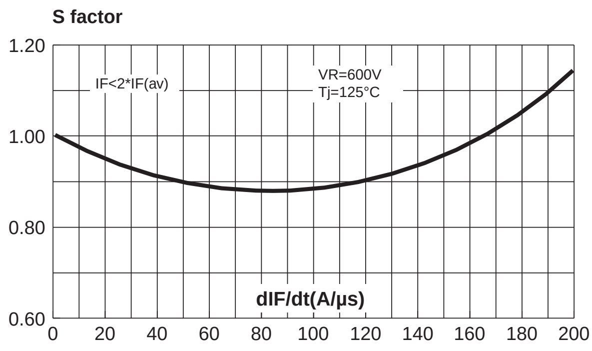


Fig. 17: Reverse recovery time versus dI_F/dt (90% confidence).

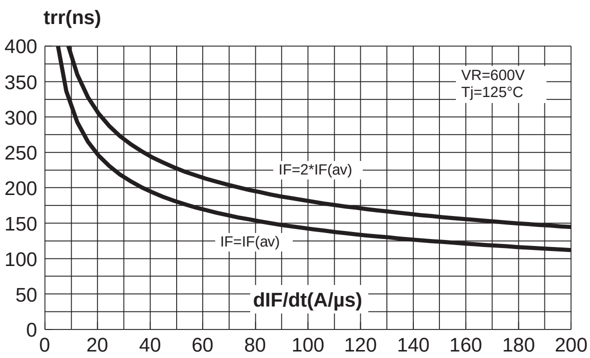


Fig. 18: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

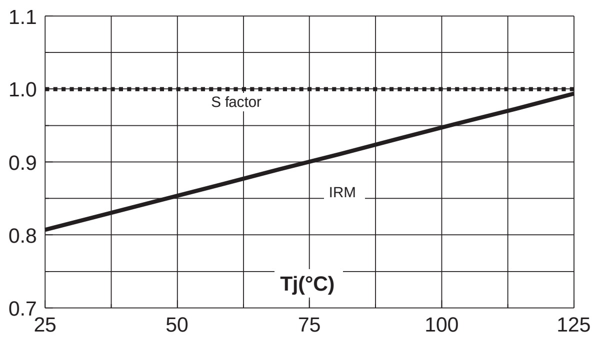


Fig. 19: Transient peak forward voltage versus dI_F/dt.

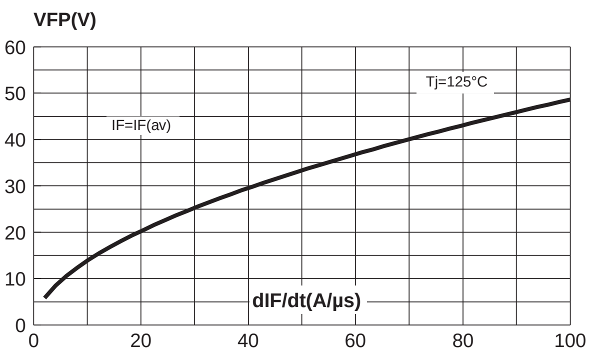
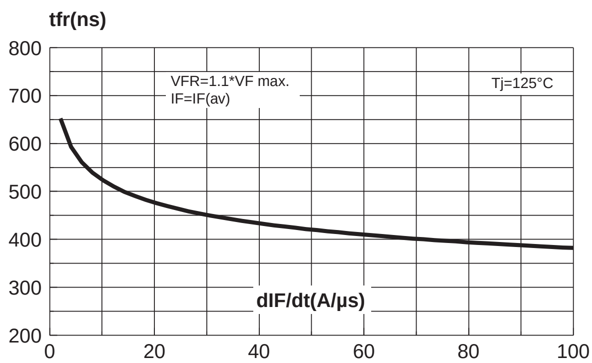
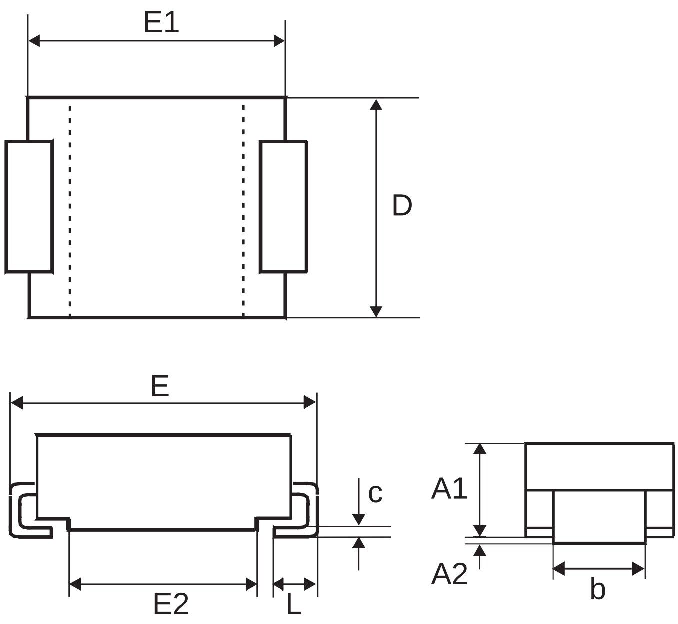


Fig. 20: Forward recovery time versus dI_F/dt.



PACKAGE MECHANICAL DATA

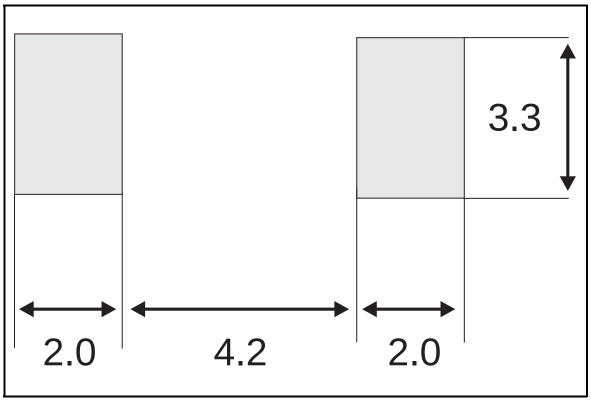
SMC



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
L	0.75	1.60	0.030	0.063

FOOTPRINT DIMENSIONS (in millimeters)

SMC Plastic



Marking : T53

Laser marking

Band indicates cathode