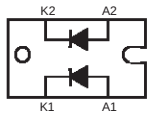
STTA5012TV1/2

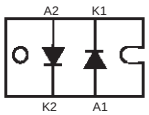
TURBOSWITCH ™ ”A”. ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCTS CHARACTERISTICS

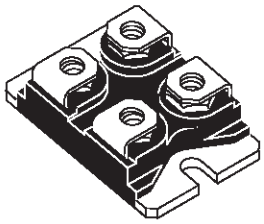
$I_{F(AV)}$	**25A**
V_{RRM}	**1200V**
t_{rr} (typ)	**60ns**
V_F (max)	**1.9V**



STTA5012TV1



STTA5012TV2



ISOTOP™

FEATURES AND BENEFITS

- ULTRA-FAST, SOFT AND NOISE-FREE RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATIONS.

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 the 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	50	A
I_{FRM}	Repetitive peak forward current (tp = 5 µs, F = 5kHz)	300	A
T_j	Maximum operating junction temperature	150	°C
T_{stg}	Storage temperature	-65 to 150	°C

ISOTOP and TURBOSWITCH are trademarks of STMicroelectronics.

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	Per diode	1.4	°C/W
		Total	0.75	
		Coupling	0.1	
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)}$ = 25A δ =0.5 Per diode Tc= 70°C	57	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Per diode Tc= 62°C	62.5	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig. 6)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =25A	Tj = 25°C Tj = 125°C		 1.3	2.1 1.9	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 2.0	150 8	µA mA
V_{to}	Threshold voltage		Tj = 125°C			1.52	V
R_d	Dynamic resistance					15	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		60	 110	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C V_R = 600V I_F =25A dI_F/dt = -200 A/µs dI_F/dt = -500 A/µs		 45	35	A
S factor	Softness factor	Tj = 125°C V_R = 600V I_F =25A dI_F/dt = -500 A/µs		 1.2		/

TURN-ON SWITCHING (see Fig. 8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F =25 A, dI_F/dt = 200 A/µs measured at 1.1 × $V_F$max			900	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =25A, dI_F/dt = 200 A/µs I_F =40A, dI_F/dt = 500 A/µs		 35	30	V

APPLICATION DATA

The 1200V TURBOSWITCH series has been designed to provide the lowest overall power losses in 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 :

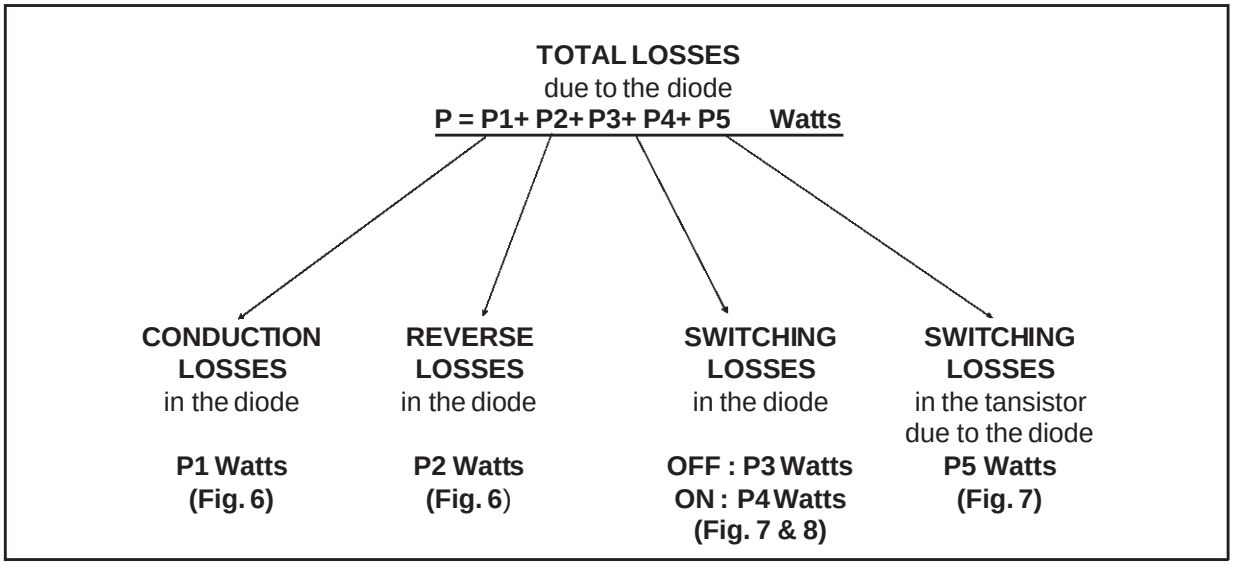


Fig. 1 : "FREEWHEEL" MODE.

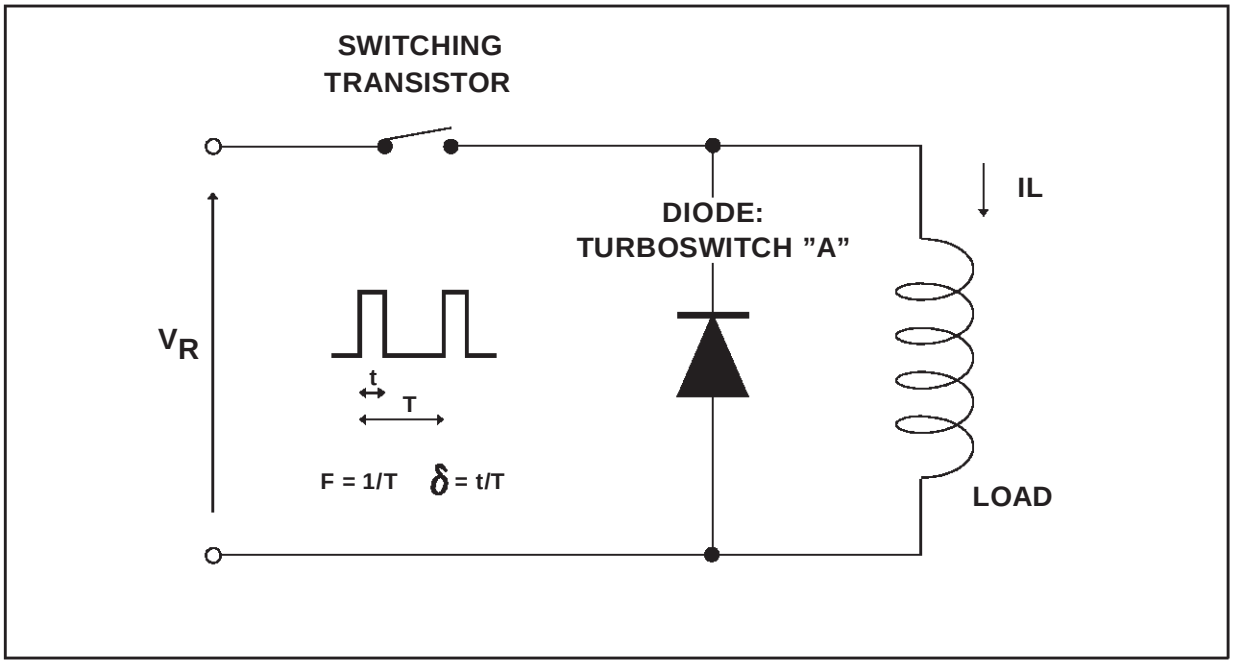


Fig. 2 : SNUBBER DIODE.

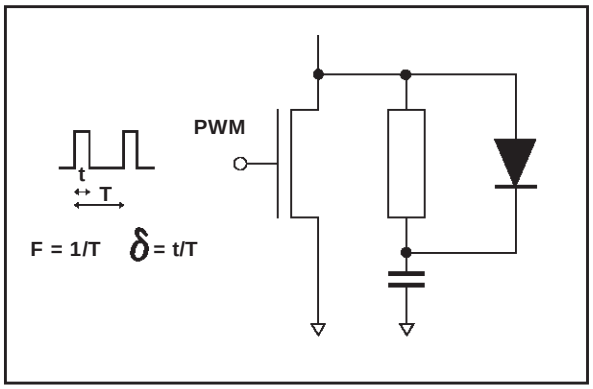


Fig. 3 : CLAMPING DIODE.

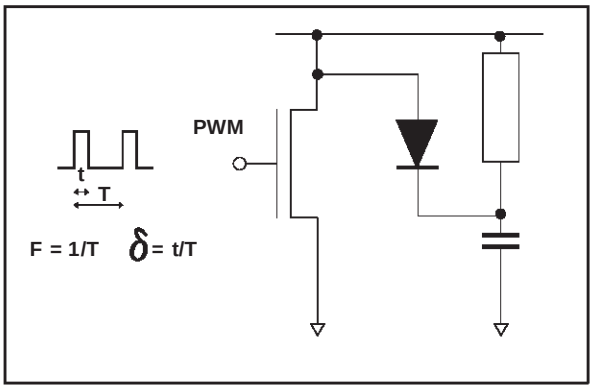


Fig. 4 : DEMAGNETIZING DIODE.

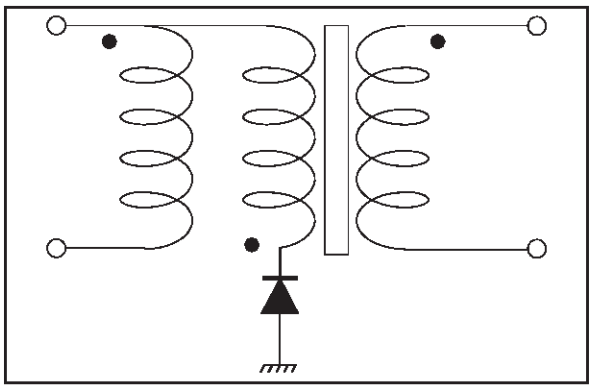
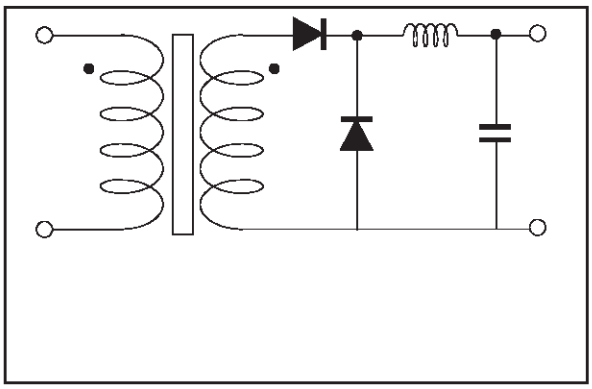
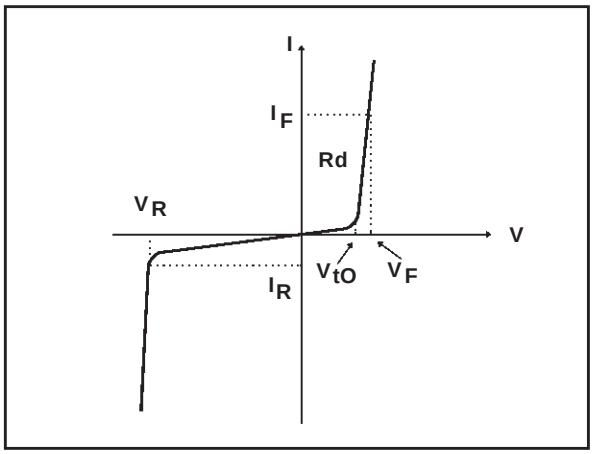


Fig. 5 : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. 6: STATIC CHARACTERISTICS



Conduction losses :

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

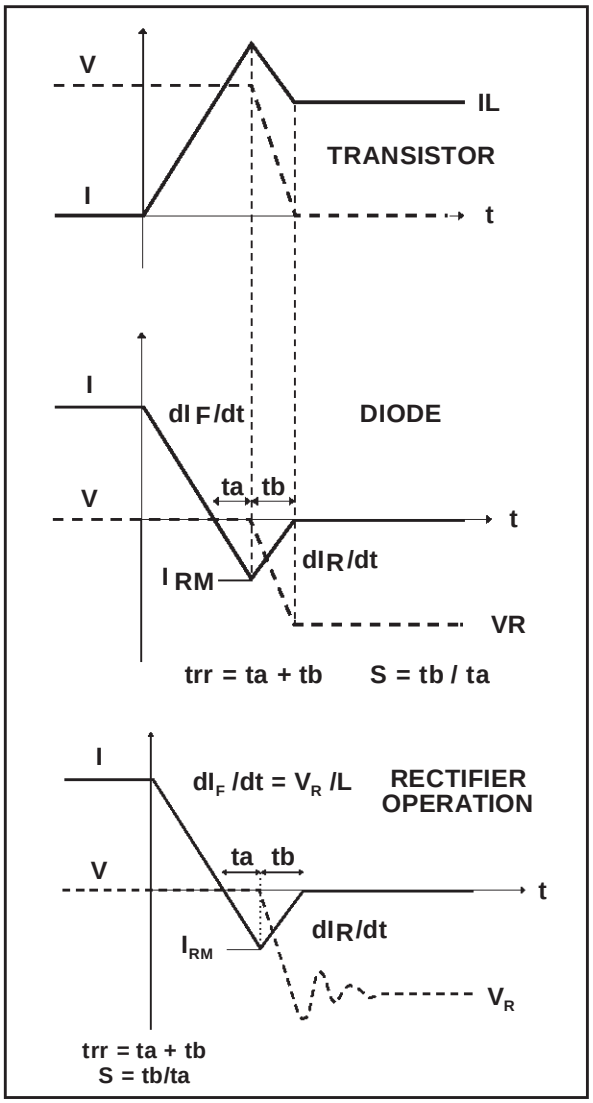
Max values at 125°C, suitable for Ipeak < 3.IF(av)

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. 7: TURN-OFF CHARACTERISTICS



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

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

Turn-off losses (in the diode) :

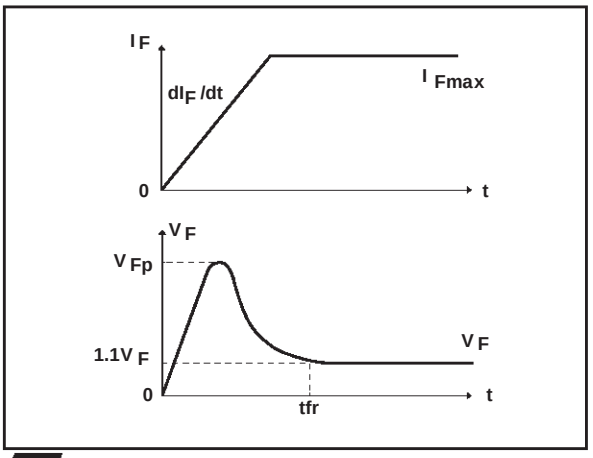
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \; x \; dI_F/dt}$$

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

Fig. 8: TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig. 9: Conduction losses versus average current (per diode).

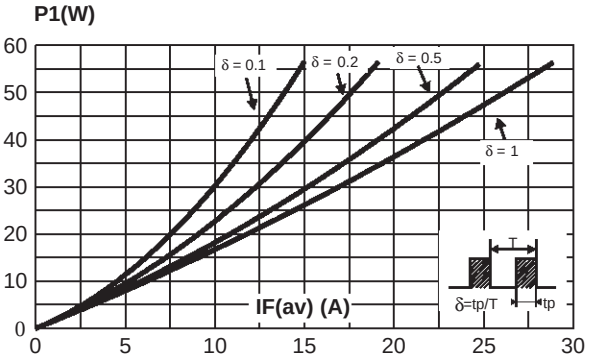


Fig. 10: Switching OFF losses versus dI_F/dt.

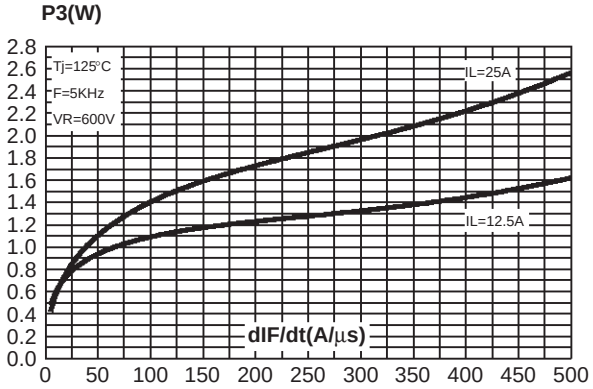


Fig. 11: Switching ON losses versus dI_F/dt.

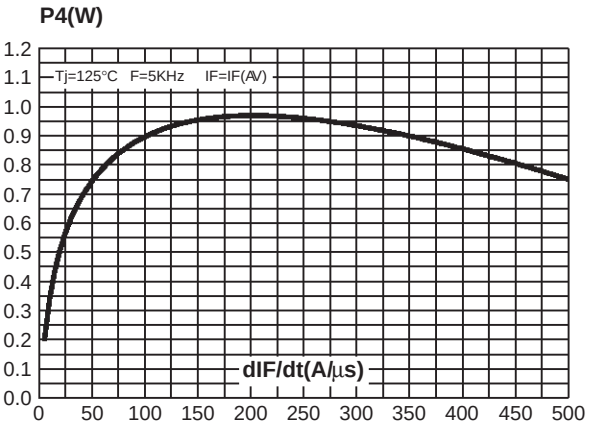


Fig. 12: Switching losses in transistor due to the diode.

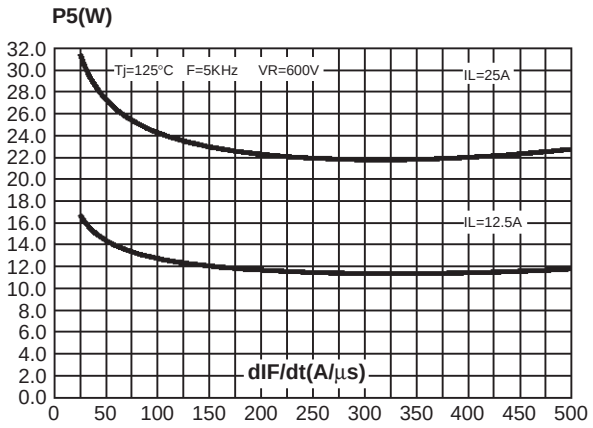


Fig. 13: Forward voltage drop versus forward current (maximum values, per diode).

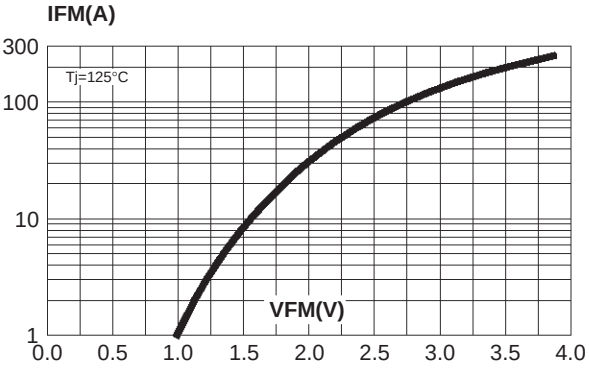


Fig. 14: Relative variation of thermal impedance junction to case versus pulse duration (per diode).

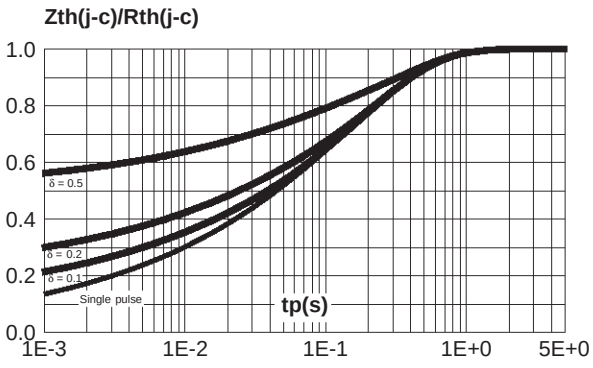


Fig. 15: Peak reverse recovery current versus dI_F/dt (90% confidence, per diode).

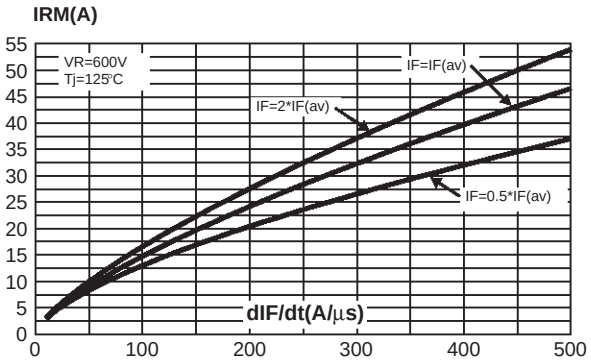


Fig. 16: Reverse recovery time versus dI_F/dt (90% confidence, per diode).

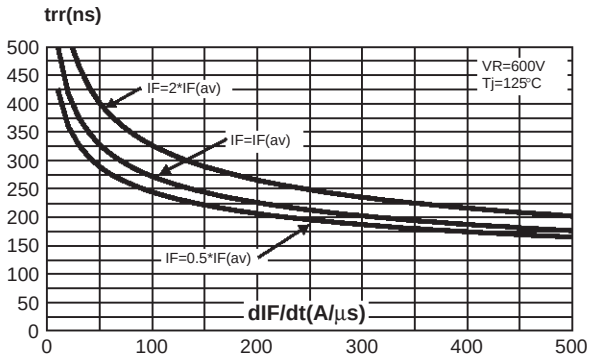


Fig. 17: Softness factor (tb/ta) versus dI_F/dt (typical values, per diode).

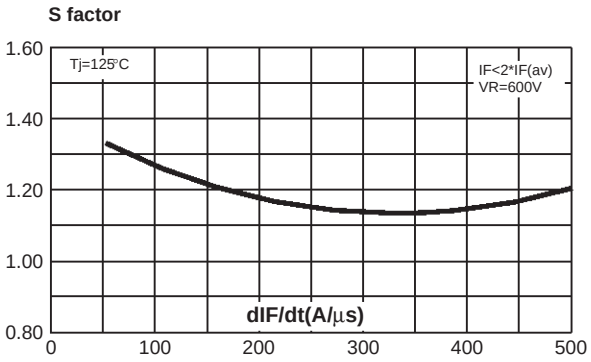


Fig. 18: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

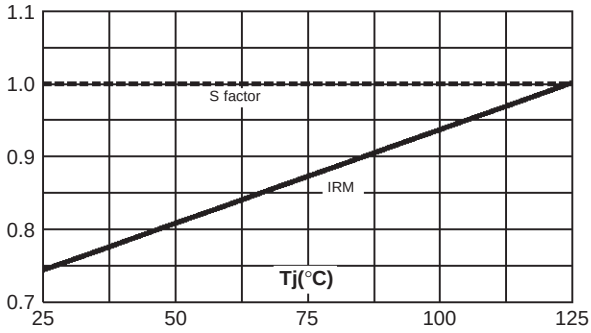


Fig. 19: Transient peak forward voltage versus dI_F/dt (90% confidence, per diode).

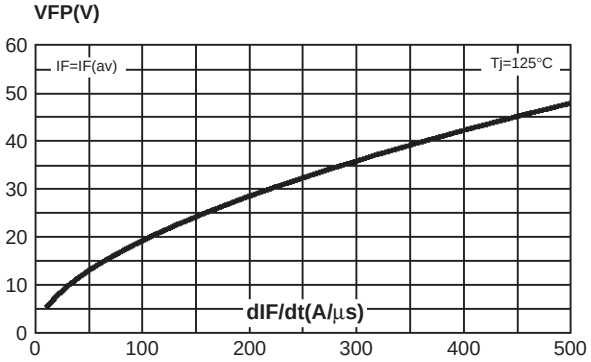
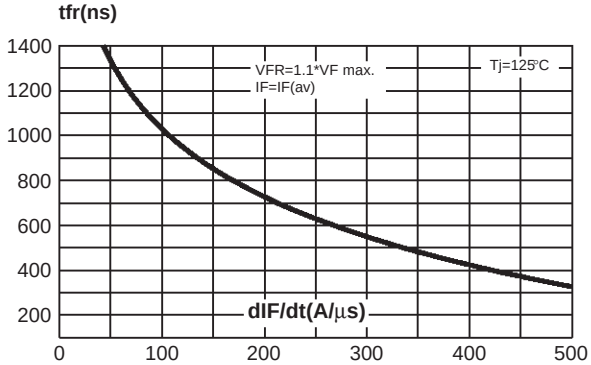
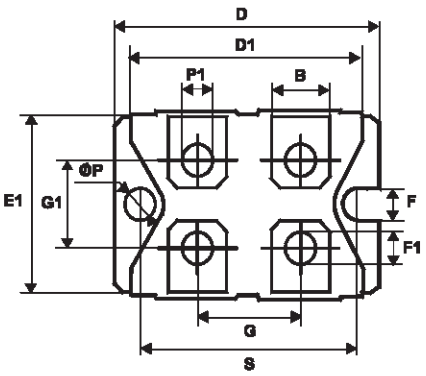


Fig. 20: Forward recovery time versus dI_F/dt (90% confidence, per diode).



PACKAGE MECHANICAL DATA

ISOTOP



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	11.80		12.20	0.465		0.480
A1	8.90		9.10	0.350		0.358
B	7.8		8.20	0.307		0.323
C	0.75		0.85	0.030		0.033
C2	1.95		2.05	0.077		0.081
D	37.80		38.20	1.488		1.504
D1	31.50		31.70	1.240		1.248
E	25.15		25.50	0.990		1.004
E1	23.85		24.15	0.939		0.951
E2		24.80			0.976	
G	14.90		15.10	0.587		0.594
G1	12.60		12.80	0.496		0.504
G2	3.50		4.30	0.138		0.169
F	4.10		4.30	0.161		0.169
F1	4.60		5.00	0.181		0.197
P	4.00		4.30	0.157		0.69
P1	4.00		4.40	0.157		0.173
S	30.10		30.30	1.185		1.193

- **Marking:** Type number
- Cooling method: C
- Weight: 28 g (without screws)
- Electric isolation: 2500$V_{(RMS)}$
- Capacitance: < 45 pF
- Inductance: < 5 nH
- Recommended torque value: 1.3 N.m (MAX 1.5 N.m) for the 6 x M4 screws. (2 x M4 screws recommended for mounting the package on the heatsink and the 4 screws given with the screw version).
- The screws supplied with the package are adapted for mounting on a board (or other types of terminals) with a thickness of 0.6 mm min and 2.2 mm max.